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S/A – MANUAL  
VOLUMES 4**

**2003  
PASTA 18**

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## ANEXO 3

# CATÁLOGOS, MANUAIS E OUTROS DOCUMENTOS TÉCNICOS

### VOLUME 4

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MANUAL 12

MANUAL 13

MANUAL 14

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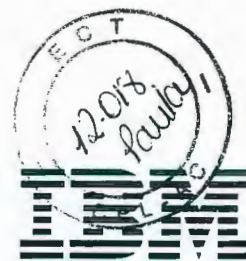


# Manual 12

## IBM Tivoli Storage Manager for Database Version 5.2 Data Protection for Oracle for UNIX Installation and User`s Guide



IBM Tivoli Storage Manager for Databases Version 5.2



# Data Protection for Oracle for UNIX Installation and User's Guide

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## Preface

*IBM Tivoli Storage Manager for Databases Version 5.2 Data Protection for Oracle* is referred to as *Data Protection for Oracle* throughout this book.

Data Protection for Oracle performs online or offline backups of Oracle8i or Oracle9i databases to Tivoli Storage Manager storage. This integration with the RMAN Media Management API maximizes the protection of data, thus providing a comprehensive storage management solution.

Tivoli Storage Manager is a separate client-server licensed product that provides storage management services in a multi-platform computer environment.

## Who should read this publication

The target audience for this publication are system installers, system users, Oracle database administrators, and system administrators .

In this book, it is assumed that you have an understanding of the following applications:

- Oracle Server
- Tivoli Storage Manager Server
- Tivoli Storage Manager backup-archive client
- Tivoli Storage Manager Application Program Interface

It is also assumed that you have an understanding of one of the following operating systems:

- AIX
- HP-UX
- Linux
- Solaris Operating Environment (hereinafter referred to as Solaris)

## IBM Tivoli Storage Manager Web site

Technical support information and publications are available at the following address:

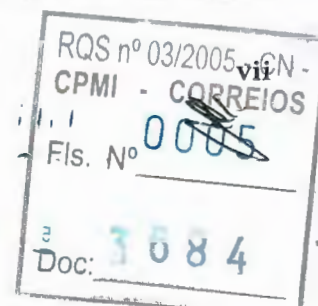
[www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html](http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html)

By accessing the Tivoli Storage Manager home page, you can access subjects that interest you. You can also keep up-to-date with the newest Tivoli Storage Manager product information.

## IBM Tivoli Storage Manager publications

Table 1. Related Tivoli Storage Manager publications

Title	Order Number
<i>IBM Tivoli Storage Manager for Windows Backup-Archive Client Installation and User's Guide</i>	GC32-0788
<i>IBM Tivoli Storage Manager for UNIX Backup-Archive Clients Installation and User's Guide</i>	GC32-0789

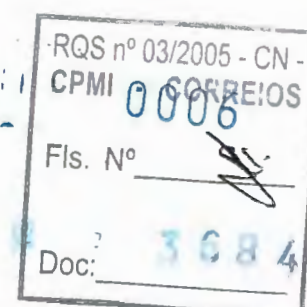




# Manual 13

IBM Tivoli Storage Manager for Mail  
5.1.5

Data Protection for Microsoft  
Exchange Server  
Installation and User`s Guide

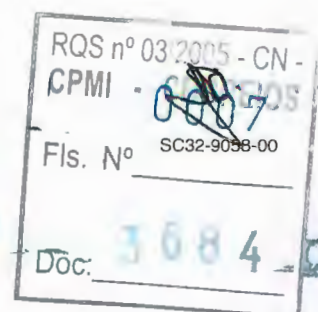


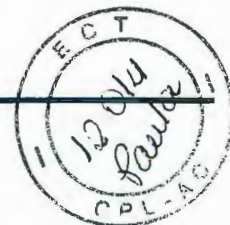


IBM Tivoli Storage Manager for Mail 5.1.5



# Data Protection for Microsoft Exchange Server Installation and User's Guide





## Preface

*IBM Tivoli Storage Manager for Mail 5.1.5 Data Protection for Microsoft Exchange Server* is referred to as *Data Protection for Exchange* throughout this book.

*Tivoli Storage Manager* and *Tivoli Storage Manager Server* are referred to as *Storage Manager* and *Storage Manager Server* respectively throughout this book.

Data Protection for Exchange performs online backups of Microsoft Exchange Server databases to Tivoli Storage Manager storage. This integration with the Microsoft Exchange Server application program interface (API) maximizes the protection of data, thus providing a comprehensive storage management solution.

Storage Manager is a separate client-server licensed product that provides storage management services in a multi-platform computer environment.

## Who should read this book

The target audience for this book are system installers, system users, and system administrators.

In this book, it is assumed that you have an understanding of the following applications:

- Microsoft Exchange Server
- Storage Manager Server
- Storage Manager Backup-Archive Client
- Storage Manager Application Program Interface

It is also assumed that you have an understanding of one of the following operating systems:

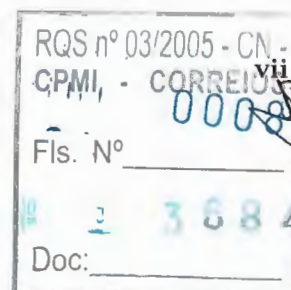
- Windows NT
- Windows 2000

Throughout this document, the term Windows refers to both Windows NT Server and Windows 2000 Server.

## What this book contains

The book contains the following sections:

- Chapter 1, "Introducing Data Protection for Exchange" on page 1  
This section provides an overview of Data Protection for Exchange.
- Chapter 2, "Installing Data Protection for Exchange" on page 9  
This section explains the environment requirements and steps necessary to install Data Protection for Exchange.
- Chapter 3, "Configuring Data Protection for Exchange" on page 13  
This section explains registering and configuring Data Protection for Exchange and provides policy recommendations.
- Chapter 4, "Using the Graphical User Interface (GUI)" on page 19  
This section explains how to perform Data Protection for Exchange functions from a graphical user interface.





# Manual 14

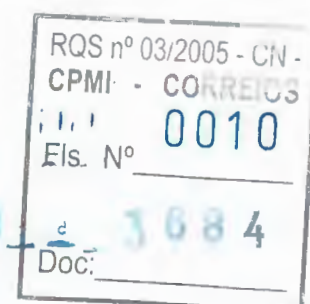
## System User's Guide: Operating System and Devices

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AIX 5L Version 5.2



# System User's Guide: Operating System and Devices





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# System User's Guide: Operating System and Devices

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**Note**

Before using this information and the product it supports, read the information in "Notices" on page 227.

**Third Edition (October 2002)**

This edition applies to AIX 5L Version 5.2 and to all subsequent releases of this product until otherwise indicated in new editions.

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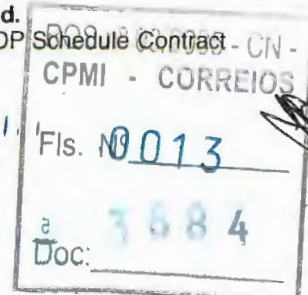
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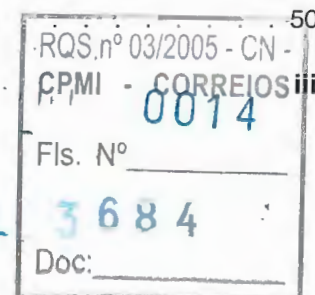
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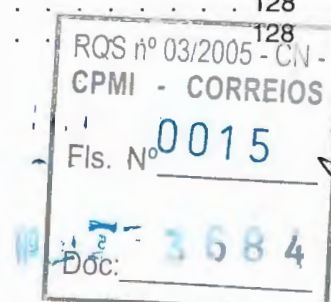
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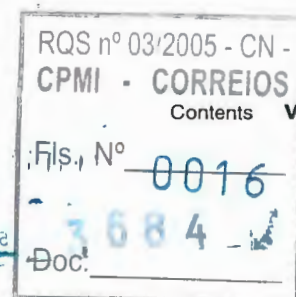
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## About This Book

This book contains information for novice system users who want to acquire greater expertise with the operating system. It covers information such as running commands, handling processes, handling files and directories, and printing. In addition, it introduces tasks such as securing files, using storage media, customizing environment files (**.profile**, **.Xdefaults**, **.mwmrc**), and writing shell scripts. For DOS users, this guide presents procedures on using DOS files in this environment.

Users in a networked environment who are interested in learning more about operating system communications commands should read the *AIX 5L Version 5.2 System User's Guide: Communications and Networks*.

---

## Who Should Use This Book

This book is intended for all system users.

---

## Highlighting

The following highlighting conventions are used in this book:

<b>Bold</b>	Identifies commands, keywords, files, directories, and other items whose names are predefined by the system.
<i>Italics</i>	Identifies parameters whose actual names or values are to be supplied by the user.
Monospace	Identifies examples of specific data values, examples of text similar to what you might see displayed, examples of portions of program code similar to what you might write as a programmer, messages from the system, or information you should actually type.

---

## Case-Sensitivity in AIX

Everything in the AIX operating system is case-sensitive, which means that it distinguishes between uppercase and lowercase letters. For example, you can use the **ls** command to list files. If you type **LS**, the system responds that the command is "not found." Likewise, **FILEA**, **FiLea**, and **filea** are three distinct file names, even if they reside in the same directory. To avoid causing undesirable actions to be performed, always ensure that you use the correct case.

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## ISO 9000

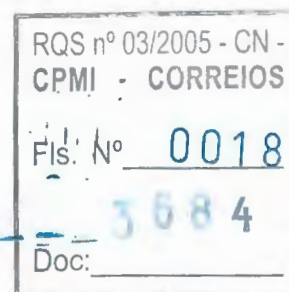
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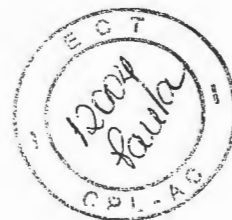
## Related Publications

The following books contain pertinent information:

- *AIX 5L Version 5.2 System User's Guide: Communications and Networks*
- *AIX 5L Version 5.2 System Management Guide: Operating System and Devices*
- *AIX 5L Version 5.2 System Management Concepts: Operating System and Devices*
- *AIX 5L Version 5.2 Guide to Printers and Printing*
- *AIX 5L Version 5.2 Commands Reference*
- *AIX 5L Version 5.2 Files Reference*







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## Chapter 1. Login Names, System IDs, and Passwords

The operating system must know who you are in order to provide you with the correct environment. To identify yourself to the operating system, log in by entering your *login name* (also known as your user ID or user name) and a *password*. Passwords are a form of security. People who know your login name cannot log in to your system unless they know your password.

If your system is set up as a multiuser system, each authorized user will have an account, password, and login name on the system. The operating system keeps track of the resources used by each user. This is known as *system accounting*. Each user will be given a private area in the storage space of the system, called the *file system*. When you log in, the file system appears to contain only your files, although there are thousands of other files on the system.

It is possible to have more than one valid login name on a system. If you want to change from one login name to another, you do not have to log out of the system. Rather, you can use the different login names simultaneously in different shells or consecutively in the same shell without logging out. In addition, if your system is part of a network with connections to other systems, you can log in to any of the other systems where you have a login name. This is referred to as a *remote login*.

When you have finished working on the operating system, you log out to ensure that your files and data are secure.

This chapter contains the following sections:

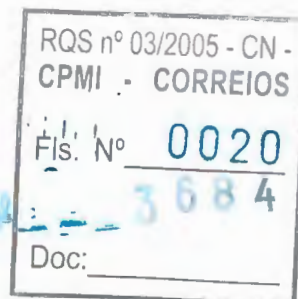
- "Login and Logout Overview"
  - "Logging In to the Operating System" on page 2
  - "Logging in More Than One Time (login Command)" on page 2
  - "Becoming Another User on a System (su Command)" on page 3
  - "Suppressing Login Messages" on page 3
  - "Logging Out of the Operating System (exit and logout Commands)" on page 3
  - "Stopping the Operating System (shutdown Command)" on page 4
- "User and System Identification" on page 4
  - "Displaying Your Login Name (whoami and logname Commands)" on page 4
  - "Displaying the Operating System's Name (uname Command)" on page 5
  - "Displaying Your System's Name (uname Command)" on page 5
  - "Displaying Who Is Logged In (who Command)" on page 6
  - "Displaying User IDs (id Command)" on page 6
- "Passwords" on page 7
  - "Password Guidelines" on page 7
  - "Changing Passwords (passwd Command)" on page 7
  - "Setting Passwords to Null (passwd Command)" on page 8
- "Command Summary for Login Names, System IDs, and Passwords" on page 8

### Login and Logout Overview

To use the operating system, your system must be running and you must be logged in. When you log in to the operating system, you identify yourself to the system and allow the system to set up your environment.

This section describes the following procedures:

- "Logging In to the Operating System" on page 2
- "Logging in More Than One Time (login Command)" on page 2





- "Becoming Another User on a System (su Command)" on page 3
- "Suppressing Login Messages" on page 3
- "Logging Out of the Operating System (exit and logout Commands)" on page 3
- "Stopping the Operating System (shutdown Command)" on page 4

## Logging In to the Operating System

Your system might be set up so that you can only log in during certain hours of the day and on certain days of the week. If you attempt to log in at a time other than the time allowed, your access will be denied. Your system administrator can verify your login times.

You log in at the login prompt. When you log in to the operating system, you are automatically placed into your home directory (also called your *login directory*).

After your system is turned on, log in to the system to start a session.

1. Type your login name following the login: prompt and press Enter:

login: *LoginName*

For example, if your login name is denise:

login: denise

2. If the password: prompt appears, type your password and press Enter. (The screen does not display your password as you type it in.)

password: [your password]

If the password prompt does not appear, you have no password defined; you can begin working in the operating system.

If your machine is not turned on, do the following before you log in:

1. Set the power switches of each attached device to On.
2. Start the system unit by setting the power switch to On (I).
3. Look at the three-digit display. When the self-tests complete without error, the three-digit display is blank.

If an error requiring attention occurs, a three-digit code remains, and the system unit stops. See your system administrator for information about error codes and recovery.

When the self-tests complete successfully, a login prompt similar to the following displays on your screen:  
login:

After you have logged in, depending on how your operating system is set up, your system will start up in either a command line interface (shell) or a graphical interface (for example, AIXwindows or Common Desktop Environment (CDE)).

If you have questions concerning the configuration of your password or user name, please consult your system administrator.

## Logging in More Than One Time (login Command)

If you are working on more than one project and want to maintain separate accounts, you can have more than one concurrent login. You do this by using the same login name or by using different login names to log in to your system.

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**Note:** Each system has a maximum number of login names that can be active at any given time. This number is determined by your license agreement and varies among installations.

For example, if you are already logged on as `denise1` and your other login name is `denise2`, at the prompt, type:

```
login denise2
```

If the password: prompt displays, type your password and press Enter. (The screen does not display your password as you type it.) You now have two logins running on your system.

See the **login** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Becoming Another User on a System (su Command)

You can change the user ID associated with a session (if you know that user's login name) by using the **su** (switch user) command.

For example, if you want to switch and become user `joyce`, at the prompt, type:

```
su joyce
```

If the password: prompt displays, type `joyce`'s password and press Enter. Your user ID is now `joyce`. If you do not know the password, the request is denied.

To verify that your user ID is `joyce`, use the **id** command. For more information on the **id** command, see "Displaying User IDs (id Command)" on page 6.

See the **su** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Suppressing Login Messages

After a successful login, the **login** command displays the message of the day, the date and time of the last successful and unsuccessful login attempts for this user, and the total number of unsuccessful login attempts for this user since the last change of authentication information (usually a password). You can suppress these messages by including a **.hushlogin** file in your home directory.

At the prompt in your home directory, type:

```
touch .hushlogin
```

The **touch** command creates the empty file named **.hushlogin** if it does not already exist. The next time you log in, all login messages will be suppressed. You can instruct the system to retain only the message of the day, while suppressing other login messages.

See the **touch** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

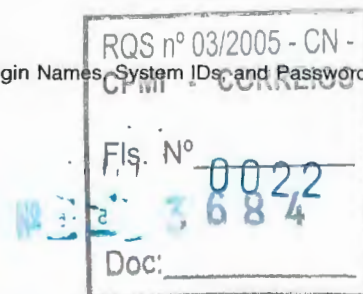
## Logging Out of the Operating System (exit and logout Commands)

To log out of the operating system, do one of the following at the system prompt:

Press the end-of-file control-key sequence (Ctrl-D keys).

OR

Type `exit` and press Enter.







OR

Type `logout` and press Enter.

After you log out, the system displays the `login:` prompt.

## Stopping the Operating System (shutdown Command)

**Attention:** Do not turn off the system without first shutting down. Turning off the system ends all processes running on the system. If other users are working on the system, or if jobs are running in the background, data might be lost. Perform proper shutdown procedures before you stop the system.

If you have root user authority, you can use the **shutdown** command to stop the system. If you are not authorized to use the **shutdown** command, simply log out of the operating system and leave it running.

At the prompt, type:

```
shutdown
```

When the **shutdown** command completes and the operating system stops running, you receive the following message:

```
....Shutdown completed....
```

See the **shutdown** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## User and System Identification

This section describes following procedures available for displaying information that identifies users on your system and the system you are using.

- "Displaying Your Login Name (whoami and logname Commands)"
- "Displaying the Operating System's Name (uname Command)" on page 5
- "Displaying Your System's Name (uname Command)" on page 5
- "Displaying Who Is Logged In (who Command)" on page 6
- "Displaying User IDs (id Command)" on page 6

## Displaying Your Login Name (whoami and logname Commands)

When you have more than one concurrent login, it is often easy to lose track of the login names or, in particular, the login name that you are using at the time.

### Using the whoami Command

To determine which login name is being used, at the prompt, type:

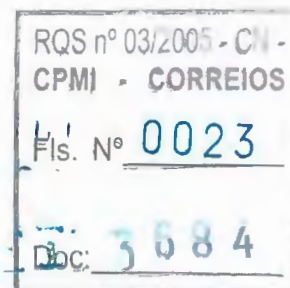
```
whoami
```

The system displays information similar to the following:

```
denise
```

In this example, the login name being used is `denise`.

See the **whoami** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.





## Using the `who am i` Command

A variation of the `who` command, the `who am i` command, allows you to display the login name, terminal name, and time of the login. At the prompt, type:

```
who am i
```

The system displays information similar to the following:

```
denise pts/0 Jun 21 07:53
```

In this example, the login name is `denise`, the name of the terminal is `pts/0`, and this user logged in at 7:53 a.m. on June 21.

See the `who` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Using the `logname` Command

Another variation of the `who` command, the `logname` command displays the same information as the `who` command.

At the prompt, type:

```
logname
```

The system displays information similar to the following:

```
denise
```

In this example, the login name is `denise`.

## Displaying the Operating System's Name (`uname` Command)

To display the name of the operating system, use the `uname` command .

For example, at the prompt, type:

```
uname
```

The system displays information similar to the following:

```
AIX
```

In this example, the operating system name is `AIX`.

See the `uname` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying Your System's Name (`uname` Command)

To display the name of your system if you are on a network, use the `uname` command with the `-n` flag. Your system name identifies your system to the network; it is not the same as your login ID.

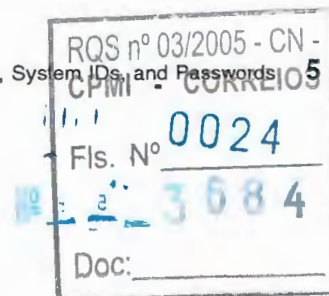
For example, at the prompt, type:

```
uname -n
```

The system displays information similar to the following:

```
barnard
```

In this example, the system name is `barnard`.



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See the **uname** command in the *AIX 5L Version 5.2 Commands Reference* Book for the complete syntax.

## Displaying Who Is Logged In (who Command)

To display information about all users currently on the local system, use the **who** command . The following information is displayed: login name, system name, and date and time of login.

**Note:** This command only identifies users on the local node.

To display information about who is using the local system node, type:

```
who
```

The system displays information similar to the following:

```
joe 1ft/0 Jun 8 08:34
denise pts/1 Jun 8 07:07
```

In this example, the user **joe**, on terminal **1ft/0**, logged in at 8:34 a.m. on June 8.

See the **who** command in the *AIX 5L Version 5.2 Commands Reference* for the exact syntax.

## Displaying User IDs (id Command)

To displays the system identifications (IDs) for a specified user, use the **id** command . The system IDs are numbers that identify users and user groups to the system. The **id** command displays the following information, when applicable:

- User name and real user ID
- Name of the user's group and real group ID
- Name of the user's supplementary groups and supplementary group IDs, if any

For example, at the prompt, type:

```
id
```

The system displays information similar to the following:

```
uid=1544(sah) gid=300(build) euid=0(root) egid=9(printq) groups=0(system),10(audit)
```

In this example, the user has user name **sah** with an ID number of 1544; a primary group name of **build** with an ID number of 300; an effective user name of **root** with an ID number of 0; an effective group name of **printq** with an ID number of 9; and two supplementary group names of **system** and **audit**, with ID numbers 0 and 10, respectively.

For example, at the prompt, type:

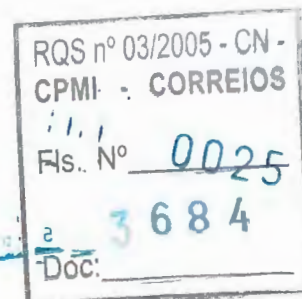
```
id denise
```

The system displays information similar to the following:

```
uid=2988(denise) gid=1(staff)
```

In this example, the user **denise** has an ID number of 2988 and only has a primary group name of **staff** with an ID number of 1.

See the **id** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.







## Passwords

Your system associates a password with each account. A unique password provides some system security for your files. Security is an important part of computer systems because it keeps unauthorized people from gaining access to the system and from tampering with other users' files. Security can also allow some users exclusive privileges to which commands they can use and which files they can access. For protection, some system administrators permit the users access only to certain commands or files.

This section describes the following procedures:

- "Password Guidelines"
- "Changing Passwords (passwd Command)"
- "Setting Passwords to Null (passwd Command)" on page 8

## Password Guidelines

You should have a unique password. *Passwords should not be shared.* Protect passwords as you would any other company asset. When creating passwords, make sure they are difficult to guess, but not so difficult that you have to write them down to remember them.

Using obscure passwords keeps your user ID secure. Passwords based on personal information, such as your name or birthday, are poor passwords. Even common words can be easily guessed.

Good passwords have at least six characters and include nonalphabetic characters. Strange word combinations and words purposely misspelled are also good choices.

**Note:** If your password is so hard to remember that you have to write it down, it is not a good password.

Use the following guidelines when selecting a password:

- Do not use your user ID as a password. Do not use it reversed, doubled, or otherwise modified.
- Do not reuse passwords. The system might be set up to deny the reuse of passwords.
- Do not use any person's name as your password.
- Do not use words that can be found in the online spelling-check dictionary as your password.
- Do not use passwords shorter than six characters.
- Do not use obscene words; they are some of the first ones checked when guessing passwords.
- Do use passwords that are easy to remember, so you won't have to write them down.
- Do use passwords that use both letters and numbers and that have both lowercase and uppercase letters.
- Do use two words, separated by a number, as a password.
- Do use pronounceable passwords. They are easier to remember.
- Do not write passwords down. However, if you must write them down, place them in a physically secure place, such as a locked cabinet.

## Changing Passwords (passwd Command)

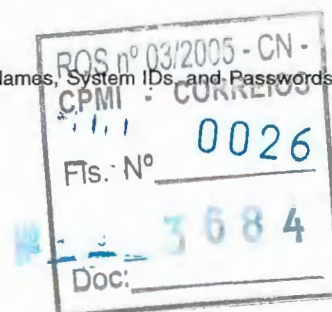
To change your password, use the **passwd** command.

1. At the prompt, type:

`passwd`

If you do not already have a password, skip step 2.

2. The following prompt displays:





Changing password for *UserID*  
*UserID*'s Old password:



This request keeps an unauthorized user from changing your password while you are away from your system. Type your current password and press Enter.

3. The following prompt displays:

*UserID*'s New password:

Type the new password you want and press Enter.

4. The following prompt displays, asking you to reenter your new password.

Enter the new password again:

This request protects you from setting your password to a mistyped string that you cannot re-create.

See the **passwd** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Setting Passwords to Null (passwd Command)

If you do not want to enter a password each time you log in, set your password to null (blank).

To set your password to null, type:

**passwd**

When you are prompted for the new password, press Enter or Ctrl-D.

The **passwd** command does not prompt again for a password entry. A message verifying the null password displays.

See the **passwd** command in the *AIX 5L Version 5.2 Commands Reference Book* for more information and the exact syntax.

---

## Command Summary for Login Names, System IDs, and Passwords

### Login and Logout Commands

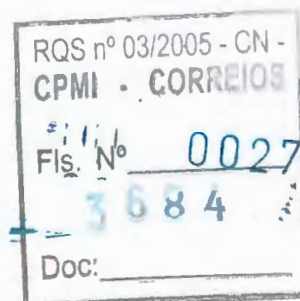
<b>login</b>	Initiates your session
<b>logout</b>	Stops all your processes
<b>shutdown</b>	Ends system operation
<b>su</b>	Changes the user ID associated with a session
<b>touch</b>	Updates the access and modification times of a file, or creates an empty file

### User and System Identification Commands

<b>id</b>	Displays the system identifications of a specified user
<b>logname</b>	Displays login name.
<b>uname</b>	Displays the name of the current operating system
<b>who</b>	Identifies the users currently logged in
<b>whoami</b>	Displays your login name

### Password Command

**passwd** Changes a user's password





### Related Information

For further information on this topic, see the following

- Chapter 4, "Commands and Processes" on page 25
- Chapter 10, "File and System Security" on page 117
- Chapter 2, "User Environment and System Information" on page 11
- Chapter 11, "Customizing the User Environment" on page 129

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### Related Information

Chapter 4, "Commands and Processes" on page 25

Chapter 10, "File and System Security" on page 117

Chapter 2, "User Environment and System Information" on page 11

Chapter 11, "Customizing the User Environment" on page 129

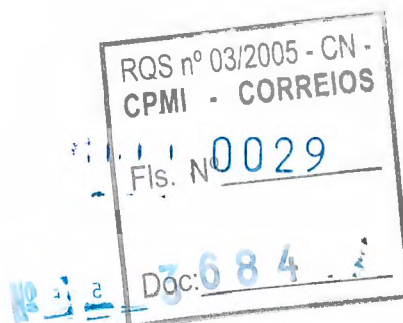
Chapter 12, "Shells" on page 139

"Korn Shell or POSIX Shell Commands" on page 144

"Bourne Shell" on page 184

"C Shell" on page 200

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## Chapter 2. User Environment and System Information

Each login name has its own system environment. The system environment is an area where information that is common to all processes running in a session is stored. You can use several commands to display information about your system.

This chapter discusses the following procedures for displaying information about your environment.

- "Listing System Devices (lscfg Command)"
- "Displaying the Console Name (lscons Command)" on page 12
- "Displaying the Terminal Name (tty Command)" on page 13
- "Listing Available Displays (lsdisp Command)" on page 13
- "Listing Available Fonts (lsfont Command)" on page 13
- "Listing the Current Software Keyboard Map (lskbd Command)" on page 14
- "Listing Available Software Products (lspp Command)" on page 14
- "Listing Control Key Assignments for Your Terminal (stty Command)" on page 14
- "Listing Environment Variables (env Command)" on page 15
- "Displaying the Value of an Environment Variable (printenv Command)" on page 16
- "Working with Bidirectional Languages (aixterm Command)" on page 16
- "Command Summary for User Environment and System Information" on page 16

### Listing System Devices (lscfg Command)

To display the name, location, and description of each device found in the current configuration, use the **lscfg** command. The list is sorted by device location.

For example, to list the devices configured in your system, at the prompt, type:

```
lscfg
```

Press Enter.

The system displays output similar to the following:

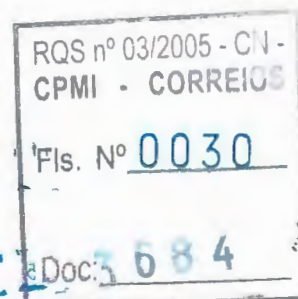
```
INSTALLED RESOURCE LIST
```

The following resources are installed on your machine.

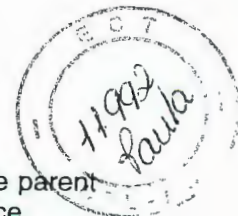
```
+/- = Added/Deleted from Diagnostic Test List.  
*   = NOT Supported by Diagnostics.
```

```
Model Architecture: chrp  
Model Implementation: Multiple Processor, PCI bus
```

```
+ sysplanar0  00-00          CPU Planar  
+ fpa0        00-00          Floating Point Processor  
+ mem0        00-0A          Memory Card  
+ mem1        00-0B          Memory Card  
+ ioplanar0   00-00          I/O Planar  
+ rs2320      00-01          RS232 Card  
+ tty0        00-01-0-01     RS232 Card Port  
- tty1        00-01-0-02     RS232 Card Port  
..  
..  
..
```







The device list is not sorted by device location alone. It is sorted by the parent/child hierarchy. If the parent has multiple children, the children are sorted by device location. If the children have the same device location, they are displayed in the order in which they were obtained by the software. To display information about a specific device, you can use the **-l** flag. For example, to list the information on device **sysplanar0**, at the prompt, type:

```
lscfg -l sysplanar0
```

Press Enter.

The system displays output similar to the following:

DEVICE	LOCATION	DESCRIPTION
sysplanar0	00-00	CPU Planar

You can also use the **lscfg** command to display vital product data (VPD), such as part numbers, serial numbers, and engineering change levels. For some devices, the VPD is collected automatically and added to the system configuration. For other devices, the VPD is entered manually. An ME preceding the data indicates that the data was entered manually.

For example, to list VPD for devices configured in your system, at the prompt, type:

```
lscfg -v
```

Press Enter.

The system displays output similar to the following:

#### INSTALLED RESOURCE LIST WITH VPD

The following resources are installed in your machine.

```
Model Architecture: chrp
Model Implementation: Multiple Processor, PCI bus
sysplanar0  00-00  CPU Planar
  Part Number.....342522
  EC Level.....254921
  Serial Number.....353535
fpa0  00-00  Floating Point Processor
mem0  00-0A  Memory Card
  EC Level.....990221
```

See the **lscfg** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying the Console Name (lscons Command)

To write the name of the current console device to standard output (usually your screen), use the **lscons** command.

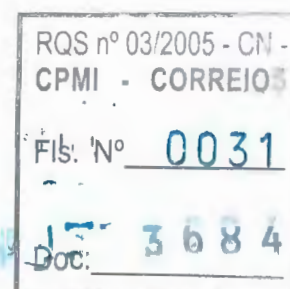
For example, at the prompt, type:

```
lscons
```

Press Enter.

The system displays output similar to the following:

```
/dev/lft0
```





See the **lscons** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Displaying the Terminal Name (tty Command)

To display the name of your terminal, use the **tty** command.

For example, at the prompt, type:

```
tty
```

Press Enter.

The system displays information similar to the following:

```
/dev/tty06
```

In this example, **tty06** is the name of the terminal, and **/dev/tty06** is the device file that contains the interface to this terminal.

See the **tty** command in the *AIX 5L Version 5.2 Commands Reference* for the exact syntax.

---

## Listing Available Displays (lsdisp Command)

To list the displays currently available on your system, providing a display identification name, slot number, display name, and description of each of the displays, use the **lsdisp** command.

For example, to list all available displays, type:

```
lsdisp
```

Press Enter.

Following is an example of the output. The list displays in ascending order according to slot number.

Name	Slot	Name	Description
ppr0	00-01	POWER_G4	Midrange Graphics Adapter
gda0	00-03	colorgda	Color Graphics Display Adapter
ppr1	00-04	POWER_Gt3	Midrange Entry Graphics Adapter

See the **lsdisp** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Listing Available Fonts (lsfont Command)

To display a list of the fonts available to your display, use the **lsfont** command.

For example, to list all fonts available to the display in list format, type:

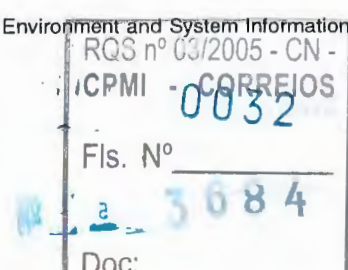
```
lsfont
```

Press Enter.

Following is an example of the output, showing the font identifier, file name, glyph size and font encoding:

FONT ID	FILE NAME	GLYPH SIZE	FONT ENCODING
0	Erg22.isol.snf	12x30	ISO8859-1
1	Erg11.isol.snf	8x15	ISO8859-1

See the **lsfont** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.





## Listing the Current Software Keyboard Map (Iskbd Command)

To display the absolute path name of the current software keyboard map loaded into the system, use the **lskbd** command.

For example, to list your current keyboard map, type:

```
lskbd
```

Press Enter.

The following is an example of the listing displayed by the **lskbd** command:

The current software keyboard map = /usr/lib/nls/loc/C.1ftkeymap

## Listing Available Software Products (Islpp Command)

To display information about software products available for your system, use the **islpp** command.

For example, to list all the software products in your system, at the system prompt, type:

```
islpp -l -a
```

Press Enter.

Following is an example of the output:

Fileset	Level	State	Description
-----			
Path: /usr/lib/objrepos			
X11_3d.gl.dev.obj		APPLIED	AIXwindows/3D GL Development Utilities
Fonts			
X11fnt.oldX.fnt		APPLIED	AIXwindows Miscellaneous X Fonts
X11mEn_US.msg		APPLIED	AIXwindows NL Message files
.			
.			
.			

If the listing is very long, the top portion may scroll off the screen. To display the listing one page (screen) at a time, use the **islpp** command piped to the **pg** command. At the prompt, type:

```
islpp | pg
```

Press Enter.

See the **islpp** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

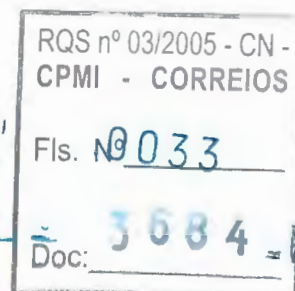
## Listing Control Key Assignments for Your Terminal (stty Command)

To display your terminal settings, use the **stty** command. Note especially which keys your terminal uses for control keys.

For example, at the prompt, type:

```
stty -a
```

Press Enter.







The system displays information similar to the following:

```
.  
.   
.   
intr = ^C; quit = ^\; erase = ^H; kill = ^U; eof = ^D;  
eol = ^@ start = ^Q; stop = ^S; susp = ^Z; dsusp = ^Y;  
reprint = ^R discard = ^O; werase = ^W; lnext = ^V  
.   
.   
.
```

In this example, lines such as `intr = ^C`; `quit = ^\`; `erase = ^H`; are your control key settings. The `^H` key is the Backspace key, and it is set to perform the erase function.

If the listing is very long, the top portion may scroll off the screen. To display the listing one page (screen) at a time, use the **stty** command piped to the **pg** command. At the prompt, type:

```
stty -a | pg
```

Press Enter.

See the **stty** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Listing Environment Variables (env Command)

All variables (with their associated values) known to a command at the beginning of its execution constitute its *environment*. This environment includes variables that a command inherits from its parent process and variables specified as keyword parameters on the command line that calls the command. The shell interacts with the environment in several ways. When started, the shell scans the environment and creates a parameter for each name found, giving the parameter the corresponding value and marking it for export. Executed commands inherit the environment.

To display your current environment variables, use the **env** command. An environment variable that is accessible to all your processes is called a *global variable*.

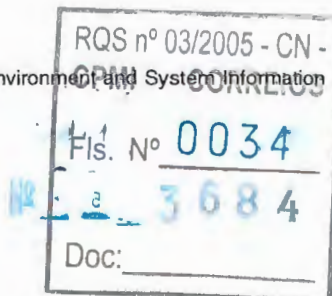
For example, to list all environment variables, type:

```
env
```

Press Enter.

Following is an example of the output:

```
TMPDIR=/usr/tmp  
myid=denise  
LANG=en_US  
UNAME=barnard  
PAGER=/bin/pg  
VISUAL=vi  
PATH=/usr/ucb:/usr/lpp/X11/bin:/bin:/usr/bin:/etc:/u/denise:/u/denise/bin:/u/bin1  
MAILPATH=/usr/mail/denise?denise has mail !!!  
MAILRECORD=/u/denise/.Outmail  
EXINIT=set beautify noflash namesg report=1 showmode showmatch  
EDITOR=vi  
PSCH=>  
HISTFILE=/u/denise/.history  
LOGNAME=denise  
MAIL=/usr/mail/denise  
PS1=denise@barnard:${PWD}>  
PS3=#
```







```
PS2=>
epath=/usr/bin
USER=denise
SHELL=/bin/ksh
HISTSIZE=500
HOME=/u/denise
FCEDIT=vi
TERM=1ft
MAILMSG=**YOU HAVE NEW MAIL. USE THE mail COMMAND TO SEE YOUR PWD=/u/denise
ENV=/u/denise/.env
```

If the listing is very long, the top portion scrolls off the screen. To display the listing one page (screen) at a time, use the **env** command piped to the **pg** command. At the prompt, type:

```
env | pg
```

Press Enter.

See the **env** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Displaying the Value of an Environment Variable (printenv Command)

To display the values of environment variables, use the **printenv** command. If you specify the *Name* parameter, the system only prints the value associated with the parameter you requested. If you do not specify the *Name* parameter, the **printenv** command displays all current environment variables, showing one *Name = Value* sequence per line.

For example, to find the current setting of the **MAILMSG** environment variable, type:

```
printenv MAILMSG
```

Press Enter.

The command returns the value of the **MAILMSG** environment variable. For example:

```
YOU HAVE NEW MAIL
```

See the **printenv** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Working with Bidirectional Languages (aixterm Command)

The **aixterm** command supports Arabic and Hebrew, which are bidirectional languages. Bidirectional languages have the ability to be read and written in two directions, such as from left to right, and from right to left. You can work with Arabic and Hebrew applications by opening a window specifying an Arabic or Hebrew locale.

See the **aixterm** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Command Summary for User Environment and System Information

<b>aixterm</b>	Enables you work with bidirectional languages
<b>env</b>	Displays the current environment or sets the environment for the execution of a command
<b>lscfg</b>	Displays diagnostic information about a device
<b>lscons</b>	Displays the name of the current console
<b>lsdisp</b>	Lists the displays currently available on the system
<b>lsfont</b>	Lists the fonts available for use by the display
<b>lskbd</b>	Lists the keyboard maps currently loaded in the system
<b>lspp</b>	Lists software products



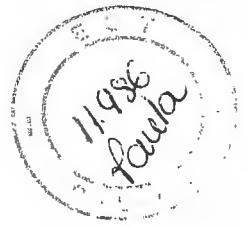


<b>printenv</b>	Displays the values of environment variables
<b>stty</b>	Displays system settings
<b>tty</b>	Displays the full path name of your terminal

## Related Information

- Chapter 4, "Commands and Processes" on page 25
- Chapter 5, "Input and Output Redirection" on page 45
- "User and System Identification" on page 4
- Chapter 11, "Customizing the User Environment" on page 129

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## Chapter 3. The Common Desktop Environment

With the Common Desktop Environment, you can access networked devices and tools without having to be aware of their location. You can exchange data across applications by simply dragging and dropping objects.

System administrators find many tasks that previously required complex command line syntax can now be done more easily and similarly from platform to platform. They can also maximize their investment in existing hardware and software by configuring centrally and distributing applications to users. They can centrally manage the security, availability, and interoperability of applications for the users they support.

**Note:** The Common Desktop Environment (CDE) 1.0. Help volumes, web-based documentation, and hardcopy manuals might refer to the desktop as Common Desktop Environment, the AIXwindows desktop, the Common Desktop Environment, CDE 1.0, or simply, the desktop.

Topics covered in this chapter are:

- "Starting and Stopping the Common Desktop Environment"
- "Modifying Desktop Profiles" on page 20
- "Adding and Removing Displays and Terminals for Common Desktop Environment" on page 20
- "Customizing Display Devices for Common Desktop Environment" on page 22

### Starting and Stopping the Common Desktop Environment

You can set up the system so that Common Desktop Environment comes up automatically when you start the system, or you can start Common Desktop Environment manually. You must log in as root to perform each of these tasks.

- "Enabling and Disabling Desktop Autostart"
- "Starting Common Desktop Environment Manually"
- "Stopping Common Desktop Environment Manually" on page 20

### Enabling and Disabling Desktop Autostart

You may find it more convenient to set up your system to start Common Desktop Environment automatically when the system is turned on. You can do this through the Web-based System Manager (type `wsm`, then select `System`), through the System Management Interface Tool (SMIT), or from a command line.

#### Prerequisite

You must have root user authority to enable or disable desktop auto-start.

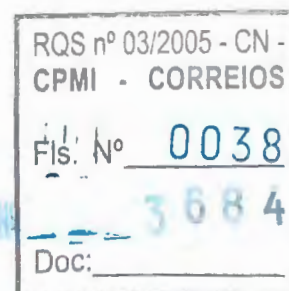
*Starting/Stopping the Common Desktop Environment Automatically Tasks*

Task	SMIT Fast Path	Command or File
Enabling the Desktop Auto-Start <sup>1</sup>	<code>smit dtconfig</code>	<code>/usr/dt/bin/dtconfig -e</code>
Disabling the Desktop Auto-Start <sup>1</sup>	<code>smit dtconfig</code>	<code>/usr/dt/bin/dtconfig -d</code>

<sup>1</sup>**Note:** Restart the machine after completing this task.

### Starting Common Desktop Environment Manually

You can start Common Desktop Environment manually.







## Start the Desktop Login Manager Manually

1. Log in to your system as root.
2. At the command line, type:  
`/usr/dt/bin/dtlogin -daemon`

A **Desktop Login** screen is displayed. When you log in, you will start a desktop session.

## Stopping Common Desktop Environment Manually

You can stop Common Desktop Environment manually.

### Stop the Login Manager Manually

When you manually stop the login manager, all X-servers and desktop sessions that the login manager started are stopped.

1. Open a terminal emulator window and log in as root.
2. Obtain the process ID of the Login Manager by typing the following:  
`cat /var/dt/Xpid`
3. Stop the Login Manager by typing:  
`kill -term process_id`

---

## Modifying Desktop Profiles

When a user logs in to the desktop, the shell environment file (**.profile** or **.login**) is not automatically read. The desktop runs the X-server before the user logs in, so the function provided by the **.profile** file or the **.login** file must be provided by the desktop's login manager.

User-specific environment variables are set in */Home Directory/***.dtprofile**. A template for this file is located in */usr/dt/config/sys.dtpfile*. Place variables and shell commands in **.dtprofile** that apply only to the desktop. Add lines to the end of the **.dtprofile** to incorporate the shell environment file.

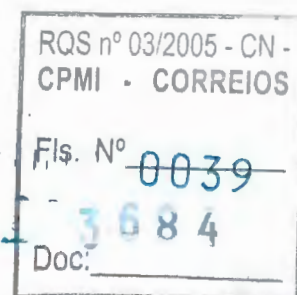
System-wide environment variables can be set in Login Manager configuration files. For details on configuring environment variables, see the *Common Desktop Environment 1.0: Advanced User's and System Administrator's Guide*.

---

## Adding and Removing Displays and Terminals for Common Desktop Environment

The login manager can be started from a system with a single local bitmap or graphics console. Many other situations are also possible, however (see the following figure). You can start Common Desktop Environment from:

- Local consoles
- Remote consoles
- Bitmap and character-display
- Xterminal systems running on a host system on the network



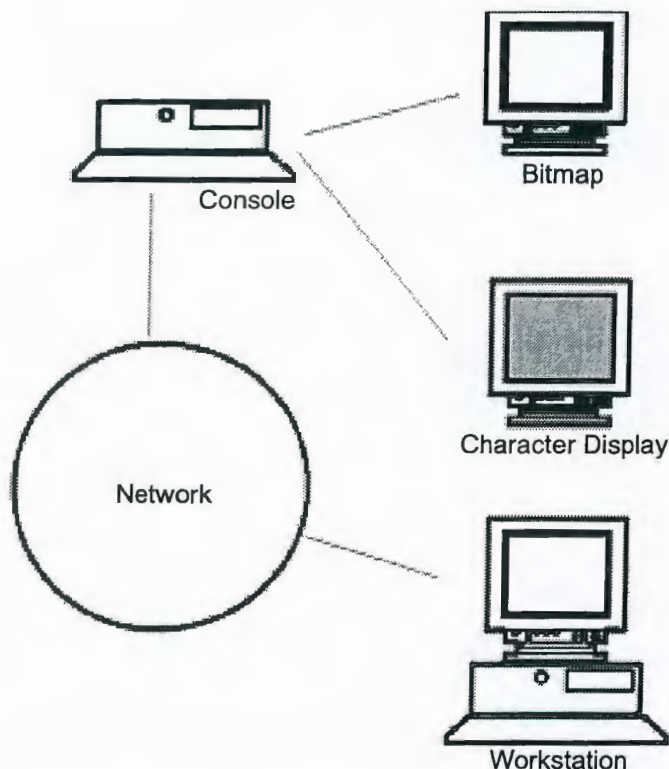


Figure 1. CDE Interface Points. This illustration shows the connection points between a console, a network, a bitmap display, a character display, and a workstation.

An Xterminal system consists of a display device, keyboard, and mouse that runs only the Xserver. Clients, including Common Desktop Environment, are run on one or more host systems on the networks. Output from the clients is directed to the Xterminal display.

The following Login Manager configuration tasks support many possible configurations.

- "Removing a Local Display"
- "Adding an ASCII or Character-Display Terminal"

## Using a Workstation as an Xterminal

From a command line, type:

```
/usr/bin/X11/X -query hostname
```

The X server of the workstation acting as an Xterminal must:

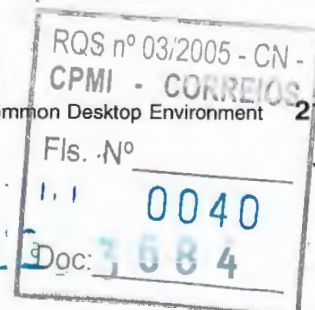
- Support XDMCP and the **-query** command-line option.
- Provide xhost permission (in **/etc/X\*.hosts**) to the terminal host.

## Removing a Local Display

To remove a local display, remove its entry in the Xservers file in the **/usr/dt/config** directory.

## Adding an ASCII or Character-Display Terminal

A character-display console is a configuration in which the console is not a bitmap device.







## Adding an ASCII or Character-Display Console if No Bitmap Display Is Present

1. If the `/etc/dt/config/Xservers` file does not exist, copy the `/usr/dt/config/Xservers` file to the `/etc/dt/config` directory.
2. If you have to copy `Xservers` to `/etc/dt/config`, you must change or add the **Dtlogin.servers:** line in `/etc/dt/config/Xconfig` to be:  
`Dtlogin*servers: /etc/dt/config/Xservers`
3. Comment out the line in `/etc/dt/config/Xservers` that starts the Xserver. This will disable the Login Option Menu.  
`# * Local local@console /path/X :0`
4. Reread the Login Manager configuration files.

## Adding a Character-Display Console if a Bitmap Display Exists

1. If the `/etc/dt/config/Xservers` file does not exist, copy the `/usr/dt/config/Xservers` file to the `/etc/dt/config` directory.
2. If you have to copy `Xservers` to `/etc/dt/config`, you must change or add the **Dtlogin.servers:** line in `/etc/dt/config/Xconfig` to be:  
`Dtlogin*servers: /etc/dt/config/Xservers`
3. Edit the line in `/etc/dt/config/Xservers` that starts the Xserver to read:  
`* Local local@none /path/X :0`
4. Reread the Login Manager configuration files.

---

## Customizing Display Devices for Common Desktop Environment

You can configure Common Desktop Environment Login Manager to run on systems with two or more display devices.

When a system includes multiple displays, the following configuration requirements must be met:

- A server must be started on each display.
- No Windows mode must be configured for each display.

It might be necessary or desirable to use different `dtlogin` resources for each display.

It may also be necessary or desirable to use different systemwide environment variables for each display device.

## Starting the Server on Each Display Device

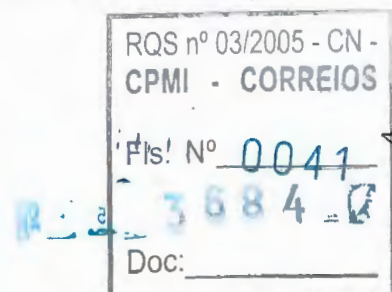
1. If the `/etc/dt/config/Xservers` file does not exist, copy the `/usr/dt/config/Xservers` file to the `/etc/dt/config` directory.
2. If you have to copy `Xservers` to `/etc/dt/config`, you must change the **Dtlogin.servers:** line in `/etc/dt/config/Xconfig` to:  
`Dtlogin*servers: /etc/dt/config/Xservers`
3. Edit `/etc/dt/config/Xservers` to start an X server on each display device.

### Syntax

The general syntax for starting the server is:

`DisplayName DisplayClass DisplayType [ @ite ] Command`

Only displays with an associated Internal Terminal Emulator (ITE) can operate in No Windows mode. No Windows mode temporarily disables the desktop for the display and runs a `getty` process if one is not already started. This allows you to log in and perform tasks not possible under Common Desktop





Environment. When you log out, the desktop is restarted for the display device. If a getty is not already running on a display device, Login Manager starts one when No Windows mode is initiated.

### Default configuration

When `ite` is omitted, `display:0` is associated with the ITE (`/dev/console`).

## Specifying a Different Display as ITE

- On the ITE display, set ITE to the character device.
- On all other displays, set ITE to none.

### Examples

The following entries in the **Xserver** file start a server on three local displays on `sysaaa:0`. Display `:0` will be the console (ITE).

```
sysaaa:0 Local local /usr/bin/X11/X :0
sysaaa:1 Local local /usr/bin/X11/X :1
sysaaa:2 Local local /usr/bin/X11/X :2
```

On host `sysbbb`, the bitmap display `:0` is not the ITE; the ITE is associated with device `/dev/ttyi1`. The following entries in the **Xserver** file start servers on the two bitmap displays with No Windows Mode enabled on `:1`.

```
sysaaa:0 Local local@none /usr/bin/X11/X :0
sysaaa:1 Local local@ttyi1 /usr/bin/X11/X :1
```

## Specifying the Display Name in Xconfig

You cannot use regular `hostname:0` syntax for the display name in `/etc/dt/config/Xconfig`.

- Use underscore in place of the colon.
- In a fully qualified host name, use underscores in place of the periods.

### Example

```
Dtlogin.claaa_0.resource: value
Dtlogin.sysaaa_prsm_ld_edu_0.resource: value
```

## Using Different Login Manager Resources for Each Display

1. If the `/etc/dt/config/Xconfig` file does not exist, copy the `/usr/dt/config/Xconfig` file to the `/etc/dt/config` directory.
2. Use the resources resource in `/etc/dt/config/Xconfig` to specify a different resource file for each display:

```
Dtlogin.DisplayName.resources: path/file
```

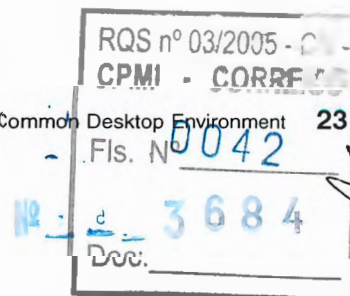
whereas *path* is the pathname of the Xresource files to be used and *file* is the file name of the Xresource files to be used.

3. Create each of the resource files specified in the **Xconfig** file. A language specific Xresources file is installed in `/usr/dt/config/<LANG>`.
4. In each file, place the `dtlogin` resources for that display.

### Example

The following lines in the **Xconfig** file specify different resource files for three displays:

```
Dtlogin.sysaaa_0.resources: /etc/dt/config/Xresources0
Dtlogin.sysaaa_1.resources: /etc/dt/config/Xresources1
Dtlogin.sysaaa_2.resources: /etc/dt/config/Xresources2
```



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## Running Different Scripts for Each Display

1. If the `/etc/dt/config/Xconfig` file does not exist, copy the `/usr/dt/config/Xconfig` file to the `/etc/dt/config` directory.
2. Use the startup, reset, and setup resources in `/etc/dt/config/Xconfig` to specify different scripts for each display (these files are run instead of `Xstartup`, `Xreset`, and `Xsetup` file):

```
Dtlogin*DisplayName*startup: /path/file
Dtlogin*DisplayName*reset: /path/file
Dtlogin*DisplayName*setup: /path/file
```

whereas *path* is the pathname of the file to be used and *file* is the file name of the file to be used. The startup script is run as root after the user has logged in, before the Common Desktop Environment session is started.

The script `/usr/dt/config/Xreset` can be used to reverse the setting made in the `Xstartup` file. The `Xreset` file runs when the user logs out.

### Example

The following lines in the `Xconfig` file specify different scripts for two displays.

```
Dtlogin.sysaaa_0*startup: /etc/dt/config/Xstartup0
Dtlogin.sysaaa_1*startup: /etc/dt/config/Xstartup1
Dtlogin.sysaaa_0*setup: /etc/dt/config/Xsetup0
Dtlogin.sysaaa_1*setup: /etc/dt/config/Xsetup1
Dtlogin.sysaaa_0*reset: /etc/dt/config/Xreset0
Dtlogin.sysaaa_1*reset: /etc/dt/config/Xreset1
```

## Setting Different Systemwide Environment Variables for Each Display

1. If the `/etc/dt/config/Xconfig` file does not exist, copy the `/usr/dt/config/Xconfig` file to the `/etc/dt/config` directory.
2. Set the environment resource in `/etc/dt/config/Xconfig` separately for each display:

```
Dtlogin*DisplayName*environment: value
```

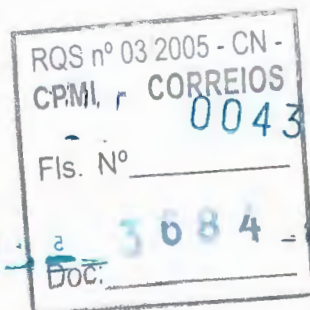
The following points apply to environment variables for each display:

- Separate variable assignments with a space or tab.
- Do not use the environment resource to set TZ and LANG.
- There is no shell processing within the `Xconfig` file.

### Example

The following lines in the `Xconfig` file set variables for two displays.

```
Dtlogin*syshere_0*environment:EDITOR=vi SB_DISPLAY_ADDR=0xB00000
Dtlogin*syshere_1*environment:EDITOR=emacs \
    SB_DISPLAY_ADDR=0xB00000
```





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## Chapter 4. Commands and Processes

A *command* is a request to perform an operation or run a program. You use commands to tell the operating system what task you want it to perform. When commands are entered, they are deciphered by a command interpreter (also known as a *shell*) and that task is processed.

A program or command that is actually running on the computer is referred to as a *process*. The operating system can run many different processes at the same time.

The operating system allows you to manipulate the input and output (I/O) of data to and from your system by using specific I/O commands and symbols. You can control input by specifying the location from which to gather data. For example, you can specify to read input while data is entered on the keyboard (standard input) or to read input from a file. You can control output by specifying where to display or store data. For example, you can specify to write output data to the screen (standard output) or to write it to a file.

This chapter discusses the following:

- "Commands Overview" on page 26
  - "Command Syntax" on page 26
  - "Reading Usage Statements" on page 28
  - "Using Web-based System Manager" on page 28
  - "Using the smit Command" on page 29
  - "Locating a Command or Program (whereis Command)" on page 29
  - "Displaying Information about a Command (man Command)" on page 29
  - "Displaying the Function of a Command (whatis Command)" on page 30
  - "Listing Previously Entered Commands (history Shell Command)" on page 30
  - "Repeating Commands Using the history Shell Command" on page 31
  - "Substituting Strings Using the history Shell Command" on page 32
  - "Editing the Command History" on page 32
  - "Creating a Command Alias (alias Shell Command)" on page 33
  - "Working with Text-Formatting Commands" on page 34
- "Processes Overview" on page 35
  - "Foreground and Background Processes" on page 36
  - "Daemons" on page 36
  - "Zombie Process" on page 36
  - "Starting a Process" on page 36
  - "Checking Processes (ps Command)" on page 37
  - "Setting the Initial Priority of a Process (nice Command)" on page 38
  - "Changing the Priority of a Running Process (renice Command)" on page 39
  - "Canceling a Foreground Process" on page 39
  - "Stopping a Foreground Process" on page 40
  - "Restarting a Stopped Process" on page 40
  - "Scheduling a Process for Later Operation (at Command)" on page 40
  - "Listing All Scheduled Processes (at or atq Command)" on page 41
  - "Removing a Process from the Schedule (at Command)" on page 42
  - "Removing a Background Process (kill Command)" on page 42
- "Command Summary for Commands and Processes" on page 43

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## Commands Overview

Some commands can be entered simply by typing one word. It is also possible to combine commands so that the output from one command becomes the input for another command. This is known as *pip*ing. For more information on piping, see "Shell Features" on page 140.

Flags further define the actions of commands. A *flag* is a modifier used with the command name on the command line, usually preceded by a dash.

Commands can also be grouped together and stored in a file. These are known as *shell procedures* or *shell scripts*. Instead of executing the commands individually, you execute the file that contains the commands. For more information on scripts and procedures, see "Creating and Running a Shell Script" on page 143.

To enter a command, type the command name at the prompt, and press Enter.

\$ CommandName

This section describes the following procedures:

- "Command Syntax" on page 28
- "Reading Usage Statements" on page 28
- "Using Web-based System Manager" on page 28
- "Using the smit Command" on page 29
- "Locating a Command or Program (whereis Command)" on page 29
- "Displaying Information about a Command (man Command)" on page 29
- "Displaying the Function of a Command (whatis Command)" on page 30
- "Listing Previously Entered Commands (history Shell Command)" on page 30
- "Repeating Commands Using the history Shell Command" on page 31
- "Substituting Strings Using the history Shell Command" on page 32
- "Editing the Command History" on page 32
- "Creating a Command Alias (alias Shell Command)" on page 33
- "Working with Text-Formatting Commands" on page 34

## Command Syntax

Although some commands can be entered by simply typing one word, other commands use flags and parameters. Each command has a syntax that designates both the required and optional flags and parameters. The general format for a command is as follows:

CommandName flag(s) parameter(s)

The following are some general rules about commands:

- Spaces between commands, flags, and parameters are significant.
- Two commands can be entered on the same line by separating the commands with a semicolon (;). For example:

\$ CommandOne;CommandTwo

The shell runs the commands sequentially.

- Commands are case-sensitive. The shell distinguishes between uppercase and lowercase letters. To the shell, print is not the same as PRINT or Print.

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- A very long command can be entered on more than one line by using the backslash (\) character. A backslash signifies line continuation to the shell. The following example is one command that spans two lines:

```
$ ls Mail info temp \
  (press Enter)
```

```
> diary
(the > prompt appears)
```

The > character is your secondary prompt (\$ is the non-root user's default primary prompt), indicating that the current line is the continuation of the previous line. Note that **cs**h (the C shell) gives no secondary prompt, and the break must be at a word boundary, and its primary prompt is %.

## Command Name

The first word of every command is the command name. Some commands have only a command name.

## Command Flags

A number of flags might follow the command name. Flags modify the operation of a command and are sometimes called *options*. A flag is set off by spaces or tabs and usually starts with a dash (-). Exceptions are **ps**, **tar**, and **ar**, which do not require a dash in front of some of the flags. For example, in the following command:

```
ls -a -F
```

ls is the command name and -a -F are the flags.

When a command uses flags, they come directly after the command name. Single-character flags in a command can be combined with one dash. For example, the previous command can also be written as follows:

```
ls -aF
```

There are some circumstances when a parameter actually begins with a dash (-). In this case, use the delimiter dash dash (--) before the parameter. The -- tells the command that whatever follows is not a flag but a parameter.

For example, if you wanted to create a directory named -tmp and you typed the following command:

```
mkdir -tmp
```

The system displays an error message similar to the following:

```
mkdir: Not a recognized flag: t
Usage: mkdir [-p] [-m mode] Directory ...
```

The correct way of entering the command is as follows:

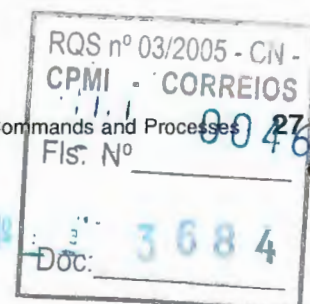
```
mkdir -- -tmp
```

Your new directory, -tmp, is now created.

## Command Parameters

After the command name, there might be a number of flags, followed by parameters. Parameters are sometimes called *arguments* or *operands*. Parameters specify information that the command needs in order to run. If you do not specify a parameter, the command might assume a default value. For example, in the following command:

```
ls -a temp
```





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`ls` is the command name, `-a` is the flag, and `temp` is the parameter. This command displays all (`-a`) the files in the directory `temp`. In the following example:

```
ls -a
```

the default value is the current directory because no parameter is given. In the following example:

```
ls temp mail
```

no flags are given, and `temp` and `mail` are parameters. In this case, `temp` and `mail` are two different directory names. The `ls` command displays all but the hidden files in each of these directories.

Whenever a parameter or option-argument is, or contains, a numeric value, the number is interpreted as a decimal integer, unless otherwise specified. Numerals in the range 0 to `INT_MAX`, as defined in the `/usr/include/sys/limits.h` file, are syntactically recognized as numeric values.

If a command you want to use accepts negative numbers as parameters or option-arguments, you can use numerals in the range `INT_MIN` to `INT_MAX`, both as defined in the `/usr/include/sys/limits.h` file. This does not necessarily mean that all numbers within that range are semantically correct. Some commands have a built-in specification permitting a smaller range of numbers, for example, some of the print commands. If an error is generated, the error message lets you know the value is out of the supported range, not that the command is syntactically incorrect.

## Reading Usage Statements

Usage statements are a way to represent command syntax and consist of symbols such as brackets (`[ ]`), braces (`{ }`), and vertical bars (`|`). The following is a sample of a usage statement for the `unget` command:

```
unget [ -rSID ][ -s ][ -n ] File ...
```

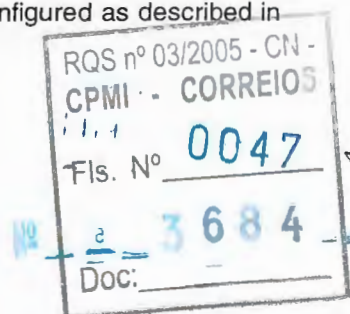
The following conventions are used in the command usage statements:

- Items that must be entered literally on the command line are in **bold**. These items include the command name, flags, and literal characters.
- Items representing variables that must be replaced by a name are in *italics*. These items include parameters that follow flags and parameters that the command reads, such as *Files* and *Directories*.
- Parameters enclosed in brackets are optional.
- Parameters enclosed in braces are required.
- Parameters not enclosed in either brackets or braces are required.
- A vertical bar signifies that you choose only one parameter. For example, `[ a | b ]` indicates that you *can* choose `a`, `b`, or nothing. Similarly, `{ a | b }` indicates that you *must* choose either `a` or `b`.
- Ellipses ( `...` ) signify the parameter can be repeated on the command line.
- The dash ( `-` ) represents standard input.

## Using Web-based System Manager

Web-based System Manager is a graphical user interface for managing the system, either from a locally attached display or remotely from another system or personal computer equipped with a Web browser. You can start Web-based System Manager in a variety of ways:

- From a command line terminal in the Common Desktop Environment (CDE) by entering the **wsm** command.
- From a command line terminal in the AIXwindows environment by entering the **wsm** command.
- From the CDE Application Manager by going to the System\_Admin folder and clicking the **Management Console** icon.
- From an HTML 3.2-compatible Web browser on a personal computer that is configured as described in the *AIX 5L Version 5.2 Web-based System Manager Administration Guide*.





## Using the smit Command

The **smit** command is a tool you can use to run other commands. Command names entered as a parameter to the **smit** command might take you to a submenu or panel for that command. For example, **smit lsuser** command takes you directly to **List All Users**, which lists the attributes of users on your system.

See the **smit** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Locating a Command or Program (whereis Command)

The **whereis** command locates the source, binary, and manuals sections for specified files. The command attempts to find the desired program from a list of standard locations.

To find files in the current directory that have no documentation, type:

```
whereis -m -u *
```

Press Enter.

To find all of the files that contain the name Mail, type:

```
whereis Mail
```

Press Enter.

The system displays information similar to the following:

```
Mail: /usr/bin/Mail /usr/lib/Mail.rc
```

See the **whereis** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying Information about a Command (man Command)

The **man** command displays information on commands, subroutines, and files. The general format for the **man** command is as follows:

```
man CommandName
```

To obtain information about the **pg** command, type:

```
man pg
```

Press Enter.

The system displays information similar to the following:

pg Command

Purpose

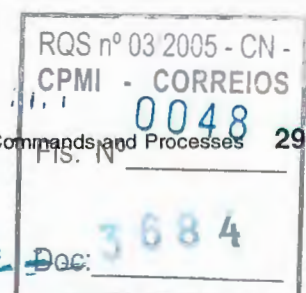
Formats files to the display.

Syntax

```
pg [ - Number ] [ -c ] [ -e ] [ -f ] [ -n ] [ -p String ]  
[ -s ] [ +LineNumber ] +/Pattern/ [ File ... ]
```

Description

The **pg** command reads a file name from the **File** parameter and writes the file to standard output one screen at a time. If you



specify a - (dash) as the File parameter, or run the pg command without options, the pg command reads standard input. Each screen is followed by a prompt. If you press the Enter key, another page is displayed. Subcommands used with the pg command let you review or search in the file.

See the **man** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying the Function of a Command (whatis Command)

The **whatis** command looks up a given command, system call, library function, or special file name, as specified by the *Command* parameter, from a database you create using the **catman -w** command. The **whatis** command displays the header line from the manual section. You can then issue the **man** command to obtain additional information.

The **whatis** command is equivalent to using the **man -f** command.

To find out what the **ls** command does, type:

```
whatis ls
```

Press Enter.

The system displays information similar to the following:

```
ls(1) -Displays the contents of a directory.
```

See the **whatis** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Listing Previously Entered Commands (history Shell Command)

The **history** command is a Korn shell built-in that lists the last 16 commands entered. The Korn shell saves commands that you entered to a command history file, usually named **\$HOME/.sh\_history**. This action saves time when you need to repeat a previous command.

By default, the Korn shell saves the text of the last 128 commands. The history file size (specified by the **HISTSIZE** environment variable) is not limited, although a very large history file size can cause the Korn shell to start slowly.

**Note:** The Bourne shell does not support command history.

For detailed information about shells, see Chapter 12, "Shells" on page 139.

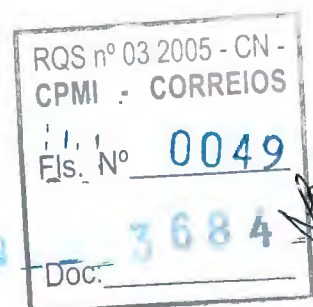
To list the previous commands you entered, at the prompt, type:

```
history
```

Press Enter.

The **history** command entered by itself lists the previous 16 commands entered. The system displays information similar to the following:

```
928  ls
929  mail
930  printenv MAILMSG
931  whereis Mail
932  whatis ls
933  cd /usr/include/sys
934  ls
935  man pg
936  cd
```



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```
937 ls | pg
938 lscons
939 tty
940 ls *.txt
941 printenv MAILMSG
942 pwd
943 history
```

The listing first displays the position of the command in the **\$HOME/.sh\_history** file followed by the command.

To list the previous five commands, at the prompt, type:  
history -5

Press Enter.

A listing similar to the following displays:

```
939 tty
940 ls *.txt
941 printenv MAILMSG
942 pwd
943 history
944 history -5
```

The **history** command followed by a number lists all the previous commands entered, starting at that number.

To list the commands since 938, at the prompt, type:  
history 938

Press Enter.

A listing similar to the following displays:

```
938 lscons
939 tty
940 ls *.txt
941 printenv MAILMSG
942 pwd
943 history
944 history -5
945 history 938
```

## Repeating Commands Using the history Shell Command

Use the **r** Korn shell alias to repeat previous commands. Type **r** and press Enter, and you can specify the number or the first character or characters of the command.

If you want to list the displays currently available on the system, type **lsdisp** and press Enter at the prompt. The system returns the information on the screen. If you want the same information returned to you again, at the prompt, type:

**r**

Press Enter.

The system runs the most recently entered command again. In this example, the **lsdisp** command runs.

To repeat the **ls \*.txt** command, at the prompt, type:

**r ls**





Press Enter.

The **r** Korn shell alias locates the most recent command that begins with the character or characters specified.

## Substituting Strings Using the history Shell Command

You can also use the **r** Korn shell alias to modify a command before it is run. In this case, a substitution parameter of the form *Old=New* can be used to modify the command before it is run.

For example, if command line 940 is **ls \*.txt**, and you want to run **ls \*.exe**, at the prompt, type:

```
r txt=exe 940
```

Press Enter.

This runs command 940, substituting **exe** for **txt**.

For example, if the command on line 940 is the most recent command that starts with a lowercase letter **/**, you can also type:

```
r txt=exe /
```

Press Enter.

**Note:** Only the first occurrence of the *Old* string is replaced by the *New* string. Entering the **r** Korn shell alias without a specific command number or character does the substitution to the previous command entered.

## Editing the Command History

Use the **fc** Korn shell built-in command to list or edit portions of the command history file. To select a portion of the file to edit or list, specify the number or the first character or characters of the command. You can specify a single command or range of commands.

If you do not specify an editor program as an argument to the **fc** Korn shell built-in command, the editor specified by the **FCEDIT** variable is used. If the **FCEDIT** variable is not defined, the **/usr/bin/ed** editor is used. The edited command or commands are printed and run when you exit the editor. Use the **printenv** command to display the value of the **FCEDIT** variable.

For example, if you want to run the command:

```
cd /usr/tmp
```

which is very similar to command line 933, at the prompt type:

```
fc 933
```

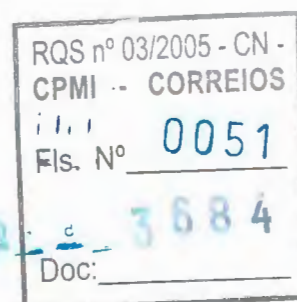
Press Enter.

At this point, your default editor appears with the command line 933. You would change **include/sys** to **tmp**, and when you exit your editor, the edited command is run.

You can also specify the editor you want to use in the **fc** command.

For example, if you want to edit a command using the **/usr/bin/vi** editor, at the prompt, type:

```
fc -e vi 933
```



Press Enter.

At this point, the **vi** editor appears with the command line 933.

You can also specify a range of commands to edit.

For example, if you want to edit the commands 930 through 940, at the prompt, type:

```
fc 930 940
```

Press Enter.

At this point, your default editor appears with the command lines 930 through 940. When you exit the editor, all the commands that appear in your editor are run sequentially.

## Creating a Command Alias (alias Shell Command)

An *alias* lets you create a shortcut name for a command, a file name, or any shell text. By using aliases, you save a lot of time when doing tasks you do frequently. The **alias** Korn shell built-in command defines a word as an alias for some command. You can use aliases to redefine built-in commands but not to redefine reserved words.

The first character of an alias name can be any printable character except the metacharacters. Any remaining characters must be the same as for a valid file name.

The format for creating an alias is as follows:

```
alias Name=String
```

in which the *Name* parameter specifies the name of the alias and the *String* parameter specifies a string of characters. If *String* contains blank spaces, enclose it in quotation marks.

To create an alias for the command **rm -i** (prompts you before deleting files), at the prompt, type:

```
alias rm="/usr/bin/rm -i"
```

Press Enter.

In this example, whenever you type the command **rm** and press Enter, the actual command performed is **/usr/bin/rm -i**.

To create an alias for the command **ls -aF | pg** (displays detailed information of all the files in the current directory, including the invisible files; marks executable files with an \* and directories with a /; and scrolls per screen), at the prompt, type:

```
alias dir="/usr/bin/ls -aF | pg"
```

Press Enter.

In this example, whenever you type the command **dir** and press Enter, the actual command performed is **/usr/bin/ls -aF | pg**.

To display all the aliases you have, at the prompt, type:

```
alias
```

Press Enter.

The system displays information similar to the following:

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CPMI - CORREIOS
Fls. N° 33
Doc: 3684



```
rm="/usr/bin/rm -i"
dir="/usr/bin/ls -aF | pg"
```

## Working with Text-Formatting Commands

You can use text-formatting commands to work with text composed of the international extended character set used for European languages.

### International Character Support in Text Formatting

The international extended character set provides the characters and symbols used in many European languages, as well as an ASCII subset composed of English-language characters, digits, and punctuation.

All characters in the European extended character set have ASCII forms. These forms can be used to represent the extended characters in input, or the characters can be entered directly with a device such as a keyboard that supports the European extended characters.

The following text-formatting commands support all international languages that use single-byte characters. These commands are located in `/usr/bin`. (The commands identified with an asterisk (\*) support text processing for multibyte languages. For more information on multibyte languages, see "Multibyte Character Support in Text Formatting" on page 35.)

addbib*	hyphen	pic*	pstext
checkmm	ibm3812	ps4014	refer*
checknr*	ibm3816	ps630	roffbib*
col*	ibm5587G*	psbanne	soelim*
colcrt	ibm5585H-T*	psdit	sortbib*
deroff*	indxbib*	psplot	tbl*
enscript	lookbib*	psrev	troff*
eqn*	makedev*	psroff	vgrind
grap*	neqn*	psrv	xpreview*
hplj	nroff*		

Text-formatting commands and macro packages not in the preceding list have not been enabled to process international characters.

### Entering Extended Single-Byte Characters

If your input device supports characters from the European-language extended character set, you can enter them directly. Otherwise, use the following ASCII escape sequence form to represent these characters:

The form `\[N]`, where *N* is the 2- or 4-digit hexadecimal code for the character.

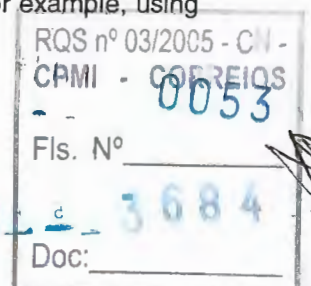
**Note:** The NCesc form `\<xx>` is no longer supported.

Text containing extended characters is output according to the formatting conventions of the language in use. Characters that are not defined for the interface to a specific output device produce no output or error indication.

Although the names of the requests, macro packages, and commands are based on English, most of them can accept input (such as file names and parameters) containing characters in the European extended character set.

For the **nroff** and **troff** commands and their preprocessors, the command input must be ASCII, or an unrecoverable syntax error will result. International characters, either single-byte or multibyte, can be entered when enclosed within quotation marks and within other text to be formatted. For example, using macros from the **pic** command:

```
define foobar % SomeText %
```





After the define directive, the first name, foobar, must be ASCII. However, the replacement text, *SomeText*, can contain non-ASCII characters.

## Multibyte Character Support in Text Formatting

Certain text-formatting commands can be used to process text for multibyte languages. These commands are identified with an asterisk (\*) in the list under "International Character Support in Text Formatting" on page 34. Text-formatting commands not in the list have not been enabled to process international characters.

### Entering Multibyte Characters

If supported by your input device, multibyte characters can be entered directly. Otherwise, you can enter any multibyte character in the ASCII form  $\backslash[N]$ , where *N* is the 2-, 4-, 6-, 7-, or 8-digit hexadecimal encoding for the character.

Although the names of the requests, macros, and commands are based on English, most of them can accept input (such as file names and parameters) containing any type of multibyte character.

If you are already familiar with using text-formatting commands with single-byte text, the following list summarizes characteristics that are noteworthy or unique to the multibyte locales:

- Text is not hyphenated.
- Special format types are required for multibyte numerical output. Japanese format types are available.
- Text is output in horizontal lines, filled from left to right.
- Character spacing is constant, so characters automatically align in columns.
- Characters that are not defined for the interface to a specific output device produce no output or error indication.

---

## Processes Overview

A program or command that is actually running on the computer is referred to as a *process*. Processes exist in parent-child hierarchies. A process started by a program or command is a *parent process*; a *child process* is the product of the parent process. A parent process can have several child processes, but a child process can have only one parent.

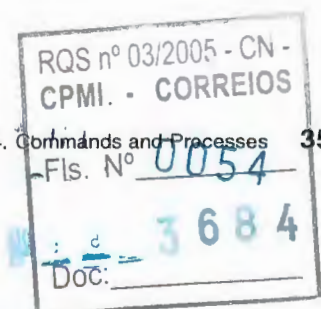
The system assigns a process identification number (PID number) to each process when it starts. If you start the same program several times, it will have a different PID number each time.

When a process is started on a system, the process uses a part of the available system resources. When more than one process is running, a scheduler that is built into the operating system gives each process its share of the computer's time, based on established priorities. These priorities can be changed by using the **nice** or **renice** commands.

**Note:** To change a process priority to a higher one, you must have root user authority. All users can lower priorities on a process they start by using the **nice** command, or on a process they have already started, by using the **renice** command.

This section describes the following procedures:

- "Foreground and Background Processes" on page 36
- "Daemons" on page 36
- "Zombie Process" on page 36
- "Starting a Process" on page 36
- "Checking Processes (ps Command)" on page 37
- "Setting the Initial Priority of a Process (nice Command)" on page 38





- "Changing the Priority of a Running Process (renice Command)" on page 39
- "Canceling a Foreground Process" on page 39
- "Stopping a Foreground Process" on page 40
- "Restarting a Stopped Process" on page 40
- "Scheduling a Process for Later Operation (at Command)" on page 40
- "Listing All Scheduled Processes (at or atq Command)" on page 41
- "Removing a Process from the Schedule (at Command)" on page 42
- "Removing a Background Process (kill Command)" on page 42

## Foreground and Background Processes

Processes that require a user to start them or to interact with them are called *foreground processes*. Processes that are run independently of a user are referred to as *background processes*. Programs and commands run as foreground processes by default. To run a process in the background, place an ampersand (&) at the end of the command name that you use to start the process.

## Daemons

*Daemons* are processes that run unattended. They are constantly in the background and are available at all times. Daemons are usually started when the system starts, and they run until the system stops. A daemon process performs system services and is available at all times to more than one task or user. Daemon processes are started by the root user or root shell and can be stopped only by the root user. For example, the **qdaemon** process provides access to system resources such as printers. Another common daemon is the **sendmail** daemon.

## Zombie Process

A *zombie process* is a dead process that is no longer executing but is still recognized in the process table (in other words, it has a PID number). It has no other system space allocated to it. Zombie processes have been killed or have exited and continue to exist in the process table until the parent process dies or the system is shut down and restarted. Zombie processes display as <defunct> when listed by the **ps** command.

## Starting a Process

You start a foreground process from a display station by either entering a program name or command name at the system prompt. After a foreground process has started, the process interacts with you at your display station until it is complete. This means no other interaction (for example, entering another command) can take place at the display station until the process is finished or you halt it.

A single user can run more than one process at a time, up to a default maximum of 40 processes per user.

### To Start a Process in the Foreground

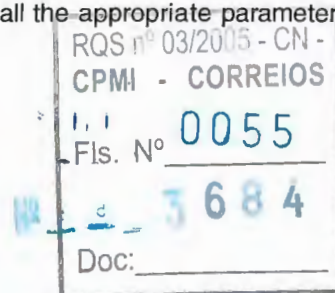
To run a process in the foreground, type the name of the command with all the appropriate parameters and flags:

\$ *CommandName*

Press Enter.

### To Start a Process in the Background

To run a process in the background, type the name of the command with all the appropriate parameters and flags, followed by an ampersand (&):





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Paula

\$ CommandName&

Press Enter.

When the process is running in the background, you can perform additional tasks by entering other commands at your display station.

Generally, background processes are most useful for commands that take a long time to run. However, because they increase the total amount of work the processor is doing, background processes also slow down the rest of the system.

Most processes direct their output to standard output, even when they run in the background. Unless redirected, standard output goes to the display device. Because the output from a background process can interfere with your other work on the system, it is usually good practice to redirect the output of a background process to a file or a printer. You can then look at the output whenever you are ready.

**Note:** Under certain circumstances, a process might generate its output in a different sequence when run in the background than when run in the foreground. Programmers might want to use the **fflush** subroutine to ensure that output occurs in the correct order regardless of whether the process runs in foreground or background.

As long as a background process is running, you can check its status with the **ps** command.

## Checking Processes (ps Command)

Any time the system is running, several processes are also running. You can use the **ps** command to find out which processes are running and to display information about those processes.

### ps Command

The **ps** command has several flags that enable you to specify which processes to list and what information to display about each process.

To show all processes running on your system, at the prompt, type:

**ps -ef**

Press Enter.

The system displays information similar to the following:

USER	PID	PPID	C	STIME	TTY	TIME	CMD
root	1	0	0	Jun 28	-	3:23	/etc/init
root	1588	6963	0	Jun 28	-	0:02	/usr/etc/biod 6
root	2280	1	0	Jun 28	-	1:39	/etc/syncd 60
mary	2413	16998	2	07:57:30	-	0:05	aixterm
mary	11632	16998	0	07:57:31	lft/1	0:01	xbiff
mary	16260	2413	1	07:57:35	pts/1	0:00	/bin/ksh
mary	16469	1	0	07:57:12	lft/1	0:00	ksh /usr/lpp/X11/bin/xinit
mary	19402	16260	20	09:37:21	pts/1	0:00	ps -ef

The columns in the previous output are defined as follows:

<b>USER</b>	User login name
<b>PID</b>	Process ID
<b>PPID</b>	Parent process ID
<b>C</b>	CPU utilization of process
<b>STIME</b>	Start time of process
<b>TTY</b>	Controlling workstation for the process
<b>TIME</b>	Total execution time for the process

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CPMI - CORREIOS  
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3684  
Doc: \_\_\_\_\_



CMD Command



In the previous example, the process ID for the **ps -ef** command is 19402. Its parent process ID is 16260, the **/bin/ksh** command.

If the listing is very long, the top portion scrolls off the screen. To display the listing one page (screen) at a time, use the **ps** command piped to the **pg** command. At the prompt, type:

```
ps -ef | pg
```

Press Enter.

To show status information of all processes running on your system, at the prompt, type:

```
ps gv
```

Press Enter.

This form of the command lists a number of statistics for each active process. Output from this command looks similar to the following:

PID	TTY	STAT	TIME	PGIN	SIZE	RSS	LIM	TSIZ	TRS	%CPU	%MEM	COMMAND
0	-	A	0:44	7	8	8	xx	0	0	0.0	0.0	swapper
1	-	A	1:29	518	244	140	xx	21	24	0.1	1.0	/etc/init
771	-	A	1:22	0	16	16	xx	0	0	0.0	0.0	kproc
1028	-	A	0:00	10	16	8	xx	0	0	0.0	0.0	kproc
1503	-	A	0:33	127	16	8	xx	0	0	0.0	0.0	kproc
1679	-	A	1:03	282	192	12	32768	130	0	0.7	0.0	pcidossvr
2089	-	A	0:22	918	72	28	xx	1	4	0.0	0.0	/etc/sync
2784	-	A	0:00	9	16	8	xx	0	0	0.0	0.0	kproc
2816	-	A	5:59	6436	2664	616	8	852	156	0.4	4.0	/usr/lpp/
3115	-	A	0:27	955	264	128	xx	39	36	0.0	1.0	/usr/lib/
3451	-	A	0:00	0	16	8	xx	0	0	0.0	0.0	kproc
3812	-	A	0:00	21	128	12	32768	34	0	0.0	0.0	usr/lib/lpd/
3970	-	A	0:00	0	16	8	xx	0	0	0.0	0.0	kproc
4267	-	A	0:01	169	132	72	32768	16	16	0.0	0.0	/etc/sysl
4514	lft/0	A	0:00	60	200	72	xx	39	60	0.0	0.0	/etc/gett
4776	pts/3	A	0:02	250	108	280	8	303	268	0.0	2.0	-ksh
5050	-	A	0:09	1200	424	132	32768	243	56	0.0	1.0	/usr/sbin
5322	-	A	0:27	1299	156	192	xx	24	24	0.0	1.0	/etc/cron
5590	-	A	0:00	2	100	12	32768	11	0	0.0	0.0	/etc/writ
5749	-	A	0:00	0	208	12	xx	13	0	0.0	0.0	/usr/lpp/
6111	-	T	0:00	66	108	12	32768	47	0	0.0	0.0	/usr/lpp/

See the **ps** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Setting the Initial Priority of a Process (nice Command)

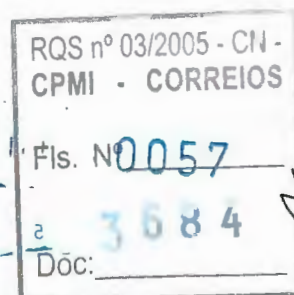
You can set the initial priority of a process to a value lower than the base scheduling priority by using the **nice** command to start the process.

**Note:** To run a process at a higher priority, you must have root user authority.

### nice Command

To set the initial priority of a process, type:

```
nice -n Number CommandString
```



where *Number* is in the range of 0 to 39, with 39 being the lowest priority. The *nice value* is the decimal value of the system-scheduling priority of a process. The higher the number, the lower the priority. If you use zero, the process will run at its base scheduling priority. *CommandString* is the command and flags and parameters you want to run.

See the **nice** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

You can also use the **smit nice** command to perform this task.

## Changing the Priority of a Running Process (renice Command)

You can change the scheduling priority of a running process to a value lower or higher than the base scheduling priority by using the **renice** command from the command line. This command changes the nice value of a process.

**Note:** To run a process at a higher priority or to change the priority for a process that you did not start, you must have root user authority.

### From the Command Line

To change the initial priority of a running process, type:

```
renice Priority -p ProcessID
```

where *Priority* is in the range of -20 to 20. The higher the number, the lower the priority. If you use zero, the process will run at its base scheduling priority. *ProcessID* is the PID for which you want to change the priority.

You can also use the **smit renice** command to perform this task.

## Canceling a Foreground Process

If you start a foreground process and then decide that you do not want it to finish, you can cancel it by pressing INTERRUPT. This is usually Ctrl-C or Ctrl-Backspace. To find out what your INTERRUPT key is set to, see "Listing Control Key Assignments for Your Terminal (stty Command)" on page 14.

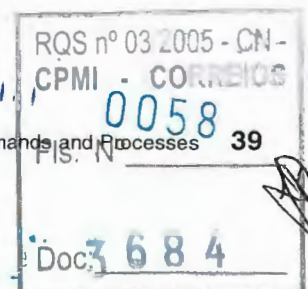
**Note:** INTERRUPT (Ctrl-C) does not cancel background processes. To cancel a background process, you must use the **kill** command.

Most simple commands are not good examples for demonstrating how to cancel a process. They run so quickly that they finish before you have time to cancel them. The examples in this section, therefore, use a command that takes more than a few seconds to run: **find / -type f**. This command displays the path names for all files on your system. You do not need to study the **find** command in order to complete this section; it is used here simply to demonstrate how to work with processes.

In the following example, the **find** command starts a process. After the process runs for a few seconds, you can cancel it by pressing the INTERRUPT key:

```
$ find / -type f
/usr/sbin/acct/lastlogin
/usr/sbin/acct/prctmp
/usr/sbin/acct/prdaily
/usr/sbin/acct/runacct
/usr/sbin/acct/sdisk
/usr/sbin/acct/shutacct INTERRUPT (Ctrl-C)
$ _
```

The system returns the prompt to the screen. Now you can enter another command.







## Stopping a Foreground Process

It is possible for a process to be stopped but not have its process ID (PID) removed from the process table. You can stop a foreground process by pressing Ctrl-Z from the keyboard.

**Note:** Ctrl-Z works successfully in the Korn shell (**ksh**) and C shell (**csh**), but not in the Bourne shell (**bsh**).

## Restarting a Stopped Process

This procedure describes how to restart a process that has been stopped with a Ctrl-Z.

**Note:** Ctrl-Z works successfully in the Korn shell (**ksh**) and C shell (**csh**), but not in the Bourne shell (**bsh**). To restart a stopped process, you must either be the user who started the process or have root user authority.

1. To show all the processes running or stopped but not those killed on your system, type:

```
ps -ef
```

You might want to pipe this command through a **grep** command to restrict the list to those processes most likely to be the one you want to restart. For example, if you want to restart a **vi** session, you could type:

```
ps -ef | grep vi
```

Press Enter. This command would display only those lines from the **ps** command output that contained the word **vi**. The output would look something like this:

UID	PID	PPID	C	STIME	TTY	TIME	COMMAND
root	1234	13682	0	00:59:53	-	0:01	vi test
root	14277	13682	1	01:00:34	-	0:00	grep vi

2. In the **ps** command output, find the process you want to restart and note its PID number. In the example, the PID is 1234.
3. To send the CONTINUE signal to the stopped process, type:

```
kill -19 1234
```

Substitute the PID of your process for the 1234. The -19 indicates the CONTINUE signal. This command restarts the process in the background. If the process can run in the background, you are finished with the procedure. If the process must run in the foreground (as a **vi** session would), you must proceed with the next step.

4. To bring the process in to the foreground, type:

```
fg 1234
```

Once again, substitute the PID of your process for the 1234. Your process should now be running in the foreground. (You are now in your **vi** edit session).

## Scheduling a Process for Later Operation (at Command)

You can set up a process as a *batch process* to run in the background at a scheduled time. The **at** and **smit** commands let you enter the names of commands to be run at a later time and allow you to specify when the commands should be run.

**Note:** The **/var/adm/cron/at.allow** and **/var/adm/cron/at.deny** files control whether you can use the **at** command. A person with root user authority can create, edit, or delete these files. Entries in these files are user login names with one name to a line. The following is an example of an **at.allow** file:

RQS nº 03/2005 - CN -  
CPMI - CORREIOS  
Fls. Nº 0059  
3684  
Doc: \_\_\_\_\_



root  
nick  
dee  
sarah



If the **at.allow** file exists, only users whose login names are listed in it can use the **at** command. A system administrator can explicitly stop a user from using the **at** command by listing the user's login name, in the **at.deny** file. If only the **at.deny** file exists, any user whose name does not appear in the file can use the **at** command.

You cannot use the **at** command if any one of the following is true:

- The **at.allow** file and the **at.deny** file do not exist (allows root user only).
- The **at.allow** file exists but the user's login name is not listed in it.
- The **at.deny** file exists and the user's login name is listed in it.

If the **at.allow** file does not exist and the **at.deny** file does not exist or is empty, only someone with root user authority can submit a job with the **at** command.

The **at** command syntax allows you to specify a date string, a time and day string, or an increment string for when you want the process to run. It also allows you to specify which shell or queue to use. The following examples show some typical uses of the command.

## at Command

For example, if your login name is joyce and you have a script named WorkReport that you want to run at midnight, do the following:

1. Type the time you want the program to start running.  
at midnight
2. Type the names of the programs to run, pressing Enter after each name. After typing the last name, press the end-of-file character (Ctrl-D) to signal the end of the list.  
WorkReport^D

After you press Ctrl-D, the system displays information similar to the following:

```
job joyce.741502800.a at Fri Jul 6 00:00:00 CDT 2002.
```

The program WorkReport is given the job number joyce.741502800.a and will run at midnight July 6.

To list the programs you have sent to be run later, type:

```
at -l
```

The system displays information similar to the following:

```
joyce.741502800.a      Fri Jul 6 00:00:00 CDT 2002
```

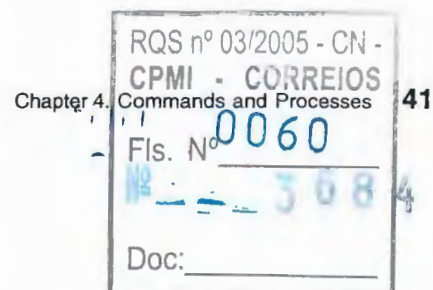
See the **at** command in the *AIX 5L Version 5.2 Commands Reference* for the exact syntax.

## Listing All Scheduled Processes (at or atq Command)

You can list all scheduled processes by using the **-l** flag with the **at** command or with the **atq** command. Both commands give the same output, but the **atq** command can order the processes by the time the **at** command was issued and can display just the number of processes in the queue.

You can list all scheduled processes in the following ways:

- With the **at** command from the command line
- With the **atq** command



For user restrictions on using the **at** command, see the **Note** in Scheduling a Process for Later Operation (at Command).

### at Command

To list the scheduled processes, type:

```
at -l
```

This command lists all the scheduled processes in your queue. If you are a root user, this command lists all the scheduled processes for all users. For complete details of the syntax, see the **at** command.

### atq Command

To list all scheduled processes in the queue, type:

```
atq
```

If you are a root user, you can list the scheduled processes in a particular user's queue by typing:

```
atq UserName
```

To list the number of scheduled processes in the queue, type:

```
atq -n
```

## Removing a Process from the Schedule (at Command)

You can remove a scheduled process with the **at** command using the **-r** flag. For user restrictions on using the **at** command, see the **Note** in Scheduling a Process for Later Operation (at Command).

### From the Command Line

1. To remove a scheduled process, you must know the process number. You can obtain the process number using the **at -l** command or the **atq** command. See "Listing All Scheduled Processes (at or atq Command)" on page 41 for details.
2. When you know the number of the process you want to remove, type:  

```
at -r ProcessNumber
```

You can also use the **smit rmat** command to perform this task.

## Removing a Background Process (kill Command)

If **INTERRUPT** does not halt your foreground process or if you decide, after starting a background process, that you do not want the process to finish, you can cancel the process with the **kill** command. Before you can cancel a process using the **kill** command, you must know its PID number. The general format for the **kill** command is as follows:

```
kill ProcessID
```

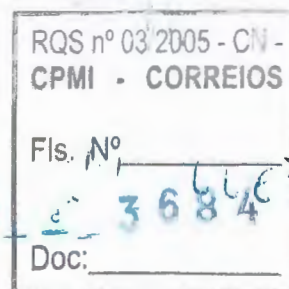
**Note:** To remove a process, you must have root user authority or be the user who started the process. The default signal to a process from the **kill** command is -15 (SIGTERM).

### kill Command

**Note:** To remove a zombie process, you must remove its parent process.

1. Use the **ps** command to determine the process ID of the process you want to remove. You might want to pipe this command through a **grep** command to list only the process you want. For example, if you want the process ID of a vi session, you could type:  

```
ps -l | grep vi
```
2. In the following example, you issue the **find** command to run in the background. You then decide to cancel the process. Issue the **ps** command to list the PID numbers.







```
$ find / -type f > dir.paths &
[1] 21593
$ ps
  PID  TTY  TIME  COMMAND
  1627 pts3  0:00  ps
  5461 pts3  0:00  ksh
 17565 pts3  0:00  -ksh
 21593 pts3  0:00  find / -type f
$ kill 21593
$ ps
  PID  TTY  TIME  COMMAND
  1627 pts3  0:00  ps
  5461 pts3  0:00  ksh
 17565 pts3  0:00  -ksh
[1] + Terminated 21593      find / -type f > dir.paths &
```

The command **kill 21593** ends the background **find** process, and the second **ps** command returns no status information about PID 21593. The system does not display the termination message until you enter your next command, unless that command is **cd**.

The **kill** command lets you cancel background processes. You might want to do this if you realize that you have mistakenly put a process in the background or a process is taking too long to run.

See the **kill** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

The **kill** command can also be used in **smit** by typing:

```
smit kill
```

---

## Command Summary for Commands and Processes

### Commands

<b>alias</b>	Shell command that prints a list of aliases to standard output
<b>history</b>	Shell command that displays the history event list
<b>man</b>	Displays information about commands, subroutines, and files online
<b>wsm</b>	Performs system management from a web browser
<b>whatis</b>	Describes the function a command performs
<b>whereis</b>	Locates the source, binary, or manual for installed programs

### Processes

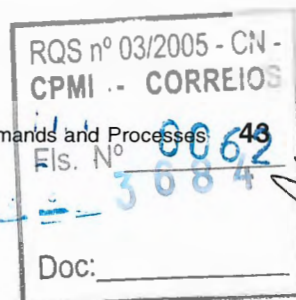
<b>at</b>	Runs commands at a later time, lists all scheduled processes, or removes a process from the schedule
<b>atq</b>	Displays the queue of jobs waiting to be run
<b>kill</b>	Sends a signal to running processes
<b>nice</b>	Runs a command at a lower or higher priority.
<b>ps</b>	Shows current status of processes.
<b>renice</b>	Alters priority of running processes

### Related Information

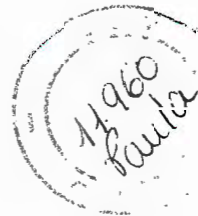
"Commands Overview" on page 26

"Processes Overview" on page 35

Chapter 12, "Shells" on page 139



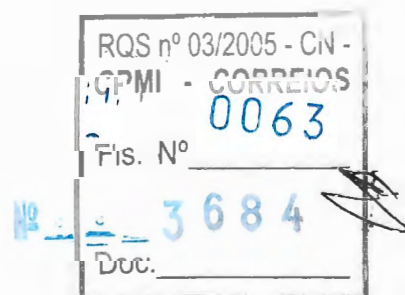




"Korn Shell or POSIX Shell Commands" on page 144

"Bourne Shell" on page 184

"C Shell" on page 200





## Chapter 5. Input and Output Redirection

The operating system allows you to manipulate the input and output (I/O) of data to and from your system by using specific I/O commands and symbols. You can control input by specifying the location from which to gather data. For example, you can specify to read input while data is entered on the keyboard (standard input) or to read input from a file. You can control output by specifying where to display or store data. You can specify to write output data to the screen (standard output) or to write it to a file.

The operating system, because it is multitasking, is designed to handle processes in combination with each other. This chapter discusses the advantages of redirecting input and output and of tying processes together.

This chapter discusses the following:

- "Standard Input, Standard Output, and Standard Error"
- "Redirecting Standard Output" on page 46
- "Redirecting Output to a File" on page 46
- "Redirecting Output and Appending to a File" on page 46
- "Creating a Text File with Redirection from the Keyboard" on page 47
- "Concatenating Text Files" on page 47
- "Redirecting Standard Input" on page 47
- "Discarding Output with the /dev/null File" on page 47
- "Redirecting Standard Error and Other Output" on page 48
- "Using Inline Input (Here) Documents" on page 48
- "Using Pipes and Filters" on page 49
- "Displaying Program Output and Copying to a File (tee command)" on page 50
- "Clearing Your Screen (clear Command)" on page 50
- "Sending a Message to Standard Output (echo Command)" on page 50
- "Appending a Single Line of Text to a File (echo Command)" on page 51
- "Copying Your Screen to a File (capture and script Commands)" on page 51
- "Displaying Text in Large Letters on Your Screen (banner Command)" on page 52
- "Command Summary for Input and Output Redirection" on page 52

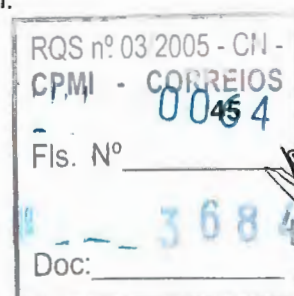
### Standard Input, Standard Output, and Standard Error

When a command begins running, it usually expects that the following files are already open: standard input, standard output, and standard error (sometimes called *error output* or *diagnostic output*). A number, called a *file descriptor*, is associated with each of these files, as follows:

<b>File descriptor 0</b>	Standard input
<b>File descriptor 1</b>	Standard output
<b>File descriptor 2</b>	Standard error (diagnostic) output

A child process normally inherits these files from its parent. All three files are initially assigned to the workstation (0 to the keyboard, 1 and 2 to the display). The shell permits them to be redirected elsewhere before control is passed to a command.

When you enter a command, if no file name is given, your keyboard is the *standard input*, sometimes denoted as *stdin*. When a command finishes, the results are displayed on your screen.



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Your screen is the *standard output*, sometimes denoted as *stdout*. By default, commands take input from the standard input and send the results to standard output.

Error messages are directed to standard error, sometimes denoted as *stderr*. By default, this is your screen.

These default actions of input and output can be varied. You can use a file as input and write results of a command to a file. This is called *input/output redirection*.

The output from a command, which normally goes to the display device, can easily be redirected to a file instead. This is known as *output redirection*. This is useful when you have a lot of output that is difficult to read on the screen or when you want to put files together to create a larger file.

Though not used as much as output redirection, the input for a command, which normally comes from the keyboard, can also be redirected from a file. This is known as *input redirection*. Redirection of input lets you prepare a file in advance and then have the command read the file.

---

## Redirecting Standard Output

When the notation `> filename` is added to the end of a command, the output of the command is written to the specified file name. The `>` symbol is known as the *output redirection operator*.

Any command that outputs its results to the screen can have its output sent to a file.

---

## Redirecting Output to a File

The output of a process can be redirected to a file by typing the command followed by the file name. For example, to send the results of the **who** command to a file called **users**, type:

```
who > users
```

Press Enter.

**Note:** If the **users** file already exists, it is deleted and replaced, unless the **noclobber** option of the **set** built-in **ksh** (Korn shell) or **cs**h (C shell) command is specified.

To see the contents of the **users** file, type:

```
cat users
```

Press Enter.

A list similar to the following displays:

```
denise    1ft/0 May 13 08:05
marta     pts/1 May 13 08:10
endrica   pts/2 May 13 09:33
```

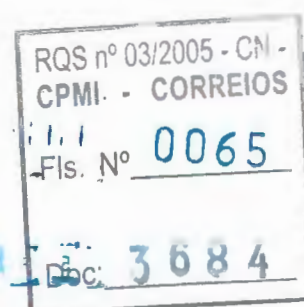
---

## Redirecting Output and Appending to a File

When the notation `>> filename` is added to the end of a command, the output of the command is appended to the specified file name, rather than writing over any existing data. The `>>` symbol is known as the *append redirection operator*.

For example, to append **file2** to **file1**, type:

```
cat file2 >> file1
```





Press Enter.

**Note:** If the **file1** file does not exist, it is created, unless the **noclobber** option of the **set** built-in **ksh** (Korn shell) or **csch** (C shell) command is specified.

---

## Creating a Text File with Redirection from the Keyboard

Used alone, the **cat** command uses whatever you type at the keyboard as input. You can redirect this input to a file. Enter Ctrl-D on a new line to signal the end of the text.

At the system prompt, type:

```
cat > filename
This is a test.
^D
```

---

## Concatenating Text Files

Combining various files into one file is known as *concatenation*.

For example, at the system prompt, type:

```
cat file1 file2 file3 > file4
```

Press Enter.

The previous example creates **file4**, which consists of **file1**, **file2**, and **file3**, appended in the order given.

The following example shows a common error when concatenating files:

```
cat file1 file2 file3 > file1
```

**Attention:** In this example, you might expect the **cat** command to append the contents of **file1**, **file2**, and **file3** into **file1**. The **cat** command creates the output file first, so it actually erases the contents of **file1** and then appends **file2** and **file3** to it.

---

## Redirecting Standard Input

When the notation **< filename** is added to the end of a command, the input of the command is read from the specified file name. The **<** symbol is known as the *input redirection operator*.

**Note:** Only commands that normally take their input from the keyboard can have their input redirected.

For example, to send the file **letter1** as a message to user **denise** with the **mail** command, type:

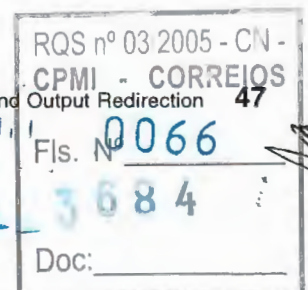
```
mail denise < letter1
```

Press Enter.

---

## Discarding Output with the /dev/null File

The **/dev/null** file is a special file. This file has a unique property; it is always empty. Any data you send to **/dev/null** is discarded. This is a useful feature when you run a program or command that generates output you want to ignore.



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For example, you have a program named `myprog` that accepts input from the screen and generates messages while it is running that you would rather ignore. To read input from the file `myscript` and discard the standard output messages, type:

```
myprog < myscript >/dev/null
```

Press Enter.

In this example, `myprog` uses the file `myscript` as input, and all standard output is discarded.

---

## Redirecting Standard Error and Other Output

In addition to the standard input and standard output, commands often produce other types of output, such as error or status messages known as diagnostic output. Like standard output, standard error output is written to the screen unless redirected.

If you want to redirect standard error or other output, you must use a file descriptor. A *file descriptor* is a number associated with each of the I/O files that a command ordinarily uses. File descriptors can also be specified to redirect standard input and standard output, but are already the default values. The following numbers are associated with standard input, output, and error:

- 0 Standard input (keyboard)
- 1 Standard output (display)
- 2 Standard error (display)

To redirect standard error output, type the file descriptor number 2 in front of the output or append redirection symbols (`>` or `>>`) and a file name after the symbol. For example, the following command takes the standard error output from the `cc` command where it is used to compile the `testfile.c` file and appends it to the end of the `ERRORS` file:

```
cc testfile.c 2 >> ERRORS
```

Other types of output can also be redirected using the file descriptors from 0 through 9. For example, if the `cmd` command writes output to file descriptor 9, you can redirect that output to the `savedata` file with the following command:

```
cmd 9> savedata
```

If a command writes to more than one output, you can independently redirect each one. Suppose that a command directs its standard output to file descriptor 1, directs its standard error output to file descriptor 2, and builds a data file on file descriptor 9. The following command line redirects each of these outputs to a different file:

```
command > standard 2> error 9> data
```

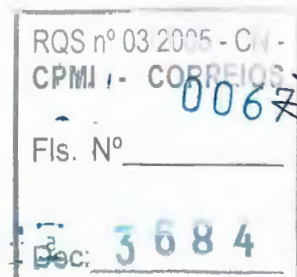
---

## Using Inline Input (Here) Documents

If a command is in the following form:

```
command << eofstring
```

and *eofstring* is any string that does not contain pattern-matching characters, then the shell takes the subsequent lines as the standard input of *command* until the shell reads a line consisting of only *eofstring* (possibly preceded by one or more tab characters). The lines between the first *eofstring* and the second are frequently referred to as an *inline input*, or *here*, document. If a hyphen (-) immediately follows the `<<` redirection characters, the shell strips leading tab characters from each line of the here document before it passes the line to the *command*.





The shell creates a temporary file containing the here document and performs variable and command substitution on the contents before passing the file to the command. It performs pattern matching on file names that are part of command lines in command substitutions. To prohibit all substitutions, quote any character of the *eofstring*:

```
command << \eofstring
```

The here document is especially useful for a small amount of input data that is more conveniently placed in the shell procedure rather than kept in a separate file (such as editor scripts). For instance, you could type:

```
cat <<- xyz
  This message will be shown on the
  display with leading tabs removed.
  xyz
```

Press Enter.

---

## Using Pipes and Filters

You can connect two or more commands so that the standard output of one command is used as the standard input of another command. A set of commands connected this way is known as a *pipeline*. The connection that joins the commands is known as a *pipe*. Pipes are useful because they let you tie many single-purpose commands into one powerful command.

You can direct the output from one command to become the input for another command using a pipeline. The commands are connected by a pipe (*|*) symbol.

When a command takes its input from another command, modifies it, and sends its results to standard output, it is known as a *filter*. Filters can be used alone but they are especially useful in pipelines. The most common filters are as follows:

- sort
- more
- pg

For example, the **ls** command writes the contents of the current directory to the screen in one scrolling data stream. When more than one screen of information is presented, some data is lost from view. To control the output so the contents display screen by screen, you can use a pipeline to direct the output of the **ls** command to the **pg** command, which controls the format of output to the screen as shown in the following example:

```
ls | pg
```

In the example, the output of the **ls** command is the input for the **pg** command. Press Enter to continue to the next screen.

Pipelines operate in one direction only (left to right). Each command in a pipeline runs as a separate process and all processes can run at the same time. A process pauses when it has no input to read or when the pipe to the next process is full.

Another example of using pipes is with the **grep** command. The **grep** command searches a file for lines that contain strings of a certain pattern. To display all your files created or modified in July, type:

```
ls -l | grep Jul
```

Press Enter.

In the example, the output of the **ls** command is the input for the **grep** command.





## Displaying Program Output and Copying to a File (tee command)

The **tee** command, used with a pipe, reads standard input, then writes the output of a program to standard output and simultaneously copies it into the specified file or files. Use the **tee** command to view your output immediately and at the same time, store it for future use.

For example, type:

```
ps -ef | tee program.ps
```

Press Enter.

This displays the standard output of the **ps -ef** command at the display device, and at the same time saves a copy of it in the **program.ps** file. If the **program.ps** file already exists, it is deleted and replaced, unless the **noclobber** option of the **set** built-in command is specified.

For example, to view and save the output from a command to an existing file:

```
ls -l | tee -a program.ls
```

This displays the standard output of **ls -l** at the display device and at the same time appends a copy of it to the end of the **program.ls** file.

The system displays information similar to the following, and the **program.ls** file contains the same information:

-rw-rw-rw-	1	jones	staff	2301	Sep 19	08:53	161414
-rw-rw-rw-	1	jones	staff	6317	Aug 31	13:17	def.rpt
-rw-rw-rw-	1	jones	staff	5550	Sep 10	14:13	try.doc

See the **tee** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Clearing Your Screen (clear Command)

You can empty the screen of messages and keyboard input with the **clear** command.

At the prompt, type:

```
clear
```

Press Enter.

The system clears the screen and displays the prompt.

## Sending a Message to Standard Output (echo Command)

You can display messages on the screen with the **echo** command.

For example, to write a message to standard output, at the prompt, type:

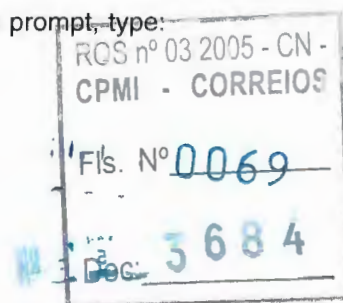
```
echo Please insert diskette . . .
```

Press Enter.

The system displays the following:

```
Please insert diskette . . .
```

For example, to use the **echo** command with pattern-matching characters, at the prompt, type:



echo The back-up files are: \*.bak

Press Enter.

The system displays the message The back-up files are: followed by the file names in the current directory ending with .bak.

---

## Appending a Single Line of Text to a File (echo Command)

You can add a single line of text to a file with the **echo** command, used with the append redirection operator.

For example, at the prompt, type:

```
echo Remember to backup mail files by end of week.>
```

```
>notes
```

Press Enter.

This adds the message Remember to backup mail files by end of week. to the end of the file notes.

---

## Copying Your Screen to a File (capture and script Commands)

You can copy everything printed on your terminal to a file that you specify with the **capture** command, which emulates a VT100 terminal.

You can use the **script** command to copy everything printed on your terminal to a file that you specify, without emulating a VT100 terminal.

Both commands are useful for printing records of terminal dialogs.

For example, to capture the screen of a terminal while emulating a VT100, at the prompt, type:

```
capture screen.01
```

Press Enter.

The system displays information similar to the following:

```
Capture command is started. The file is screen.01.  
Use ^P to dump screen to file screen.01.  
You are now emulating a vt100 terminal.  
Press Any Key to continue.
```

After entering data and dumping the screen contents, stop the **capture** command by pressing Ctrl-D or typing exit and pressing Enter. The system displays information similar to the following:

```
Capture command is complete. The file is screen.01.  
You are NO LONGER emulating a vt100 terminal.
```

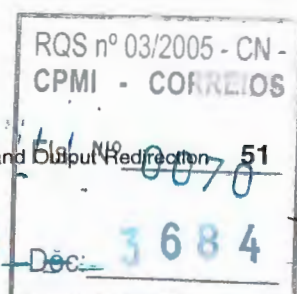
Use the **cat** command to display the contents of your file.

For example, to capture the screen of a terminal, at the prompt, type:

```
script
```

Press Enter.

The system displays information similar to the following:



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Paula

Script command is started. The file is typescript.

Everything displayed on the screen is now copied to the **typescript** file.

To stop the **script** command, press Ctrl-D or type **exit** and press Enter. The system displays information similar to the following:

Script command is complete. The file is typescript.

Use the **cat** command to display the contents of your file.

See the **capture** and **script** commands in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Displaying Text in Large Letters on Your Screen (banner Command)

The **banner** command displays ASCII characters to your screen in large letters. Each line in the output can be up to 10 digits (or uppercase or lowercase characters) in length.

For example, at the prompt, type:

```
banner GOODBYE!
```

Press Enter.

The system displays GOODBYE! in large letters on your screen.

---

## Command Summary for Input and Output Redirection

>	"Redirecting Standard Output" on page 46
<	"Redirecting Standard Input" on page 47
> >	"Redirecting Output and Appending to a File" on page 46
	"Using Pipes and Filters" on page 49
<b>banner</b>	Writes ASCII character strings in large letters to standard output
<b>capture</b>	Allows terminal screens to be dumped to a file
<b>clear</b>	Clears the terminal screen
<b>echo</b>	Writes character strings to standard output
<b>script</b>	Allows terminal input and output to be copied to a file
<b>tee</b>	Displays the standard output of a program and copies it into a file

## Related Information

"Commands Overview" on page 26

"Processes Overview" on page 35

Chapter 12, "Shells" on page 139

"Korn Shell or POSIX Shell Commands" on page 144

"Bourne Shell" on page 184

"C Shell" on page 200

Chapter 7, "Files" on page 67

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Paula

## Chapter 6. File Systems and Directories

*File systems* consist of groups of directories and the files within the directories. File systems are commonly represented as an inverted tree. The root directory, symbolized by the slash (/) symbol, defines a file system and appears at the top of a file system tree diagram. Directories branch downward from the root directory in the tree diagram and can contain both files and subdirectories. Branching creates unique paths through the directory structure to every object in the file system.

Collections of files are stored in *directories*. These collections of files are often related to each other; storing them in a structure of directories keeps them organized.

A *file* is a collection of data that can be read from or written to. A file can be a program you create, text you write, data you acquire, or a device you use. Commands, printers, terminals, correspondence, and application programs are all stored in files. This allows users to access diverse elements of the system in a uniform way and gives great flexibility to the file system.

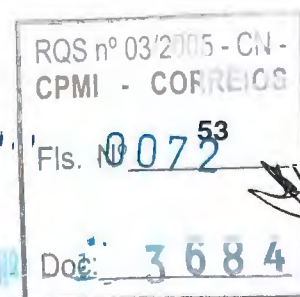
This chapter discusses the following:

- "File Systems"
  - "File System Types" on page 54
  - "File System Structure" on page 54
  - "Displaying Available Space on a File System (df Command)" on page 55
- "Directory Overview" on page 56
  - "Types of Directories" on page 56
  - "Directory Organization" on page 57
  - "Directory Naming Conventions" on page 57
  - "Directory Path Names" on page 57
  - "Directory Abbreviations" on page 58
- "Directory-Handling Procedures" on page 58
  - "Creating a Directory (mkdir Command)" on page 59
  - "Moving or Renaming a Directory (mvdir Command)" on page 59
  - "Displaying the Current Directory (pwd Command)" on page 60
  - "Changing to Another Directory (cd Command)" on page 60
  - "Copying a Directory (cp Command)" on page 61
  - "Displaying Contents of a Directory (ls Command)" on page 61
  - "Deleting or Removing a Directory (rmdir Command)" on page 63
  - "Comparing the Contents of Directories (dircmp Command)" on page 63
- "Command Summary for File Systems and Directories" on page 64

### File Systems

A *file system* is a hierarchical structure (file tree) of files and directories. This type of structure resembles an inverted tree with the roots at the top and the branches at the bottom. This file tree uses directories to organize data and programs into groups, allowing the management of many directories and files at one time.

Some tasks are performed more efficiently on a file system than on each directory within the file system. For example, you can back up, move, or secure an entire file system.



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The basic type of file system is called the *Journaled File System (JFS)*. This file system uses database journaling techniques to maintain its structural consistency. This prevents damage to the file system when the system is halted abnormally.

Some of the most important system management tasks have to do with file systems, specifically:

- Allocating space for file systems on logical volumes
- Creating file systems
- Making file system space available to system users
- Monitoring file system space usage
- Backing up file systems to guard against data loss if the system fails
- Maintaining file systems in a consistent state

These tasks should be performed by your system administrator.

## File System Types

The operating system supports multiple file system types. These include:

<b>Journaled File System (JFS)</b>	The basic file system type, it supports the entire set of file system commands.
<b>Enhanced Journaled File System (JFS2)</b>	The basic file system type, it supports the entire set of file system commands.
<b>Network File System (NFS)</b>	A file system type that permits files residing on remote machines to be accessed as though they reside on the local machine.
<b>CD-ROM File System (CDRFS)</b>	A file system type that allows the contents of a CD-ROM to be accessed through the normal file system interfaces (open, read, and close).

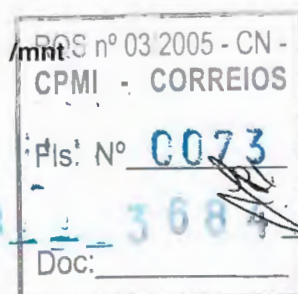
## File System Structure

On standalone machines, the following file systems reside on the associated devices by default:

/File System	/Device
/dev/hd1	/home
/dev/hd2	/usr
/dev/hd3	/tmp
/dev/hd4	/(root)
/dev/hd9var	/var
/proc	/proc
/dev/hd10opt	/opt

The file tree has the following characteristics:

- Files that can be shared by machines of the same hardware architecture are located in the **/usr** file system.
- Variable per-client files, for example, spool and mail files, are located in the **/var** file system.
- The **/(root)** file system contains files and directories critical for system operation. For example, it contains
  - A device directory (**/dev**)
  - Mount points where file systems can be mounted onto the root file system, for example, **/mnt**







- The **/home** file system is the mount point for users' home directories.
- For servers, the **/export** directory contains paging-space files, per-client (unshared) root file systems, dump, home, and **/usr/share** directories for diskless clients, as well as exported **/usr** directories.
- The **/proc** file system contains information about the state of processes and threads in the system.
- The **/opt** file system contains optional software, such as applications.

The following list provides information about the contents of some of the subdirectories of the **/(root)** file system.

<b>/bin</b>	Symbolic link to the <b>/usr/bin</b> directory.
<b>/dev</b>	Contains device nodes for special files for local devices. The <b>/dev</b> directory contains special files for tape drives, printers, disk partitions, and terminals.
<b>/etc</b>	Contains configuration files that vary for each machine. Examples include: <ul style="list-style-type: none"><li>• <b>/etc/hosts</b></li><li>• <b>/etc/passwd</b></li></ul>
<b>/export</b>	Contains the directories and files on a server that are for remote clients.
<b>/home</b>	Serves as a mount point for a file system containing user home directories. The <b>/home</b> file system contains per-user files and directories.  In a standalone machine, a separate local file system is mounted over the <b>/home</b> directory. In a network, a server might contain user files that should be accessible from several machines. In this case, the server's copy of the <b>/home</b> directory is remotely mounted onto a local <b>/home</b> file system.
<b>/lib</b>	Symbolic link to the <b>/usr/lib</b> directory, which contains architecture-independent libraries with names in the form <b>lib*.a</b> .
<b>/sbin</b>	Contains files needed to boot the machine and mount the <b>/usr</b> file system. Most of the commands used during booting come from the boot image's RAM disk file system; therefore, very few commands reside in the <b>/sbin</b> directory.
<b>/tmp</b>	Serves as a mount point for a file system that contains system-generated temporary files.
<b>/u</b>	Symbolic link to the <b>/home</b> directory.
<b>/usr</b>	Serves as a mount point for a file system containing files that do not change and can be shared by machines (such as executable programs and ASCII documentation).  Standalone machines mount a separate local file system over the <b>/usr</b> directory. Diskless and disk-poor machines mount a directory from a remote server over the <b>/usr</b> file system.
<b>/var</b>	Serves as a mount point for files that vary on each machine. The <b>/var</b> file system is configured as a file system because the files that it contains tend to grow. For example, it is a symbolic link to the <b>/usr/tmp</b> directory, which contains temporary work files.

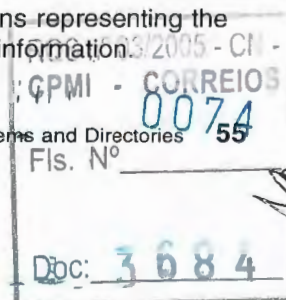
## Displaying Available Space on a File System (df Command)

You can use the **df** command to display information about total space and available space on a file system. The *FileSystem* parameter specifies the name of the device on which the file system resides, the directory on which the file system is mounted, or the relative path name of a file system. If you do not specify the *FileSystem* parameter, the **df** command displays information for all currently mounted file systems. If a file or directory is specified, then the **df** command displays information for the file system on which it resides.

Normally, the **df** command uses free counts contained in the superblock. Under certain exceptional conditions, these counts might be in error. For example, if a file system is being actively modified when the **df** command is running, the free count might not be accurate.

See the **df** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

**Note:** On some remote file systems, such as Network File Systems (NFS), the columns representing the available space on the display are left blank if the server does not provide the information.





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The following are examples of how to use the **df** command:

1. To display information about all mounted file systems, type:

```
df
```

Press Enter.

If your system is configured so the **/**, **/usr**, **/site**, and **/usr/venus** directories reside in separate file systems, the output from the **df** command is similar to the following:

Filesystem	512-blocks	free	%used	Iused	%Iused	Mounted on
/dev/hd4	20480	13780	32%	805	13%	/
/dev/hd2	385024	15772	95%	27715	28%	/usr
/dev/hd9var	40960	38988	4%	115	1%	/var
/dev/hd3	20480	18972	7%	81	1%	/tmp
/dev/hd1	4096	3724	9%	44	4%	/home

2. To display available space on the file system in which your current directory resides, type:

```
df .
```

Press Enter.

## Directory Overview

A *directory* is a unique type of file that contains only the information needed to access files or other directories. As a result, a directory occupies less space than other types of files. Directories enable you to group files and other directories, allowing you to organize the file system into a modular hierarchy and giving the file-system structure flexibility and depth. Unlike other types of files, a special set of commands control directories.

Directories contain directory entries. Each entry contains a file or subdirectory name and an index node reference number (*i-node* number). To increase speed and enhance use of disk space, the data in a file is stored at various locations in the memory of the computer. The *i-node* number contains the addresses used to locate all the scattered blocks of data associated with a file. The *i-node* number also records other information about the file, including time of modification and access, access modes, number of links, file owner, and file type. It is possible to link several names for a file to the same *i-node* number by creating directory entries with the **ln** command.

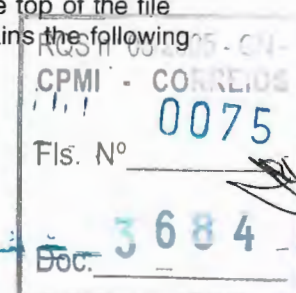
Because directories often contain information that should not be available to all users of the system, directory access can be protected. By setting a directory's permissions, you can control who has access to the directory, also determining which users (if any) can alter information within the directory. See "File and Directory Access Modes" on page 119 for more information.


This section discusses:

- "Types of Directories"
- "Directory Organization" on page 57
- "Directory Naming Conventions" on page 57
- "Directory Path Names" on page 57
- "Directory Abbreviations" on page 58
- "Directory-Handling Procedures" on page 58

## Types of Directories

Directories can be defined by the operating system, the system administrator, or users. The system-defined directories contain specific kinds of system files, such as commands. At the top of the file system hierarchy is the system-defined **/(root)** directory. The **/(root)** directory usually contains the following standard system-related directories:





<b>/dev</b>	Contains special files for I/O devices.
<b>/etc</b>	Contains files for system initialization and system management.
<b>/home</b>	Contains login directories for the system users.
<b>/tmp</b>	Contains files that are temporary and can be deleted in a specified number of days.
<b>/usr</b>	Contains the <b>lpp</b> , <b>include</b> , and other system directories.
<b>/usr/bin</b>	Contains user-executable programs.

Some directories, such as your login or home directory (**\$HOME**), are defined and customized by the system administrator. When you log in to the operating system, the login directory is the current directory.

Directories that you create are called user-defined directories. These directories help you organize and maintain your files.

## Directory Organization

Directories contain files, subdirectories, or a combination of both. A subdirectory is a directory within a directory. The directory containing the subdirectory is called the *parent directory*.

For the operating system to track and find directories, each directory has an entry for the parent directory in which it was created, .. (dot dot), and an entry for the directory itself, . (dot). In most directory listings, these files are hidden.

### Directory Tree

The file system structure of directories can easily become complex. Attempt to keep the file and directory structure as simple as possible. Also, create files and directories with easily recognizable names. This makes working with files easier.

### Parent Directory

Each directory, except for **/(root)**, has one parent directory and can have zero or more child directories.

### Home Directory

When you log in, the system puts you in a directory called your *home directory* or login directory. This directory is set up by the system administrator for each user. Your home directory is the repository for your personal files. Normally, directories that you create for your own use will be subdirectories of your home directory. To return to your home directory at any time, type the **cd** command and press Enter at the prompt.

### Working Directory

You are always working within a directory. Whichever directory you are currently working in is called your *current* or *working* directory. The **pwd** (present working directory) command reports the name of your working directory. Use the **cd** command to change working directories.

## Directory Naming Conventions

The name of each directory must be unique within the directory where it is stored. This ensures that the directory also has a unique path name in the file system. Directories follow the same naming conventions that files do, as explained in "File-Naming Conventions" on page 69.

## Directory Path Names

Each file and directory can be reached by a unique path, known as the *path name*, through the file system tree structure. The path name specifies the location of a directory or file within the file system.

**Note:** Path names cannot exceed 1023 characters in length.

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The file system uses the following kinds of path names:

<b>absolute path name</b>	Traces the path from the <b>/ (root)</b> directory. Absolute path names always begin with the slash (/) symbol.
<b>relative path name</b>	Traces the path from the current directory through its parent or its subdirectories and files.

An absolute path name represents the complete name of a directory or file from the **/ (root)** directory downward. Regardless of where you are working in the file system, you can always find a directory or file by specifying its absolute path name. Absolute path names start with a slash (/), the symbol representing the root directory. The path name **/A/D/9** is the absolute path name for **9**. The first slash (/) represents the **/ (root)** directory, which is the starting place for the search. The remainder of the path name directs the search to **A**, then to **D**, and finally to **9**.

Two files named **9** can exist because the absolute path names to the files give each file a unique name within the file system. The path names **/A/D/9** and **/C/E/G/9** specify two unique files named **9**.

Unlike full path names, relative path names specify a directory or file based on the current working directory. For relative path names, you can use the notation dot dot (..) to move upward in the file system hierarchy. The dot dot (..) represents the parent directory. Because relative path names specify a path starting in the current directory, they do not begin with a slash (/). Relative path names are used to specify the name of a file in the current directory or the path name of a file or directory above or below the level of the current directory in the file system. If **D** is the current directory, the relative path name for accessing **10** is **F/10**, but the absolute path name is always **/A/D/F/10**. Also, the relative path name for accessing **3** is **../B/3**.

You can also represent the name of the current directory by using the notation dot (.). The dot (.) notation is commonly used when running programs that read the current directory name.

## Directory Abbreviations

Abbreviations provide a convenient way to specify certain directories. The following is a list of abbreviations.

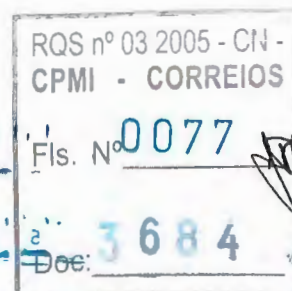
Abbreviation	Meaning
.	The current working directory.
..	The directory above the current working directory (the parent directory).
~	Your home directory (this is not true for the Bourne shell. For more information, see "Bourne Shell" on page 184).
\$HOME	Your home directory (this is true for all shells).

## Directory-Handling Procedures

You can work with directories and their contents in a variety of ways.

The command and an example are presented for each of the following directory tasks:

- "Creating a Directory (mkdir Command)" on page 59
- "Moving or Renaming a Directory (mvdir Command)" on page 59
- "Displaying the Current Directory (pwd Command)" on page 60
- "Changing to Another Directory (cd Command)" on page 60
- "Copying a Directory (cp Command)" on page 61
- "Displaying Contents of a Directory (ls Command)" on page 61
- "Deleting or Removing a Directory (rmdir Command)" on page 63





- “Comparing the Contents of Directories (dircmp Command)” on page 63

## Creating a Directory (mkdir Command)

You can use the **mkdir** command to create one or more directories specified by the *Directory* parameter. Each new directory contains the standard entries dot (.) and dot dot (..). You can specify the permissions for the new directories with the **-m Mode** flag.

When you create a directory, it is created within the current, or working, directory unless you specify an absolute path name to another location in the file system.

The following are examples of how to use the **mkdir** command:

1. To create a new directory called **Test** in the current working directory with default permissions, type:  
`mkdir Test`

Press Enter.

2. To create a directory called **Test** with **rxwxr-xr-x** permissions in a previously created **/home/demo/sub1** directory, type:

```
mkdir -m 755 /home/demo/sub1/Test
```

Press Enter.

3. To create a directory called **Test** with default permissions in the **/home/demo/sub2** directory, type:

```
mkdir -p /home/demo/sub2/Test
```

Press Enter.

The **-p** flag creates the **/home**, **/home/demo**, and **/home/demo/sub2** directories if they do not already exist.

See the **mkdir** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Moving or Renaming a Directory (mvdir Command)

To move or rename a directory, use the **mvdir** command.

For example, to move a directory, type:

```
mvdir book manual
```

Press Enter.

This moves the **book** directory under the directory named **manual**, if the **manual** directory exists. Otherwise, the **book** directory is renamed to **manual**.

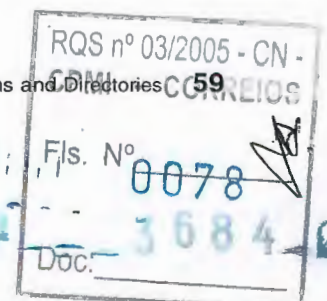
For example, to move and rename a directory, type:

```
mvdir book3 proj4/manual
```

Press Enter.

This moves the **book3** directory to the directory named **proj4** and renames **proj4** to **manual** (if the **manual** directory did not previously exist).

See the **mvdir** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.



## Displaying the Current Directory (pwd Command)

You can use the **pwd** command to write to standard output the full path name of your current directory (from the **/**(root) directory). All directories are separated by a slash (/). The **/**(root) directory is represented by the first slash (/), and the last directory named is your current directory.

For example, to display your current directory, type:

```
pwd
```

Press Enter.

The full path name of your current directory displays similar to the following:

```
/home/thomas
```

## Changing to Another Directory (cd Command)

The **cd** command moves you from your present directory to another directory. You must have execute (search) permission in the specified directory.

If you do not specify a *Directory* parameter, the **cd** command moves you to your login directory (**\$HOME** in the **ksh** and **bsh** environments, or **\$home** in the **csk** environment). If the specified directory name is a full path name, it becomes the current directory. A full path name begins with a slash (/) indicating the **/**(root) directory, a dot (.) indicating current directory, or a dot dot (..) indicating parent directory. If the directory name is not a full path name, the **cd** command searches for it relative to one of the paths specified by the **\$CDPATH** shell variable (or **\$cdpath** **csk** variable). This variable has the same syntax as, and similar semantics to, the **\$PATH** shell variable (or **\$path** **csk** variable).

The following are examples of how to use the **cd** command:

1. To change to your home directory, type:

```
cd
```

Press Enter.

2. To change to the **/usr/include** directory, type:

```
cd /usr/include
```

Press Enter.

3. To go down one level of the directory tree to the **sys** directory, type:

```
cd sys
```

Press Enter.

If the current directory is **/usr/include** and it contains a subdirectory named **sys**, then **/usr/include/sys** becomes the current directory.

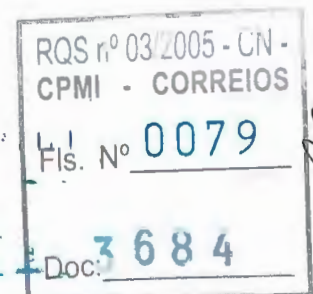
4. To go up one level of the directory tree, type:

```
cd ..
```

Press Enter.

The special file name, dot dot (..), refers to the directory immediately above the current directory, its parent directory.

See the **cd** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.





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## Copying a Directory (cp Command)

You can use the **cp** command to create a copy of the contents of the file or directory specified by the *SourceFile* or *SourceDirectory* parameters into the file or directory specified by the *TargetFile* or *TargetDirectory* parameters. If the file specified as the *TargetFile* exists, the copy writes over the original contents of the file. If you are copying more than one *SourceFile*, the target must be a directory.

To place a copy of the *SourceFile* into a directory, specify a path to an existing directory for the *TargetDirectory* parameter. Files maintain their respective names when copied to a directory unless you specify a new file name at the end of the path. The **cp** command also copies entire directories into other directories if you specify the **-r** or **-R** flags.

The following are examples of how to use the **cp** command.

1. To copy all the files in the **/home/accounts/customers/orders** directory to the **/home/accounts/customers/shipments** directory, type:

```
cp /home/accounts/customers/orders/* /home/accounts/customers/shipments
```

Press Enter.

This copies only the files in **orders** directory into the **shipments** directory.

2. To copy a directory, including all its files and subdirectories, to another directory, type:

```
cp -R /home/accounts/customers /home/accounts/vendors
```

Press Enter.

This copies the **customers** directory, including all its files, subdirectories, and the files in those subdirectories, into the **vendors** directory.

See the **cp** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying Contents of a Directory (ls Command)

You can display the contents of a directory by using the **ls** command.

### ls command

The **ls** command writes to standard output the contents of each specified *Directory* or the name of each specified *File*, along with any other information you ask for with the flags. If you do not specify a *File* or *Directory*, the **ls** command displays the contents of the current directory.

By default, the **ls** command displays all information in alphabetic order by file name. If the command is executed by a user with root authority, it uses the **-A** flag by default, listing all entries except dot (.) and dot dot (..). To show all entries for files, including those that begin with a . (dot), use the **ls -a** command.

You can format the output in the following ways:

- List one entry per line, using the **-l** flag.
- List entries in multiple columns, by specifying either the **-C** or **-x** flag. The **-C** flag is the default format when output is to a tty.
- List entries in a comma-separated series, by specifying the **-m** flag.

To determine the number of character positions in the output line, the **ls** command uses the **\$COLUMNS** environment variable. If this variable is not set, the command reads the **terminfo** file. If the **ls** command cannot determine the number of character positions by either of these methods, it uses a default value of 80.

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The information displayed with the **-e** and **-l** flags is interpreted as follows:

The first character may be one of the following:

- d** Entry is a directory.
- b** Entry is a block special file.
- c** Entry is a character special file.
- l** Entry is a symbolic link.
- p** Entry is a first-in, first-out (FIFO) pipe special file.
- s** Entry is a local socket.
- Entry is an ordinary file.

The next nine characters are divided into three sets of three characters each. The first three characters show the owner's permission. The next set of three characters shows the permission of the other users in the group. The last set of three characters shows the permission of anyone else with access to the file. The three characters in each set show read, write, and execute permission of the file. Execute permission of a directory lets you search a directory for a specified file.

Permissions are indicated as follows:

- r** Read permission granted
- t** Only the directory owner or the file owner can delete or rename a file within that directory, even if others have write permission to the directory.
- w** Write (edit) permission granted
- x** Execute (search) permission granted
- Corresponding permission not granted.

The information displayed with the **-e** flag is the same as with the **-l** flag, except for the addition of an 11th character, interpreted as follows:

- +** Indicates a file has extended security information. For example, the file might have extended **ACL**, **TCB**, or **TP** attributes in the mode.
- Indicates a file does not have extended security information.

When the size of the files in a directory are listed, the **ls** command displays a total count of blocks, including indirect blocks.

For example, to list all files in the current directory, type:

```
ls -a
```

Press Enter.

This lists all files, including

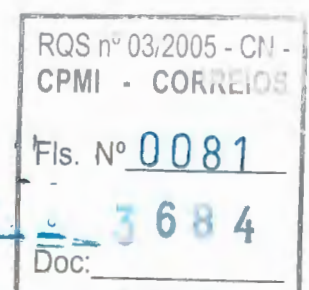
- dot (.)
- dot dot (..)
- Other files whose names might or might not begin with a dot (.)

For example, to display detailed information, type:

```
ls -l chap1 .profile
```

Press Enter.

This displays a long listing with detailed information about **chap1** and **.profile**.



For example, to display detailed information about a directory, type:

```
ls -ld . manual manual/chap1
```

Press Enter.

This displays a long listing for the directories `.` and `manual`, and for the file `manual/chap1`. Without the `-d` flag, this would list the files in the `.` and `manual` directories instead of the detailed information about the directories themselves.

See the `ls` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Deleting or Removing a Directory (rmdir Command)

You can use the `rmdir` command to remove the directory, specified by the *Directory* parameter, from the system. The directory must be empty (it can only contain `.` and `..`) before you can remove it, and you must have write permission in its parent directory. Use the `ls -la Directory` command to check whether the directory is empty.

The following are examples of how to use the `rmdir` command:

1. To empty and remove a directory, type:

```
rm mydir/* mydir/.  
rmdir mydir
```

Press Enter.

This removes the contents of `mydir`, then removes the empty directory. The `rm` command displays an error message about trying to remove the directories dot (`.`) and dot dot (`..`), and then the `rmdir` command removes them and the directory itself.

**Note:** `rm mydir/* mydir/.*` first removes files with names that do not begin with a dot, and then removes those with names that do begin with a dot. You might not realize that the directory contains file names that begin with a dot because the `ls` command does not normally list them unless you use the `-a` flag.

2. To remove the `/tmp/jones/demo/mydir` directory and all the directories beneath it, type:

```
cd /tmp  
rmdir -p jones/demo/mydir
```

Press Enter.

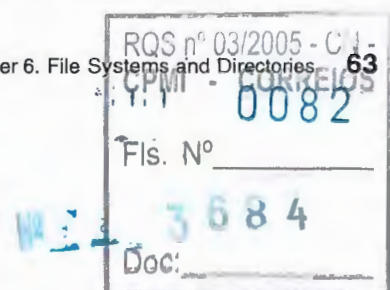
This removes the `jones/demo/mydir` directory from the `/tmp` directory. If a directory is not empty or you do not have write permission to it when it is to be removed, the command terminates with appropriate error messages.

See the `rmdir` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Comparing the Contents of Directories (dircmp Command)

You can use the `dircmp` command to compare two directories specified by the *Directory1* and *Directory2* parameters and write information about their contents to standard output. First, the `dircmp` command compares the file names in each directory. If the same file name is contained in both, the `dircmp` command compares the contents of both files.

In the output, the `dircmp` command lists the files unique to each directory. It then lists the files with identical names in both directories, but with different contents. If no flag is specified, it also lists files that have identical contents as well as identical names in both directories.





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The following are examples of how to use the **dircmp** command:

1. To summarize the differences between the files in the **proj.ver1** and **proj.ver2** directories, type:

```
dircmp proj.ver1 proj.ver2
```

Press Enter.

This displays a summary of the differences between the **proj.ver1** and **proj.ver2** directories. The summary lists separately the files found only in one directory or the other, and those found in both. If a file is found in both directories, the **dircmp** command notes whether the two copies are identical.

2. To show the details of the differences between the files in the **proj.ver1** and **proj.ver2** directories, type:

```
dircmp -d -s proj.ver1 proj.ver2
```

Press Enter.

The **-s** flag suppresses information about identical files. The **-d** flag displays a **diff** listing for each of the differing files found in both directories.

See the **dircmp** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

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## Command Summary for File Systems and Directories

### File Systems

**df** Reports information about space on file systems.

### Directory Abbreviations

**.** The current working directory.  
**..** The directory above the current working directory (the parent directory).  
**~** Your home directory (this is not true for the Bourne shell. For more information, see "Bourne Shell" on page 184).  
**\$HOME** Your home directory (this is true for all shells).

### Directory Handling Procedures

**cd** Changes the current directory.  
**cp** Copies files or directories.  
**dircmp** Compares two directories and the contents of their common files.  
**ls** Displays the contents of a directory.  
**mkdir** Creates one or more new directories.  
**mvdir** Moves (renames) a directory.  
**pwd** Displays the path name of the working directory.  
**rmdir** Removes a directory.

### Related Information

"Commands Overview" on page 26

"Processes Overview" on page 35

Chapter 5, "Input and Output Redirection" on page 45

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## Chapter 7. Files

Files are used for all input and output (I/O) of information in the operating system. To standardize access to both software and hardware. Input occurs when the contents of a file is modified or written to. Output occurs when the contents of one file is read or transferred to another file. For example, to create a printed copy of a file, the system reads the information from the text file and writes that information to the file representing the printer.

This chapter discusses the following:

- "Types of Files" on page 68
  - "File-Naming Conventions" on page 69
  - "File Path Names" on page 69
  - "Pattern Matching with Wildcards and Metacharacters" on page 69
  - "Pattern Matching versus Regular Expressions" on page 70
- "File Handling Procedures" on page 71
  - "Deleting Files (rm Command)" on page 71
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## Types of Files

The following basic types of files exist:

<b>regular</b>	Stores data (text, binary, and executable)
<b>directory</b>	Contains information used to access other files
<b>special</b>	Defines a FIFO (first-in, first-out) pipe file or a physical device

All file types recognized by the system fall into one of these categories. However, the operating system uses many variations of these basic types.

## Regular Files

Regular files are the most common files and are used to contain data. Regular files are in the form of text files or binary files:

### Text Files

Text files are regular files that contain information stored in ASCII and readable by the user. You can display and print these files. The lines of a text file must not contain **NUL** characters, and none can exceed **{LINE\_MAX}** bytes in length, including the new-line character.

The term *text file* does not prevent the inclusion of control or other nonprintable characters (other than **NUL**). Therefore, standard utilities that list text files as inputs or outputs are either able to process the special characters or they explicitly describe their limitations within their individual sections.

### Binary Files

Binary files are regular files that contain information readable by the computer. Binary files might be executable files that instruct the system to accomplish a job. Commands and programs are stored in executable, binary files. Special compiling programs translate ASCII text into binary code.

Text and binary files differ only in that text files have lines of less than **{LINE\_MAX}** bytes, with no **NUL** characters, each terminated by a newline character.

## Directory Files

Directory files contain information that the system needs to access all types of files, but directory files do not contain the actual file data. As a result, directories occupy less space than a regular file and give the file system structure flexibility and depth. Each directory entry represents either a file or a subdirectory. Each entry contains the name of the file and the file's index node reference number (i-node number). The i-node number points to the unique index node assigned to the file. The i-node number describes the location of the data associated with the file. Directories are created and controlled by a separate set of commands.

## Special Files

Special files define devices for the system or temporary files created by processes. The basic types of special files are FIFO (first-in, first-out), block, and character. FIFO files are also called *pipes*. Pipes are created by one process to temporarily allow communication with another process. These files cease to exist when the first process finishes. Block and character files define devices.

Every file has a set of permissions (called *access modes*) that determine who can read, modify, or execute the file.

To learn more about file access modes, see "File and Directory Access Modes" on page 119 .



## File-Naming Conventions

The name of each file must be unique within the directory where it is stored. This ensures that the file also has a unique path name in the file system. File-naming guidelines are:

- A file name can be up to 255 characters long and can contain letters, numbers, and underscores.
- The operating system is case-sensitive, which means it distinguishes between uppercase and lowercase letters in file names. Therefore, FILEA, FiLea, and filea are three distinct file names, even if they reside in the same directory.
- File names should be as descriptive and meaningful as possible.
- Directories follow the same naming conventions as files.
- Certain characters have special meaning to the operating system. Avoid using these characters when you are naming files. These characters include the following:  
/ \ " ' \* ; - ? [ ] ( ) ~ ! \$ { } < > # @ & |
- A file name is hidden from a normal directory listing if it begins with a dot (.). When the **ls** command is entered with the **-a** flag, the hidden files are listed along with regular files and directories.

## File Path Names

The path name for each file and directory in the file system consists of the names of every directory that precedes it in the tree structure.

Because all paths in a file system originate from the **/(root)** directory, each file in the file system has a unique relationship to the root directory, known as the *absolute path name*. Absolute path names begin with the slash (/) symbol. For example, the absolute path name of file **h** could be **/B/C/h**. Notice that two files named **h** can exist in the system. Because the absolute paths to the two files are different, **/B/h** and **/B/C/h**, each file named **h** has a unique name within the system. Every component of a path name is a directory except the final component. The final component of a path name can be a file name.

**Note:** Path names cannot exceed 1023 characters in length.

## Pattern Matching with Wildcards and Metacharacters

Wildcard characters provide a convenient way for specifying multiple file or directory names with one character. The wildcard characters are asterisk (\*) and question mark (?). The metacharacters are open and close square brackets ([]), hyphen (-), and exclamation mark (!).

### Using the \* Wildcard Character

Use the asterisk (\*) to match any sequence or string of characters. The (\*) indicates any characters, including no characters. For example, if you have the following files in your directory:

1test 2test afile1 afile2 bfile1 file file1 file10 file2 file3

and you want to refer to only the files that begin with file, you would use:

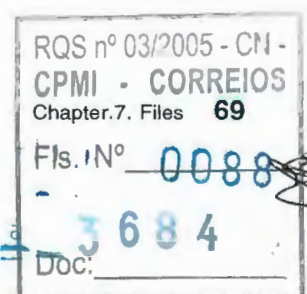
file\*

The files selected would be: file file1 file10 file2 file3

To refer to only the files that contain the word file, you would use:

\*file\*

The files selected would be: afile1 afile2 bfile1 file file1 file10 file2 file3





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## Using the ? Wildcard Character

Use the ? to match any one character. The ? indicates any single character.

To refer to only the files that start with file and end with a single character, use:  
file?

The files selected would be: file1 file2 file3

To refer to only the files that start with file and end with any two characters, use:  
file??

The file selected would be: file10

## Using [ ] Shell Metacharacters

Metacharacters offer another type of wildcard notation by enclosing the desired characters within [ ]. It is like using the ?, but it allows you to choose specific characters to be matched. The [ ] also allow you to specify a range of values using the hyphen (-). To specify all the letters in the alphabet, use [[:alpha:]]. To specify all the lowercase letters in the alphabet, use [[:lower:]].

To refer to only the files that end in 1 or 2, use:  
\*file[12]

The files selected would be: afile1 afile2 file1 file2

To refer to only the files that start with any number, use:  
[0123456789]\* or [0-9]\*

The files selected would be: 1test 2test

To refer to only the files that do not begin with an a, use:  
[!a]\*

The files selected would be: 1test 2test bfile1 file file1 file10 file2 file3

## Pattern Matching versus Regular Expressions

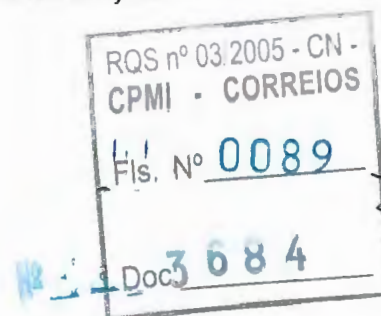
Regular expressions allow you to select specific strings from a set of character strings. The use of regular expressions is generally associated with text processing.

Regular expressions can represent a wide variety of possible strings. While many regular expressions can be interpreted differently depending on the current locale, internationalization features provide for contextual invariance across locales.

See the examples in the following comparison between File Matching Patterns and Regular Expressions:

Pattern Matching	Regular Expression
*	.*
?	.
[!a]	[^a]
[abc]	[abc]
[[:alpha:]]	[[:alpha:]]

See the **awk** command in the *AIX 5L Version 5.2 Commands Reference* for the exact syntax.





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## File Handling Procedures

There are many ways to work with the files on your system. Usually you create a text file with a text editor. The common editors in the UNIX environment are **vi** and **ed**. Because several text editors are available, you can choose to edit with the editor you feel comfortable with.

You can also create files by using input and output redirection, as described in "Chapter 5, "Input and Output Redirection" on page 45". You can send the output of a command to a new file or append it to an existing file.

After creating and modifying files, you might have to copy or move files from one directory to another, rename files to distinguish different versions of a file, or give different names to the same file. You might also need to create directories when working on different projects.

Also, you might need to delete certain files. Your directory can quickly get cluttered with files that contain old or useless information. To release storage space on your system, ensure that you delete files that are no longer needed.

This section discusses the following:

- "Deleting Files (rm Command)"
- "Moving and Renaming Files (mv Command)" on page 72
- "Copying Files (cp Command)" on page 72
- "Finding Files (find Command)" on page 74
- "Displaying the File Type (file Command)" on page 75
- "Displaying File Contents (pg, more, page, and cat Commands)" on page 75
- "Finding Text Strings Within Files (grep Command)" on page 76
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### Deleting Files (rm Command)

When you no longer need a file, you can remove it with the **rm** command. The **rm** command removes the entries for a specified file, group of files, or certain select files from a list within a directory. User confirmation, read permission, and write permission are not required before a file is removed when you use the **rm** command. However, you must have write permission for the directory containing that file.

The following are examples of how to use the **rm** command:

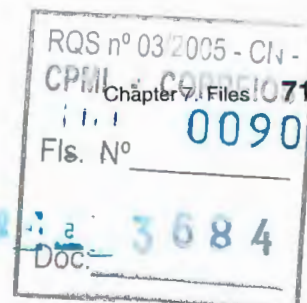
1. To delete the file named **myfile**, type:

```
rm myfile
```

Press Enter.

2. To delete all the files in the **mydir** directory, one by one, type:

```
rm -i mydir/*
```



Press Enter.

After each file name displays, type *y* and press Enter to delete the file. Or to keep the file, just press Enter.

See the **rm** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Moving and Renaming Files (mv Command)

To move files and directories from one directory to another or rename a file or directory, use the **mv** command. If you move a file or directory to a new directory without specifying a new name, it retains its original name.

**Attention:** The **mv** command can overwrite many existing files unless you specify the **-i** flag. The **-i** flag prompts you to confirm before it overwrites a file. The **-f** flag does not prompt you. If both the **-f** and **-i** flags are specified in combination, the last flag specified takes precedence.

### Moving Files with mv Command

The following are examples of how to use the **mv** command:

1. To move a file to another directory and give it a new name, type:

```
mv intro manual/chap1
```

Press Enter.

This moves the **intro** file to the **manual/chap1** directory. The name **intro** is removed from the current directory, and the same file appears as **chap1** in the **manual** directory.

2. To move a file to another directory, keeping the same name, type:

```
mv chap3 manual
```

Press Enter.

This moves **chap3** to **manual/chap3**.

### Renaming Files with mv Command

You can use the **mv** command to change the name of a file without moving it to another directory.

To rename a file, type:

```
mv appendix apndx.a
```

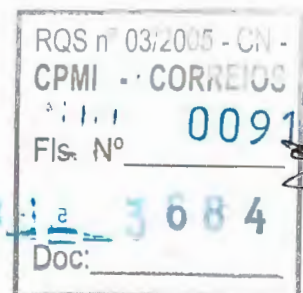
Press Enter.

This renames the **appendix** file to **apndx.a**. If a file named **apndx.a** already exists, its old contents are replaced with those of the **appendix** file.

See the **mv** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Copying Files (cp Command)

You can use the **cp** command to create a copy of the contents of the file or directory specified by the *SourceFile* or *SourceDirectory* parameters into the file or directory specified by the *TargetFile* or *TargetDirectory* parameters. If the file specified as the *TargetFile* exists, the copy writes over the original contents of the file without warning. If you are copying more than one *SourceFile*, the target must be a directory.





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If a file with the same name exists at the new destination, the copied file overwrites the file at the new destination. Therefore, it is a good practice to assign a *new* name for the copy of the file to ensure that a file of the same name does not exist in the destination directory.

To place a copy of the *SourceFile* into a directory, specify a path to an existing directory for the *TargetDirectory* parameter. Files maintain their respective names when copied to a directory unless you specify a new file name at the end of the path. The **cp** command also copies entire directories into other directories if you specify the **-r** or **-R** flags.

You can also copy special-device files using the **-R** flag. Specifying **-R** causes the special files to be re-created under the new path name. Specifying the **-r** flag causes the **cp** command to attempt to copy the special files to regular files.

The following are examples of how to use the **cp** command:

1. To make a copy of a file in the current directory, type:

```
cp prog.c prog.bak
```

Press Enter.

This copies **prog.c** to **prog.bak**. If the **prog.bak** file does not already exist, then the **cp** command creates it. If it does exist, then the **cp** command replaces it with a copy of the **prog.c** file.

2. To copy a file in your current directory into another directory, type:

```
cp jones /home/nick/clients
```

Press Enter.

This copies the **jones** file to **/home/nick/clients/jones**.

3. To copy all the files in a directory to a new directory, type:

```
cp /home/janet/clients/* /home/nick/customers
```

Press Enter.

This copies only the files in the **clients** directory to the **customers** directory.

4. To copy a specific set of files to another directory, type:

```
cp jones lewis smith /home/nick/clients
```

Press Enter.

This copies the **jones**, **lewis**, and **smith** files in your current working directory to the **/home/nick/clients** directory.

5. To use pattern-matching characters to copy files, type:

```
cp programs/*.c .
```

Press Enter.

This copies the files in the **programs** directory that end with **.c** to the current directory, indicated by the single dot (**.**). You must type a space between the **c** and the final dot.

See the **cp** command in the *AIX 5L Version 5.2 Commands Reference* for the exact syntax.

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## Finding Files (find Command)

You can use the **find** command to recursively search the directory tree for each specified *Path*, seeking files that match a Boolean expression written using the terms given in the following text. The output from the **find** command depends on the terms specified by the *Expression* parameter.

The following are examples of how to use the **find** command:

1. To list all files in the file system with the name **.profile**, type:

```
find / -name .profile
```

Press Enter.

This searches the entire file system and writes the complete path names of all files named **.profile**. The slash (/) tells the **find** command to search the /(root) directory and all of its subdirectories.

To save time, limit the search by specifying the directories where you think the files might be.

2. To list files having a specific permission code of **0600** in the current directory tree, type:

```
find . -perm 0600
```

Press Enter.

This lists the names of the files that have *only* owner-read and owner-write permission. The dot (.) tells the **find** command to search the current directory and its subdirectories. For an explanation of permission codes, see the **chmod** command.

3. To search several directories for files with certain permission codes, type:

```
find manual clients proposals -perm -0600
```

Press Enter.

This lists the names of the files that have owner-read and owner-write permission and possibly other permissions. The **manual**, **clients**, and **proposals** directories and their subdirectories are searched. In the previous example, **-perm 0600** selects only files with permission codes that match **0600** exactly. In this example, **-perm -0600** selects files with permission codes that allow the accesses indicated by **0600** and other accesses above the **0600** level. This also matches the permission codes **0622** and **2744**.

4. To list all files in the current directory that have been changed during the current 24-hour period, type:

```
find . -ctime 1
```

Press Enter.

5. To search for regular files with multiple links, type:

```
find . -type f -links +1
```

Press Enter.

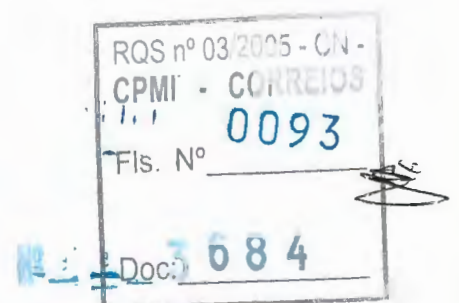
This lists the names of the ordinary files (**-type f**) that have more than one link (**-links +1**).

**Note:** Every directory has at least two links: the entry in its parent directory and its own **.(dot)** entry. For more information on multiple file links, see the **ln** command.

6. To search for all files that are exactly 414 bytes in length, type:

```
find . -size 414c
```

Press Enter.



See the **find** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying the File Type (file Command)

You can use the **file** command to read the files specified by the *File* or **-f FileList** parameter, perform a series of tests on each one. The command attempt to classify the files by type. The command then writes the file types to standard output.

If a file appears to be ASCII, the **file** command examines the first 512 bytes and determines its language. If a file does not appear to be ASCII, the **file** command further attempts to determine whether it is a binary data file or a text file that contains extended characters.

If the *File* parameter specifies an executable or object module file and the version number is greater than 0, the **file** command displays the version stamp.

The **file** command uses the **/etc/magic** file to identify files that have a magic number, that is, any file containing a numeric or string constant that indicates the type.

The following are examples of how to use the **file** command:

1. To display the type of information the file named **myfile** contains, type:

```
file myfile
```

Press Enter.

This displays the file type of **myfile** (such as directory, data, ASCII text, C-program source, and archive).

2. To display the type of each file named in the **filenames.lst** file, which contains a list of file names, type:

```
file -f filenames.lst
```

Press Enter.

This displays the type of each file named in the **filenames.lst** file. Each file name must display on a separate line.

3. To create the **filenames.lst** file, so that it contains all the file names in the current directory, type:

```
ls > filenames.lst
```

Press Enter.

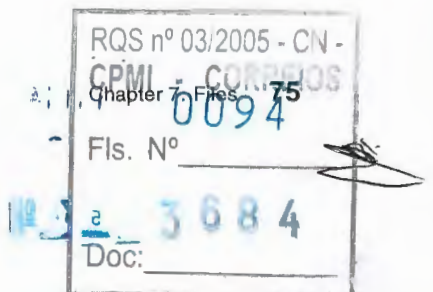
Edit the **filenames** file as desired.

See the **file** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying File Contents (pg, more, page, and cat Commands)

The **pg**, **more**, and **page** commands allow you to view the contents of a file and control the speed at which your files are displayed. You can also use the **cat** command to display the contents of one or more files on your screen. Combining the **cat** command with the **pg** command allows you to read the contents of a file one full screen at a time.

You can also display the contents of files by using input and output redirection. See Chapter 5, "Input and Output Redirection" on page 45 for more details on input and output redirection.





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## pg Command

The **pg** command reads the file names from the *File* parameter and writes them to standard output one screen at a time. If you specify hyphen (-) as the *File* parameter, or run the **pg** command without options, the **pg** command reads standard input. Each screen is followed by a prompt. If you press the Enter key, another screen displays. Subcommands used with the **pg** command let you review something that has already passed.

For example, to look at the contents of the file *myfile* one page at a time, type:

```
pg myfile
```

Press Enter.

See the **pg** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## more or page Command

The **more** or **page** command displays continuous text one screen at a time. It pauses after each screen and prints the *filename* and percent completed (for example, *myfile* (7%)) at the bottom of the screen. If you then press the Enter key, the **more** command displays an additional line. If you press the spacebar, the **more** command displays another screen of text.

**Note:** On some terminal models, the **more** command clears the screen, instead of scrolling, before displaying the next screen of text.

For example, to view a file named *myfile*, type:

```
more myfile
```

Press Enter.

Press the spacebar to view the next screen.

See the **more** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## cat Command

The **cat** command reads each *File* parameter in sequence and writes it to standard output.

For example, to display the contents of the file *notes*, type:

```
cat notes
```

Press Enter. If the file is more than 24 lines long, some of it scrolls off the screen. To list a file one page at a time, use the **pg** command.

For example, to display the contents of the files *notes*, *notes2*, and *notes3*, type:

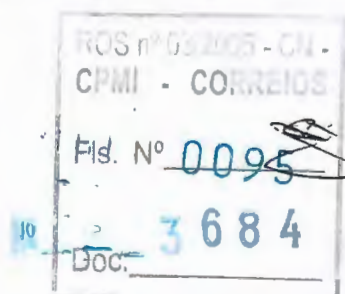
```
cat notes notes2 notes3
```

Press Enter.

See the **cat** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Finding Text Strings Within Files (grep Command)

The **grep** command searches for the pattern specified by the *Pattern* parameter and writes each matching line to standard output.





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The following are examples of how to use the **grep** command:

1. To search in a file named **pgm.s** for a pattern that contains some of the pattern-matching characters **^**, **?**, **[**, **]**, **\**, **|**, **.**, and **\***, in this case, lines starting with any lowercase or uppercase letter, type:  

```
grep "^[a-zA-Z]" pgm.s
```

Press Enter.

This displays all lines in the **pgm.s** file that begin with a letter.

2. To display all lines in a file named **sort.c** that do not match a pattern, type:  

```
grep -v bubble sort.c
```

Press Enter.

This displays all lines that do not contain the word **bubble** in the **sort.c** file.

3. To display lines in the output of the **ls** command that match the string **staff**, type:  

```
ls -l | grep staff
```

Press Enter.

See the **grep** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Sorting Text Files (sort Command)

You can use the **sort** command to alphabetize or sequence lines in the files specified by the *File* parameters and writes the result to standard output. If the *File* parameter specifies more than one file, the **sort** command concatenates the files and alphabetizes them as one file.

**Note:** The **sort** command is case-sensitive and orders uppercase letters before lowercase (this is dependent on the locale).

In the following examples, the contents of the file named **names** are:

```
marta  
denise  
joyce  
endrica  
melanie
```

and the contents of the file named **states** are:

```
texas  
colorado  
ohio
```

1. To display the sorted contents of the file named **names**, type:

```
sort names
```

Press Enter.

The system displays information similar to the following:

```
denise  
endrica  
joyce  
marta  
melanie
```

2. To display the sorted contents of the **names** and **states** files, type:

```
sort names states
```

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Press Enter.

The system displays information similar to the following:

```
colorado
denise
endrica
joyce
marta
melanie
ohio
texas
```

3. To replace the original contents of the file named **names** with its sorted contents, type:  
`sort -o names names`

Press Enter.

This replaces the contents of the **names** file with the same data but in sorted order.

See the **sort** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Comparing Files (diff Command)

You can use the **diff** command to compare text files. It can compare single files or the contents of directories.

When the **diff** command is run on regular files, and when it compares text files in different directories, the **diff** command tells which lines must be changed in the files so that they match.

The following are examples of how to use the **diff** command:

1. To compare two files, type:  
`diff chap1.bak chap1`

Press Enter.

This displays the differences between the **chap1.bak** and **chap1** files.

2. To compare two files while ignoring differences in the amount of white space, type:  
`diff -w prog.c.bak prog.c`

Press Enter. If the two files differ only in the number of spaces and tabs between words, the **diff -w** command considers the files to be the same.

See the **diff** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Counting Words, Lines, and Bytes in Files (wc Command)

By default, the **wc** command counts the number of lines, words, and bytes in the files specified by the *File* parameter. If a file is not specified for the *File* parameter, standard input is used. The command writes the results to standard output and keeps a total count for all named files. If flags are specified, the ordering of the flags determines the ordering of the output. A *word* is defined as a string of characters delimited by spaces, tabs, or newline characters.

When files are specified on the command line, their names are printed along with the counts.

For example, to display the line, word, and byte counts of the file named **chap1**, type:

```
wc chap1
```

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Press Enter. This displays the number of lines, words, and bytes in the chap1 file.

For example, to display only byte and word counts, type:

```
wc -cw chap*
```

Press Enter. This displays the number of bytes and words in each file where the name starts with chap, and displays the totals.

See the **wc** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying the First Lines of Files (head Command)

The **head** command writes to standard output the first few lines of each of the specified files or of the standard input. If no flag is specified with the **head** command, the first 10 lines are displayed by default.

For example, to display the first five lines of the Test file, type:

```
head -5 Test
```

Press Enter.

See the **head** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Displaying the Last Lines of Files (tail Command)

The **tail** command writes the file specified by the *File* parameter to standard output beginning at a specified point.

For example, to display the last 10 lines of the notes file, type:

```
tail notes
```

Press Enter.

For example, to specify the number of lines to start reading from the end of the notes file, type:

```
tail -20 notes
```

Press Enter.

For example, to display the notes file one page at a time, beginning with the 200th byte, type:

```
tail -c +200 notes | pg
```

Press Enter.

For example, to follow the growth of the file named accounts, type:

```
tail -f accounts
```

Press Enter. This displays the last 10 lines of the accounts file. The **tail** command continues to display lines as they are added to the accounts file. The display continues until you press the (Ctrl-C) key sequence to stop the display.

See the **tail** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

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## Cutting Sections of Text Files (cut Command)

To write selected bytes, characters, or fields from each line of a file to standard output, use the **cut** command.

For example, to display several fields of each line of a file, type:

```
cut -f1,5 -d: /etc/passwd
```

Press Enter. This displays the login name and full user name fields of the system password file. These are the first and fifth fields (-f1,5) separated by colons (-d:).

For example, if the **/etc/passwd** file looks like this:

```
su:*:0:0:User with special privileges:/:usr/bin/sh
daemon:*:1:1::/etc:
bin:*:2:2::/usr/bin:
sys:*:3:3::/usr/src:
adm:*:4:4:System Administrator:/var/adm:/usr/bin/sh
pierre:*:200:200:Pierre Harper:/home/pierre:/usr/bin/sh
joan:*:202:200:Joan Brown:/home/joan:/usr/bin/sh
```

the **cut** command produces:

```
su:User with special privileges
daemon:
bin:
sys:
adm:System Administrator
pierre:Pierre Harper
joan:Joan Brown
```

See the **cut** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Pasting Sections of Text Files (paste Command)

The **paste** command merges the lines of up to 12 files into one file.

For example, if you have a file named **names** that contains the following text:

```
rachel
jerry
mark
linda
scott
```

another file named **places** that contains the following text:

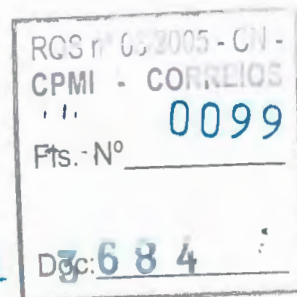
```
New York
Austin
Chicago
Boca Raton
Seattle
```

and another file named **dates** that contains the following text:

```
February 5
March 13
June 21
July 16
November 4
```

To paste the text of the files **names**, **places**, and **dates** together, type:

```
paste names places dates > npd
```



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Press Enter. This creates a file named `npd` that contains the data from the `names` file in one column, the `places` file in another, and the `dates` file in a third. The `npd` file now contains the following:

rachel	New York	February 5
jerry	Austin	March 13
mark	Chicago	June 21
linda	Boca Raton	July 16
scott	Seattle	November 4

A tab character separates the name, place, and date on each line. These columns do not align, because the tab stops are set at every eighth column.

For example, to separate the columns with a character other than a tab, type:

```
paste -d"!@" names places dates > npd
```

Press Enter. This alternates `!` and `@` as the column separators. If the `names`, `places`, and `dates` files are the same as in example 1, then the `npd` file contains the following:

```
rachel!New York@February 5
jerry!Austin@March 13
mark!Chicago@June 21
linda!Boca Raton@July 16
scott!Seattle@November 4
```

For example, to list the current directory in four columns, type:

```
ls | paste - - -
```

Press Enter. Each hyphen (`-`) tells the **paste** command to create a column containing data read from the standard input. The first line is put in the first column, the second line in the second column, and so on.

See the **paste** command in the *AIX 5L Version 5.2 Commands Reference* for the exact syntax.

## Numbering Lines in Text Files (`nl` Command)

The **nl** command reads the specified file (standard input by default), numbers the lines in the input, and writes the numbered lines to standard output.

For example, to number only the nonblank lines, type:

```
nl chap1
```

Press Enter. This displays a numbered listing of `chap1`, numbering only the nonblank lines in the body sections.

For example, to number all lines, type:

```
nl -ba chap1
```

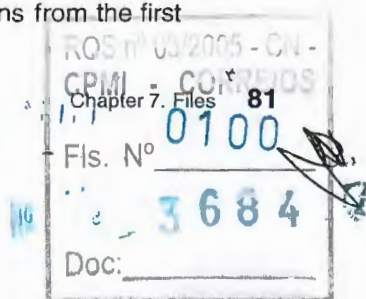
Press Enter. This numbers all the lines in the file named `chap1`, including blank lines.

See the **nl** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Removing Columns in Text Files (`colrm` Command)

The **colrm** command removes specified columns from a file. Input is taken from standard input. Output is sent to standard output.

If the command is called with one parameter, the columns of each line from the specified column to the last column are removed. If the command is called with two parameters, the columns from the first specified column to the second specified column are removed.



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**Note:** Column numbering starts with column 1.

For example, to remove columns from the `text.fil` file, type:

```
colrm 6 < text.fil
```

Press Enter.

If `text.fil` contains:

```
123456789
```

then the `colrm` command displays:

```
12345
```

See the `colrm` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Linking Files and Directories

*Links* are connections between a file name and an index node reference number (i-node number), the internal representation of a file. Because directory entries contain file names paired with i-node numbers, every directory entry is a link. The i-node number actually identifies the file, not the file name. By using links, any i-node number or file can be known by many different names.

For example, i-node number 798 contains a memo regarding June sales in the Omaha office. Presently, the directory entry for this memo is as follows:

i-node Number	File Name
798	memo

Because this information relates to information stored in the `sales` and `omaha` directories, linking is used to share the information where it is needed. Using the `ln` command, links are created to these directories. Now the file has three file names as follows:

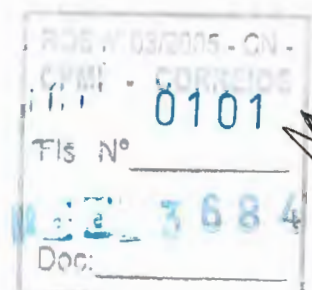
i-node Number	File Name
798	memo
798	sales/june
798	omaha/junesales

When you use the `pg` or `cat` command to view the contents of any of the three file names, the same information is displayed. If you edit the contents of the i-node number from any of the three file names, the contents of the data displayed by all of the file names will reflect any changes.

## Types of Links

Links are created with the `ln` command and are of the following types:

<b>hard link</b>	Allows access to the data of a file from a new file name. Hard links ensure the existence of a file. When the last hard link is removed, the i-node number and its data are deleted. Hard links can be created only between files that are in the same file system.
<b>symbolic link</b>	Allows access to data in other file systems from a new file name. The symbolic link is a special type of file that contains a path name. When a process encounters a symbolic link, the process may search that path. Symbolic links do not protect a file from deletion from the file system.





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**Note:** The user who creates a file retains ownership of that file no matter how many links are created. Only the owner of the file or the root user can set the access mode for that file. However, changes can be made to the file from a linked file name with the proper access mode.

A file or directory exists as long as there is one hard link to the i-node number for that file. In the long listing displayed by the `ls -l` command, the number of hard links to each file and subdirectory is given. All hard links are treated equally by the operating system regardless of which link was created first.

## Linking Files (ln Command)

Linking files with the `ln` command is a convenient way to work with the same data in more than one place. Links are created by giving alternate names to the original file. The use of links allows a large file, such as a database or mailing list, to be shared by several users without making copies of that file. Not only do links save disk space, but changes made to one file are automatically reflected in all the linked files.

The `ln` command links the file designated in the *SourceFile* parameter to the file designated by the *TargetFile* parameter or to the same file name in another directory specified by the *TargetDirectory* parameter. By default, the `ln` command creates hard links. To use the `ln` command to create symbolic links, designate the `-s` flag.

If you are linking a file to a new name, you can list only one file. If you are linking to a directory, you can list more than one file.

The *TargetFile* parameter is optional. If you do not designate a target file, the `ln` command creates a file in your current directory. The new file inherits the name of the file designated in the *SourceFile* parameter.

**Note:** You cannot link files across file systems without using the `-s` flag.

For example, to create another link to a file named `chap1`, type:

```
ln -f chap1 intro
```

Press Enter. This links `chap1` to the new name, `intro`. When the `-f` flag is used, the file name `intro` is created if it does not already exist. If `intro` does exist, the file is replaced by a link to `chap1`. Then both the `chap1` and `intro` file names will refer to the same file. Any changes made to one file also appear in the other.

For example, to link a file named `index` to the same name in another directory named `manual`, type:

```
ln index manual
```

Press Enter. This links `index` to the new name, `manual/index`.

For example, to link several files to names in another directory, type:

```
ln chap2 jim/chap3 /home/manual
```

Press Enter. This links `chap2` to the new name `/home/manual/chap2` and `jim/chap3` to `/home/manual/chap3`.

For example, to use the `ln` command with pattern-matching characters, type:

```
ln manual/* .
```

**Note:** You must type a space between the asterisk and the period.

Press Enter. This links all files in the `manual` directory into the current directory, `.`, giving them the same names they have in the `manual` directory.

For example, to create a symbolic link, type:

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```
ln -s /tmp/toc toc
```

Press Enter. This creates the symbolic link, `toc`, in the current directory. The `toc` file points to the `/tmp/toc` file. If the `/tmp/toc` file exists, the `cat toc` command lists its contents.

To achieve identical results without designating the *TargetFile* parameter, type:

```
ln -s /tmp/toc
```

Press Enter.

See the `ln` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Removing Linked Files

The `rm` command removes the link from the file name that you indicate. When one of several hard-linked file names is deleted, the file is not completely deleted because it remains under the other name. When the last link to an i-node number is removed, the data is removed as well. The i-node number is then available for reuse by the system.

See the `rm` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## DOS Files

The AIX operating system allows you to work with DOS files on your system. Copy to a diskette the DOS files you want to work with. Your system can read these files into a base operating system directory in the correct format and back onto the diskette in DOS format.

**Note:** The wildcard characters `*` and `?` (asterisk and question mark) do not work correctly with the commands discussed in this section (although they do with the base operating system shell). If you do not specify a file name extension, the file name is matched as if you had specified a blank extension.

## Copying DOS Files to Base Operating System Files

The `dosread` command copies the specified DOS file to the specified base operating system file.

**Note:** DOS file-naming conventions are used with one exception. Because the backslash (`\`) character can have special meaning to the base operating system, use a slash (`/`) character as the delimiter to specify subdirectory names in a DOS path name.

For example, to copy a text file named `chap1.doc` from a DOS diskette to the base operating file system, type:

```
dosread -a chap1.doc chap1
```

Press Enter. This copies the DOS text file `\CHAP1.DOC` on the `/dev/fd0` default device to the base operating system file `chap1` in the current directory.

For example, to copy a binary file from a DOS diskette to the base operating file system, type:

```
dosread -D/dev/fd0 /survey/test.dta /home/fran/testdata
```

Press Enter. This copies the `\SURVEY\TEST.DTADOS` data file on `/dev/fd1` to the base operating system file `/home/fran/testdata`.

See the `dosread` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

Form with stamps and handwritten numbers:

- Stamp: 070
- Stamp: 3684
- Stamp: Dec:
- Stamp: 12



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## Copying Base Operating System Files to DOS Files

The **doswrite** command copies the specified base operating system file to the specified DOS file.

**Note:** DOS file-naming conventions are used with one exception. Because the backslash (\) character can have special meaning to the base operating system, use a slash (/) character as the delimiter to specify subdirectory names in a DOS path name.

For example, to copy a text file named chap1 from the base operating file system to a DOS diskette, type:

```
doswrite -a chap1 chap1.doc
```

Press Enter. This copies the base operating system file chap1 in the current directory to the DOS text file \CHAP1.DOC on /dev/fd0.

For example, to copy a binary file named /survey/test.dta from the base operating file system to a DOS diskette, type:

```
doswrite -D/dev/fd0 /home/fran/testdata /survey/test.dta
```

Press Enter. This copies the base operating system data file /home/fran/testdata to the DOS file \SURVEY\TEST.DTA on /dev/fd1.

See the **doswrite** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Deleting DOS Files

The **dosdel** command deletes the specified DOS file.

**Note:** DOS file-naming conventions are used with one exception. Because the backslash (\) character can have special meaning to the base operating system, use a slash (/) character as the delimiter to specify subdirectory names in a DOS path name.

The **dosdel** command converts lowercase characters in the file or directory name to uppercase before it checks the disk. Because all file names are assumed to be full (not relative) path names, you need not add the initial slash (/).

For example, to delete a DOS file named file.ext on the default device (/dev/fd0), type:

```
dosdel file.ext
```

Press Enter.

See the **dosdel** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Listing Contents of a DOS Directory

The **dosdir** command displays information about the specified DOS files or directories.

**Note:** DOS file-naming conventions are used with one exception. Because the backslash (\) character can have special meaning to the base operating system, use a slash (/) character as the delimiter to specify subdirectory names in a DOS path name.

The **dosdir** command converts lowercase characters in the file or directory name to uppercase before it checks the disk. Because all file names are assumed to be full (not relative) path names, you need not add the initial / (slash).

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For example, to read a directory of the DOS files on `/dev/fd0`, type:

```
dosdir
```

Press Enter. The command returns the names of the files and disk-space information, similar to the following.

```
PG3-25.TXT
PG4-25.TXT
PG5-25.TXT
PG6-25.TXT
Free space: 312320 bytes
```

See the `dosdir` command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Command Summary for Files

*	Wildcard, matches any characters.
?	Wildcard, matches any single character.
[ ]	Metacharacters, matches enclosed characters.

## File-Handling Procedures

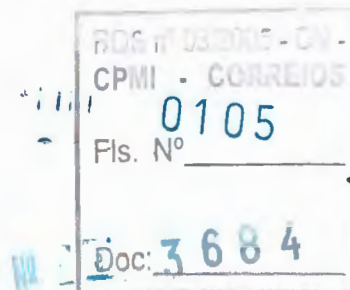
<b>cat</b>	Concatenates or displays files
<b>cmp</b>	Compares two files
<b>colrm</b>	Extracts columns from a file
<b>cp</b>	Copies files
<b>cut</b>	Writes out selected bytes, characters, or fields from each line of a file
<b>diff</b>	Compares text files
<b>file</b>	Determines the file type
<b>find</b>	Finds files with a matching expression
<b>grep</b>	Searches a file for a pattern
<b>head</b>	Displays the first few lines or bytes of a file or files
<b>more</b>	Displays continuous text one screen at a time on a display screen
<b>mv</b>	Moves files
<b>nl</b>	Numbers lines in a file
<b>pg</b>	Formats files to the display
<b>rm</b>	Removes (unlinks) files or directories
<b>paste</b>	Merges the lines of several files or subsequent lines in one file
<b>page</b>	Displays continuous text one screen at a time on a display screen
<b>sort</b>	Sorts files, merges files that are already sorted, and checks files to determine if they have been sorted
<b>tail</b>	Writes a file to standard output, beginning at a specified point
<b>wc</b>	Counts the number of lines, words, and bytes in a file

## Linking Files and Directories

**ln** Links files and directories

## DOS Files

<b>dosdel</b>	Deletes DOS files
<b>dosdir</b>	Lists the directory for DOS files
<b>dosread</b>	Copies DOS files to Base Operating System files
<b>doswrite</b>	Copies Base Operating System files to DOS files



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## Related Information

"Commands Overview" on page 26

"Processes Overview" on page 35

Chapter 5, "Input and Output Redirection" on page 45

Chapter 12, "Shells" on page 139

"File Systems" on page 53

"Directory Overview" on page 56

Chapter 7, "Files" on page 67

"Linking Files and Directories" on page 82

Chapter 8, "Printers, Print Jobs, and Queues" on page 89

Chapter 9, "Backup Files and Storage Media" on page 103

Chapter 10, "File and System Security" on page 117

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## Chapter 8. Printers, Print Jobs, and Queues

Depending on the printer, you can control the appearance and characteristics of the final output. The printers need not be located in the same area as the system unit and the system console. A printer can be attached directly to a local system, or a print job can be sent over a network to a remote system.

To handle print jobs with maximum efficiency, the system places each job into a queue to await printer availability. The system can save output from one or more files in the queue. As the printer produces the output from one file, the system processes the next job in the queue. This process continues until each job in the queue has been printed.

For detailed information about printers, print jobs, and queues, see the *AIX 5L Version 5.2 Guide to Printers and Printing*.

This chapter discusses the following chapters:

- "Printer Terminology"
- "Starting a Print Job (qprt Command)" on page 91
- "Canceling a Print Job (qcan Command)" on page 94
- "Checking Print Job Status (qchk Command)" on page 95
- "Printer Status Conditions" on page 96
- "Prioritizing a Print Job (qpri Command)" on page 96
- "Holding and Releasing a Print Job (qhld Command)" on page 97
- "Moving a Print Job to Another Print Queue (qmov Command)" on page 98
- "Formatting Files for Printing (pr Command)" on page 99
- "Printing ASCII Files on a PostScript Printer" on page 100
- "Automating the Conversion of ASCII to PostScript" on page 101
- "Overriding Automatic Determination of Print File Types" on page 102
- "Command Summary for Printers, Print Jobs, and Queues" on page 102
- "Related Information" on page 102

### Printer Terminology

The following describes terms commonly used with printing.

#### Local Printers

When a printer is attached to a node or host, the printer is referred to as a *local printer*.

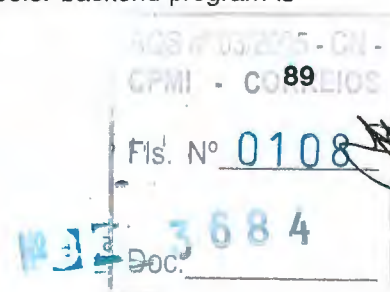
#### Print Job

A *print job* is a unit of work to be run on a printer. A print job can consist of printing one or more files, depending on how the print job is requested. The system assigns a unique job number to each job it runs.

#### Print Spooler

The *spooler* used for printing is not specifically a print job spooler. Instead, it provides a generic spooling function that can be used for queuing various types of jobs, including print jobs queued to a printer.

The spooler does not normally know what type of job it is queuing. When the system administrator defines a spooler queue, the purpose of the queue is defined by the spooler backend program that is specified for the queue. For example, if the spooler backend program is the **piobe** command (the printer I/O backend), the queue is a print queue. Likewise, if the spooler backend program is



a compiler, the queue is for compile jobs. When the spooler's **qdaemon** command selects a job from a spooler queue, it runs the job by invoking the **backend** program specified by the system administrator when the queue was defined.

The main spooler command is the **enq** command. Although you can invoke this command directly to queue a print job, the following front-end commands are defined for submitting a print job: the **lp**, **lpr**, and **qprt** commands. A print request issued by one of these commands is first passed to the **enq** program, which then places the information about the file in the queue for the **qdaemon** to process.

### Printer Backend

The *printer backend* is a collection of programs called by the spooler's **qdaemon** command to manage a print job that is queued for printing. The printer backend performs the following functions:

- Receives from the **qdaemon** command a list of one or more files to be printed
- Uses printer and formatting attribute values from the database, overridden by flags entered on the command line
- Initializes the printer before printing a file
- Runs filters as necessary to convert the print-data stream to a format supported by the printer
- Provides filters for simple formatting of ASCII documents
- Provides support for printing national language characters
- Passes the filtered print-data stream to the printer device driver
- Generates header and trailer pages
- Generates multiple copies
- Reports paper out, intervention required, and printer error conditions
- Reports problems detected by the filters
- Cleans up after a print job is canceled
- Provides a print environment that a system administrator can customize to address specific printing needs

### qdaemon

The **qdaemon** is a process that runs in the background and controls the queues. It is generally started when the system is turned on.

### Queue

The *queue* is where you direct a print job. It is a stanza in the **/etc/qconfig** file whose name is the name of the queue and points to the associated queue device. The following is a sample listing:

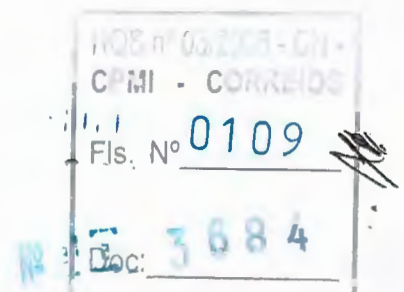
```
Msa1:
    device = lp0
```

In the previous example, **Msa1** is the queue name, and **lp0** is the device name.

### Queue Device

The *queue device* is the stanza in the **/etc/qconfig** file that normally follows the local queue stanza. It specifies the **/dev** file (printer device) that should be printed to and the backend that should be used. Following is a sample listing:

```
lp0:
    file = /dev/lp0
    header = never
    trailer = never
    access = both
    backend = /usr/lpd/piobe
```





In the previous output, `lp0` is the device name and the rest of the lines define how the device is used.

**Note:** There can be more than one queue device associated with a single queue.

### Real Printer

A *real printer* is the printer hardware attached to a serial or parallel port at a unique hardware device address. The printer device driver in the kernel communicates with the printer hardware and provides an interface between the printer hardware and a virtual printer, but it is not aware of the concept of virtual printers.

### Remote Printers

A *remote print system* allows nodes that are not directly linked to a printer to have printer access. To use remote printing facilities, the individual nodes must be connected to a network using the Transmission Control Protocol/Internet Protocol (TCP/IP) and must support the required TCP/IP applications.

### Virtual Printer

A *virtual printer* is a set of attributes that define a specific software view of a real printer. This view of the virtual printer refers only to the high-level data stream (such as ASCII or PostScript) that the printer understands. It does not include any information about how the printer hardware is attached to the host computer or about the protocol used for transferring bytes of data to and from the printer. Virtual printers are defined by the system manager.

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## Starting a Print Job (`qprt` Command)

To request a print job, use the `qprt` Command or the `smit` Command. For more information, see "Using the `qprt` Command" on page 92 and "Using the `smit` Command" on page 94. When using these commands, specify the following:

- Name of the file to print
- Print queue name
- Name of the output bin
- Number of copies to print
- Whether to make a copy of the file on the remote host
- Whether to erase the file after printing
- Whether to send notification of the job status
- Whether to send notification of the job status by the system mail
- Burst status
- User name for "Delivery To" label
- Console acknowledgment message for remote print
- File acknowledgment message for remote print
- Priority level

## Prerequisites

Before you start a print job, ensure the following:

- For local print jobs, the printer must be physically attached to your system.
- For remote print jobs, your system must be configured to communicate with the remote print server.

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## Using the qprt Command

The **qprt** command creates and queues a print job to print the file you specify. If you specify more than one file, all the files together make up one print job. These files are printed in the order specified on the command line.

Before you can print a file, you must have read access to it. To remove a file after it has printed, you must have write access to the directory that contains the file.

The most commonly used flags of the **qprt** command is as follows:

<b>-b Number</b>	Specifies the bottom margin. The bottom margin is the number of blank lines to be left at the bottom of each page.
<b>-B Value</b>	Specifies whether burst pages (continuous-form pages separated at perforations) should be printed. The <i>Value</i> variable consists of a two-character string. The first character applies to header pages. The second character applies to trailer pages. Each of the two characters can be one of the following: <ul style="list-style-type: none"> <li><b>a</b> Always prints the (header or trailer) page for each file in each print job.</li> <li><b>n</b> Never prints the (header or trailer) page.</li> <li><b>g</b> Prints the (header or trailer) page once for each print job (group of files).</li> </ul> For example, the <b>-B ga</b> flag specifies that a header page be printed at the beginning of each print job and that a trailer page be printed after each file in each print job.
<b>-e Option</b>	Specifies whether emphasized print is wanted. <ul style="list-style-type: none"> <li><b>+</b> Indicates emphasized print is wanted.</li> <li><b>!</b> Indicates emphasized print is not wanted.</li> </ul>
<b>-E Option</b>	Specifies whether double-high print is wanted. <ul style="list-style-type: none"> <li><b>+</b> Indicates double-high print is wanted.</li> <li><b>!</b> Indicates double-high print is not wanted.</li> </ul>
<b>-f FilterType</b>	A one-character identifier that specifies a filter through which your print file or files are to be passed before being sent to the printer. The available filter identifiers are <b>p</b> , which invokes the <b>pr</b> filter, and <b>n</b> , which processes output from the <b>troff</b> command.
<b>-i Number</b>	Causes each line to be indented the specified number of spaces. The <i>Number</i> variable must be included in the page width specified by the <b>-w</b> flag.
<b>-K Option</b>	Specifies whether condensed print is wanted. <ul style="list-style-type: none"> <li><b>+</b> Indicates condensed print is wanted.</li> <li><b>!</b> Indicates condensed print is not wanted.</li> </ul>
<b>-l Number</b>	Sets the page length to the specified number of lines. If the <i>Number</i> variable is 0, page length is ignored, and the output is considered to be one continuous page. The page length includes the top and bottom margins and indicates the printable length of the paper.
<b>-L Option</b>	Specifies whether lines wider than the page width should be wrapped to the next line or truncated at the right margin. <ul style="list-style-type: none"> <li><b>+</b> Indicates that long lines should wrap to the next line.</li> <li><b>!</b> Indicates that long lines should not wrap but instead should be truncated at the right margin.</li> </ul>
<b>-N Number</b>	Specifies the number of copies to be printed. If this flag is not specified, one copy is printed.

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<b>-p</b> <i>Number</i>	Sets the pitch to <i>Number</i> characters per inch. Typical values for <i>Number</i> are 10 and 12. The actual pitch of the characters printed is also affected by the values for the <b>-K</b> (condensed) flag and the <b>-W</b> (double-wide) flag.
<b>-P</b> <i>Queue[:QueueDevice]</i>	Specifies the print queue name and the optional queue device name. If this flag is not specified, the default printer is assumed.
<b>-Q</b> <i>Value</i>	Specifies paper size for the print job. The <i>Value</i> for paper size is printer-dependent. Typical values are: 1 for letter-size paper, 2 for legal, and so on. Consult your printer manual for the values assigned to specific paper sizes.
<b>-t</b> <i>Number</i>	Specifies the top margin. The top margin is the number of blank lines to be left at the top of each page.
<b>-w</b> <i>Number</i>	Sets the page width to the number of characters specified by the <i>Number</i> variable. The page width must include the number of indentation spaces specified with the <b>-i</b> flag.
<b>-W</b> <i>Option</i>	Specifies whether double-wide print is wanted. + Indicates double-wide print is wanted. ! Indicates double-wide print is not wanted.
<b>-z</b> <i>Value</i>	Rotates page printer output the number of quarter-turns clockwise as specified by the <i>Value</i> variable. The length ( <b>-l</b> ) and width ( <b>-w</b> ) values are automatically adjusted accordingly. 0 Portrait 1 Landscape right 2 Portrait upside-down 3 Landscape left
<b>-=</b> <i>OutputBin</i>	Specifies the output bin destination for a print job. The possible values are listed below. However, the valid output bins are printer-dependent. 0 Top printer bin 1-49 High Capacity Output (HCO) bins 1 - 49 49 Printer-specific output bins
<b>-#</b> <i>Value</i>	Specifies a special function. j Displays the job number for the specified print job. h Queues the print job, but puts it in the <b>HELD</b> state until it is released again. v Validates the specified printer backend flag values. This validation is useful in checking for illegal flag values at the time of submitting a print job. If the validation is not specified, an incorrect flag value will stop the print job later when the job is actually being processed.

For example, to request the **myfile** file to be printed on the first available printer configured for the default print queue using default values, type:

```
qprt myfile
```

For example, to request the file **somefile** to be printed on a specific queue using specific flag values and to validate the flag values at the time of print job submission, type:

```
qprt -f p -e + -Pfastest -# v somefile
```

This passes the **somefile** file through the **pr** filter command (the **-f p** flag) and prints it using emphasized mode (the **-e +** flag) on the first available printer configured for the queue named **fastest** (the **-Pfastest** flag).

For example, to print **myfile** on legal-size paper, type:

```
qprt -Q2 myfile
```

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For example, to print three copies of each of the **new.index.c**, **print.index.c**, and **more.c** files at the print queue **Msp1**, type:

```
qprt -PMsp1 -N 3 new.index.c print.index.c more.c
```

For example, to print three copies of the concatenation of the files **new.index.c**, **print.index.c**, and **more.c**, type:

```
cat new.index.c print.index.c more.c | qprt -PMsp1 -N 3
```

**Note:** The AIX operating system also supports the BSD UNIX print command (**lpr**) and the System V UNIX print command (**lp**). See the **lpr** and **lp** commands in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

See the **qprt** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Using the smit Command

You can also issue the **qprt** command with **smit**. At the prompt, type:

```
smit qprt
```

Press Enter.

---

## Canceling a Print Job (qcan Command)

You can cancel any job in the **print** queue by using the **qcan** Command or the **smit** Command. When you cancel a print job, you are prompted to provide the name of the print queue where the job resides and the job number to be canceled.

This procedure applies to both local and remote print jobs.

### Prerequisites

- For local print jobs, the printer must be physically attached to your system.
- For remote print jobs, your system must be configured to communicate with the remote print server.

## Using the qcan Command

The **qcan** command cancels either a particular job number in a local or remote print queue, or all jobs in a local print queue. To determine the job number, type the **qchk** command.

The common format of the **qcan** command is as follows:

```
qcan -PQueueName -x JobNumber
```

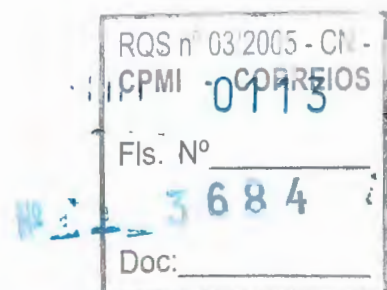
For example, to cancel job number 123 on whichever printer the job is on, type:

```
qcan -x 123
```

For example, to cancel all jobs queued on printer 1p0, type:

```
qcan -X -P1p0
```

**Note:** The AIX operating system also supports the BSD UNIX cancel print command (**lprm**) and the System V UNIX cancel print command (**cancel**). See the **lprm** and **cancel** commands in the *AIX 5L Version 5.2 Commands Reference* for more information and the exact syntax.





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## Using the smit Command

To cancel a print job using SMIT, type:

```
smit qcan
```

See the **qcan** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Checking Print Job Status (qchk Command)

To display the current status information for specified job numbers, queues, printers, or users, you can use the **Web-based System Manager Fast Path**, **qchk** Command, or the **smit** Command.

### Prerequisites

- For local print jobs, the printer must be physically attached to your system.
- For remote print jobs, your system must be configured to communicate with the remote print server.

### Web-based System Manager Fast Path

To check the status of a print job using the Web-based System Manager fast path, type:

```
wsm printers
```

In the Printer Queues container, select the print job, then use the menus to check its status.

### Using the qchk Command

You can use the **qchk** command to display the current status information regarding specified print jobs, print queues, or users.

The common format of the **qchk** command is:

```
qchk -P QueueName -# JobNumber -u OwnerName
```

See the **qchk** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

The following are examples of how to use the **qchk** command:

1. To display the default print queue, type:

```
qchk -q
```

Press Enter.

2. To display the long status of all queues until all queued jobs are complete, while updating the screen every 5 seconds, type:

```
qchk -A -L -w 5
```

To return to the command prompt, type **^C**.

3. To display the status for print queue lp0, type:

```
qchk -P lp0
```

Press Enter.

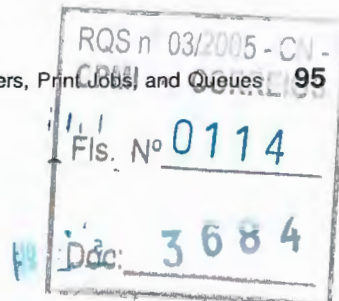
4. To display the status for job number 123, type:

```
qchk -# 123
```

Press Enter.

5. To check the status of all jobs in all queues, type:

```
qchk -A
```



**Note:** The AIX operating system also supports the BSD UNIX check print queue command (**lpq**) and the System V UNIX check print queue command (**lpstat**).

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See the **lpq** and **lpstat** commands in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Using the smit Command

To check a print job's status using SMIT, type:

```
smit qchk
```

---

## Printer Status Conditions

Some of the status conditions that a print queue can have are as follows:

<b>DEV_BUSY</b>	Indicates that: <ul style="list-style-type: none"><li>• More than one queue is defined to a printer device (<b>lp0</b>), and another queue is currently using the printer device.</li><li>• <b>qdaemon</b> attempted to use the printer port device (<b>lp0</b>), but another application is currently using that printer device.</li></ul> <p>To recover from a <b>DEV_BUSY</b>, wait until the queue or application has released the printer device or cancel the job or process that is using the printer port.</p>
<b>DEV_WAIT</b>	Indicates that the queue is waiting on the printer because the printer is offline, out of paper, jammed, or the cable is loose, bad, or wired incorrectly. <p>To recover from a <b>DEV_WAIT</b>, correct the problem that caused it to wait. Sometimes, the jobs have to be removed from the queue before the problem can be corrected.</p>
<b>DOWN</b>	A queue will usually go into a <b>DOWN</b> state after it has been in the <b>DEV_WAIT</b> state. This situation occurs when the printer device driver cannot tell if the printer is there due to absence of correct signalling. However, some printers might not have the capability to signal the queuing system that it is offline, and instead signals that it is off. If the printer device signals or appears to be off, the queue will go into the <b>DOWN</b> state. <p>To recover from a <b>DOWN</b> state, correct the problem that has brought the queue down and have the system administrator bring the queue back up. The queue <i>must</i> be manually brought up before it can be used again.</p>
<b>HELD</b>	Specifies that a print job is held. The print job will not be processed by the spooler until it is released.
<b>QUEUED</b>	Specifies that a print file is queued and is waiting in line to be printed.
<b>READY</b>	Specifies that everything involved with the queue is ready to queue and print a job.
<b>RUNNING</b>	Specifies that a print file is printing.

---

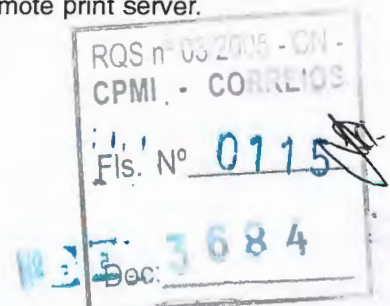
## Prioritizing a Print Job (qpri Command)

To change the priority of a print job, use the **qpri** Command or **smit** Command. You can only assign job priority on local queues. Higher values indicate a higher priority for the print job. The default priority is 15. The maximum priority for most user print jobs is 20. However, print jobs from users with root user authority or members of the **printq** group (group 0) can receive a priority of 30.

**Note:** You cannot assign priority to a remote print job.

## Prerequisites

- For local print jobs, the printer must be physically attached to your system.
- For remote print jobs, your system must be configured to communicate with the remote print server.





## Using the qpri Command(qpri Command)

The **qpri** command reassigns the priority of a print job that you submitted. If you have root user authority or belong to the printq group, you can assign priority to any job while it is in the print queue.

The basic format of the **qpri** command is:

```
qpri -# JobNumber -a PriorityLevel
```

For example, to change job number 123 to priority number 18, type:

```
qpri -# 123 -a 18
```

For example, to prioritize a local print job as it is submitted, type:

```
qpri -PQueueName -R PriorityLevel FileName
```

See the **qpri** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Using the smit Command

To change the priority of a print job using SMIT, type:

```
smit qpri
```

---

## Holding and Releasing a Print Job (qhld Command)

After you have sent a print job to a print queue, you can put the print job on hold by using the **Web-Based System Manager Fast Path**, the **qhld** Command, or the **smit** Command. “**Web-based System Manager Fast Path**”, the “**Using the qhld Command**”, or the “**Using the smit Command**” on page 98. You can use the same commands to later release the print job for printing.

### Prerequisites

- For local print jobs, the printer must be physically attached to your system.
- For remote print jobs, your system must be configured to communicate with the remote print server.

### Web-based System Manager Fast Path

To hold or release a print job using the Web-based System Manager fast path, type:

```
wsm printers
```

In the Printer Queues container, select the print job, then use the menus to put it on hold or to release it for printing.

### Using the qhld Command

The **qhld** command puts a print job on hold after you have sent it. You can either put a particular print job on hold, or you can hold all the print jobs on a specified print queue. To determine the print job number, type the **qchk** command.

The common format of the **qhld** command is:

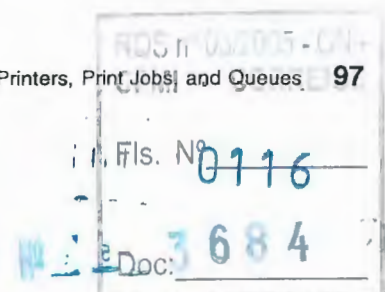
```
qhld [ -r ] { [ -#JobNumber ] [ -PQueue ] [ -uUser ] }
```

See the **qhld** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

The following are examples of how to use the **qhld** command:

1. To hold job number 452 on whichever print queue the job is on, type:

```
qhld -#452
```





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Press Enter.

2. To hold all jobs queued on print queue hp2, type:  
`qhld -Php2`

Press Enter.

3. To release job number 452 on whichever print queue the job is on, type:  
`qhld -#452 -r`

Press Enter.

4. To release all jobs queued on print queue hp2, type:  
`qhld -Php2 -r`

Press Enter.

## Using the smit Command

To hold or release a print job using SMIT, type:  
`smit qhld`

---

## Moving a Print Job to Another Print Queue (qmov Command)

After you have sent a print job to a print queue, you might want to move the print job to another print queue. You can move it with the **qmov** command or the **smit** command.

### Prerequisites

- For local print jobs, the printer must be physically attached to your system.
- For remote print jobs, your system must be configured to communicate with the remote print server.

## Using the qmov Command

You can either move a particular print job, or you can move all the print jobs on a specified print queue or all the print jobs sent by a specified user. To determine the print job number, type the **qchk** command.

The common format of the **qmov** command is:

```
qmov -mNewQueue {[ -#JobNumber ] [ -PQueue ] [ -uUser ] }
```

See the **qmov** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

The following are examples of how to use the **qmov** command:

1. To move job number 280 to print queue hp2, type:

```
qmov -mhp2 -#280
```

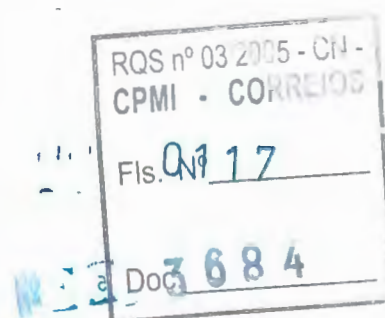
Press Enter.

2. To move all print jobs on print queue hp4D to print queue hp2, type:

```
qmov -mhp2 -Php4D
```

## Using the smit Command

To move a print job using SMIT, type:  
`smit qmov`



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## Formatting Files for Printing (pr Command)

The **pr** command performs simple formatting of the files you sent to be printed. Pipe the output of the **pr** command to the **qprt** command to format your text.

Some useful **pr** command flags are as follows:

<b>-d</b>	Double-spaces the output.
<b>-h "String"</b>	Displays the specified string, enclosed in quotation marks (" "), instead of the file name as the page header. The flag and string should be separated by a space.
<b>-l Lines</b>	Overrides the 66-line default and resets the page length to the number of lines specified by the <i>Lines</i> variable. If the <i>Lines</i> value is smaller than the sum of both the header and trailer depths (in lines), the header and trailer are suppressed (as if the <b>-t</b> flag were in effect).
<b>-m</b>	Merges files. Standard output is formatted so that the <b>pr</b> command writes one line from each file specified by a <i>File</i> variable, side by side into text columns of equal fixed widths, based on the number of column positions. Do not use this flag with the <b>-Column</b> flag.
<b>-n [Width][Character]</b>	Provides line numbering based on the number of digits specified by the <i>Width</i> variable. The default is 5 digits. If the <i>Character</i> (any non-digit character) variable is specified, it is appended to the line number to separate it from what follows on the line. The default character separator is the ASCII TAB character.
<b>-o Offset</b>	Indents each line by the number of character positions specified by the <i>Offset</i> variable. The total number of character positions per line is the sum of the width and offset. The default value of <i>Offset</i> is 0.
<b>-sCharacter</b>	Separates columns by the single character specified by the <i>Character</i> variable instead of by the appropriate number of spaces. The default value for <i>Character</i> is an ASCII TAB character.
<b>-t</b>	Does not display the five-line identifying header and the five-line footer. Stops after the last line of each file without spacing to the end of the page.
<b>-w Width</b>	Sets the number of column positions per line to the value specified by the <i>Width</i> variable. The default value is 72 for equal-width multicolumn output. There is no limit otherwise. If the <b>-w</b> flag is not specified and the <b>-s</b> flag is specified, the default width is 512 column positions.
<b>-Column</b>	Sets the number of columns to the value specified by the <i>Column</i> variable. The default value is 1. Do not use this option with the <b>-m</b> flag. The <b>-e</b> and <b>-i</b> flags are assumed for multicolumn output. A text column should never exceed the length of the page (see the <b>-l</b> flag). When this flag is used with the <b>-t</b> flag, use the minimum number of lines to write the output.
<b>+Page</b>	Begins the display with the page number specified by the <i>Page</i> variable. The default value is 1.

For example, to print a file named **prog.c** with headings and page numbers, type:

```
pr prog.c | qprt
```

Press Enter.

The **pr** Command, by default, adds page headings and page numbers to **prog.c** and sends it to the **qprt** command. The heading consists of the date the file was last modified, the file name, and the page number.

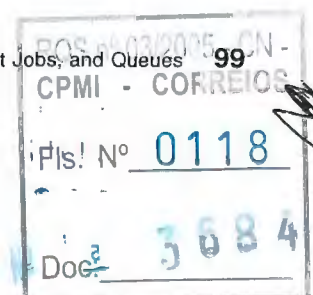
For example, to specify a title for a file named **prog.c**, type:

```
pr -h "MAIN PROGRAM" prog.c | qprt
```

Press Enter.

This prints **prog.c** with the title MAIN PROGRAM in place of the file name. The modification date and page number are still printed.

For example, to print a file named **word.lst** in multiple columns, type:





```
pr -3 word.lst | qprt
```

Press Enter.

This prints the **word.lst** file in three vertical columns.

For example, to print several files side by side on the paper:

```
pr -m -h "Members and Visitors" member.lst visitor.lst | qprt
```

This prints **member.lst** and **visitor.lst** side by side with the title **Members and Visitors**.

For example, to modify a file named **prog.c** for later use, type:

```
pr -t -e prog.c > prog.notab.c
```

Press Enter.

This replaces tab characters in **prog.c** with spaces and puts the result in **prog.notab.c**. Tab positions are at columns 9, 17, 25, 33, and so on. The **-e** flag tells the **pr** command to replace the tab characters; the **-t** flag suppresses the page headings.

For example, to print a file named **myfile** in two columns, in landscape, and in 7-point text, type:

```
pr -l66 -w172 -2 myfile | qprt -z1 -p7
```

Press Enter.

See the **pr** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Printing ASCII Files on a PostScript Printer

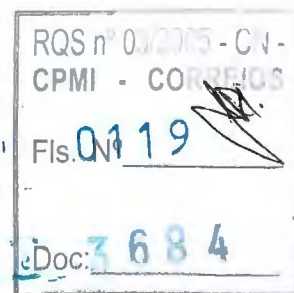
The Text Formatting System includes the **enscript** filter for converting ASCII print files to PostScript for printing on a PostScript printer. The **qprt -da** command calls this filter when a print job is submitted to a PostScript print queue.

### Prerequisites

- The printer must be physically attached to your system.
- The printer must be configured and defined.
- The transcript portion of Text Formatting Services must be installed.

You might specify the following flags with the **qprt** command to customize the output when submitting ASCII files to a PostScript print queue.

<b>-1+</b>	Adds page headings.
<b>-2+</b>	Formats the output in two columns.
<b>-3+</b>	Prints the page headings, dates, and page numbers in a fancy style. This is sometimes referred to as <b>gaudy</b> mode.
<b>-4+</b>	Prints the file, even if it contains unprintable characters.
<b>-5+</b>	Lists characters that are not included in a font.
<b>-h string</b>	Specifies a string to be used for page headings. If this flag is not specified, the heading consists of the file name, modification date, and page number.
<b>-l value</b>	Specifies the maximum number of lines printed per page. Depending on the point size, fewer lines per page might actually appear.
<b>-L!</b>	Truncates lines longer than the page width.
<b>-p</b>	Specifies the point size. If this flag is not specified, a point size of 10 is assumed, unless two-column rotated mode ( <b>-2+ -z1</b> ) is specified, in which case a value of 7 is used.





**-s** Specifies the font style. If this flag is not specified, the Courier font is used. Acceptable values are as follows:

- Courier-Oblique
- Helvetica
- Helvetica-Oblique
- Helvetica-Narrow
- Helvetica-Narrow-Oblique
- NewCenturySchlbk-Italic
- Optima
- Optima-Oblique
- Palatino-Roman
- Palatino-Italic
- Times-Roman
- Times-Italic

**Note:** The PostScript printer must have access to the specified font.

**-z1** Rotates the output 90 degrees (landscape mode).

For example, to send the ASCII file `myfile.ascii` to the PostScript printer named `Mspsl`, type:

```
qprt -da -PMspsl myfile.ascii
```

Press Enter.

For example, to send the ASCII file `myfile.ascii` to the PostScript printer named `Mspsl` and print in the Helvetica font, type:

```
qprt -da -PMspsl -sHelvetica myfile.ascii
```

Press Enter.

For example, to send the ASCII file `myfile.ascii` to the PostScript printer named `Mspsl` and print in the point size 9, type:

```
qprt -da -PMspsl -p9 myfile.ascii
```

Press Enter.

## Automating the Conversion of ASCII to PostScript

Many applications that generate PostScript print files follow the convention of making the first two characters of the PostScript file `%!`  which identifies the print file as a PostScript print file. To configure the system to detect ASCII print files submitted to a PostScript print queue and automatically convert them to PostScript files before sending them to the PostScript printer, perform these steps:

1. At the prompt, type:

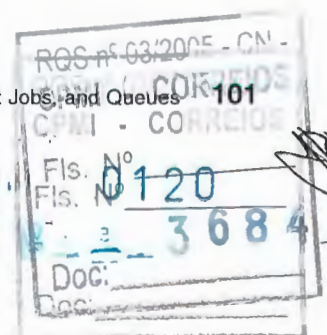
```
smit chpq
```

Press Enter.

2. Type the PostScript queue name, or use the List feature to select from a list of queues.
3. Select **Printer Setup** menu option.
4. Change value of **AUTOMATIC detection of print file TYPE to be done?** field to **yes**.

Any of the following commands now convert an ASCII file to a PostScript file and print it on a PostScript printer. To convert `myfile.ascii`, type any of the following at the command line:

```
qprt -Pps myfile.ps myfile.ascii
```



`lpr -Pps myfile.ps myfile.asci`  
`lp -dps myfile.ps myfile.acsii`

where ps is a PostScript print queue.

---

## Overriding Automatic Determination of Print File Types

You might need to override the automatic determination of print file type for PostScript printing in the following situations.

- To print a PostScript file named `myfile.ps` that does not begin with `%!`, type the following at the command line, for example:  
`qprt -ds -Pps myfile.ps`
- To print the source listing of a PostScript file named `myfile.ps` that begins with `%!`, type the following at the command line, for example:  
`qprt -da -Pps myfile.ps`

---

## Command Summary for Printers, Print Jobs, and Queues

<b>cancel</b>	Cancels requests to a line printer
<b>lp</b>	Sends requests to a line printer
<b>lpq</b>	Examines the spool queue
<b>lpr</b>	Enqueues print jobs
<b>lprm</b>	Removes jobs from the line printer spooling queue
<b>lpstat</b>	Displays line printer status information
<b>pr</b>	Writes a file to standard output
<b>qcan</b>	Cancels a print job
<b>qchk</b>	Displays the status of a print queue
<b>qhld</b>	Holds or releases a print job
<b>qmov</b>	Moves a print job to another print queue
<b>qpri</b>	Prioritizes a job in the print queue
<b>qprt</b>	Starts a print job

## Related Information

"Commands Overview" on page 26

"Processes Overview" on page 35

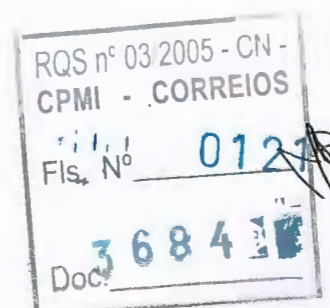
Chapter 5, "Input and Output Redirection" on page 45

"File Systems" on page 53

"Directory Overview" on page 56

Chapter 7, "Files" on page 67

Chapter 2, "User Environment and System Information" on page 11





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## Chapter 9. Backup Files and Storage Media

Once your system is in use, your next consideration should be to back up the file systems, directories, and files. All computer files are potentially easy to change or erase, either intentionally or by accident. If you use a careful and methodical approach to backing up your file systems, you should always be able to restore recent versions of files or file systems with little difficulty.

**Note:** When a hard disk crashes, the information contained on that disk is destroyed. The only way to recover the destroyed data is to retrieve the information from your backup copy.

There are several different methods of backing up. The most frequently used method is a regular backup, which is a copy of a file system, directory, or file that is kept for file transfer or in case the original data is unintentionally changed or destroyed. Another form of backing up is the archive backup; this method is used for future reference, historical purposes, or for recovery if the original data is damaged or lost.

This chapter discusses the following:

- "Establishing a Backup Policy"
- "Formatting Diskettes (format or fdformat Command)" on page 105
- "Checking the Integrity of the File System (fsck Command)" on page 106
- "Copying to or from Diskettes (lfcopy Command)" on page 107
- "Copying Files to Tape or Disk (cpio -o Command)" on page 107
- "Copying Files from Tape or Disk (cpio -i Command)" on page 108
- "Copying to or from Tapes (tcopy Command)" on page 109
- "Checking the Integrity of a Tape (tapechk Command)" on page 109
- "Compressing Files (compress and pack Commands)" on page 109
- "Expanding Compressed Files (uncompress and unpack Commands)" on page 111
- "Backing Up Files (backup Command)" on page 112
- "Restoring Backed-Up Files (restore Command)" on page 113
- "Archiving Files (tar Command)" on page 114
- "Command Summary for Backup Files and Storage Media" on page 115

### Establishing a Backup Policy

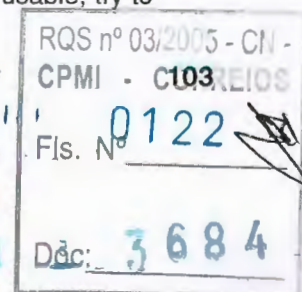
No single backup policy can meet the needs of all users. A policy that works well for a system with one user, for example, could be inadequate for a system that serves 5 or 10 different users. Likewise, a policy developed for a system on which many files are changed daily would be inefficient for a system on which data changes infrequently. Only you can determine the best backup policy for your system, but the following general guidelines should help:

**Make sure you can recover from major losses.**

Can your system continue to run after any single fixed disk fails? Can you recover your system if all the fixed disks should fail? Could you recover your system if you lost your backup diskettes or tape to fire or theft? Although these things are not likely, any of them are possible. Think through each of these possible losses and design a backup policy that would enable you to recover your system after any of them.

**Check your backups periodically.**

Backup media and its hardware can be unreliable. A large library of backup tapes or diskettes is useless if their data cannot be read back onto a fixed disk. To make certain that your backups are usable, try to





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display the table of contents from the backup tape periodically (using **restore -T**, or **tar -t** for archive tapes). If you use diskettes for your backups and have more than one diskette drive, try to read diskettes from a different drive than the one on which they were created. You also might want the security of repeating each level 0 backup with a second set of diskettes. If you use a streaming tape device for backups, you can use the **tapechk** command to perform rudimentary consistency checks on the tape.

### Keep old backup media.

Develop a regular cycle for reusing your backup media; however, do not reuse *all* of your backup media. Sometimes it might be months before you or another system user notices that an important file is damaged or missing. Do save old backup media for such possibilities. For example, you could have the following three cycles of backup tapes or diskettes:

- Once per week, recycle all daily diskettes except the one for Friday.
- Once per month, recycle all Friday diskettes except for the one from the last Friday of the month. This makes the last four Friday backups always available.
- Once per quarter, recycle all monthly diskettes except for the last one. Keep the last monthly diskette from each quarter indefinitely, perhaps in a different building.

### Check file systems before backing them up.

A backup that was made from a damaged file system might be useless. Before making your backups, it is good policy to check the integrity of the file system with the **fsck** command.

### Ensure files are not in use during a backup.

Ensure your system is not in use when you make your backups. If the system is in use, files can change while they are being backed up, and the backup copy will not be accurate.

### Back up your system before major changes are made to the system.

Back up your entire system before any hardware testing or repair work is performed or before you install any new devices, programs, or other system features.

### Other Factors

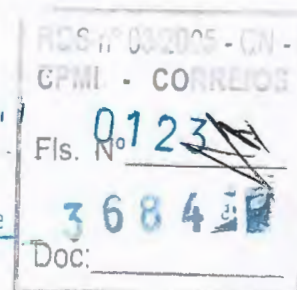
When planning and implementing a backup strategy, consider the following factors:

- How often does the data change? The operating system data does not change very often so you do not need to back it up frequently. User data, on the other hand, usually changes frequently and you should back it up frequently.
- How many users are on the system? The number of users affects the amount of storage media and frequency required for backups.
- How difficult would it be to re-create the data? It is important to consider that some data cannot be re-created if there is no backup available.

Having a backup strategy in place to preserve your data is very important. Evaluating the needs of your site will help you to determine the backup policy that is best for you. Perform user information backups frequently and regularly. Recovering from data loss is very difficult if a good backup strategy has not been implemented.

## Backup Media

Several different types of backup media are available. The different types of backup media available to your specific system configuration depend upon both your software and hardware. The types most frequently used are the 5.25-inch diskette, 8-mm tape, 9-track tape, and the 3.5-inch diskette.





**Attention:** Running the **backup** command results in the loss of all material previously stored on the selected backup medium.

### Diskettes

Diskettes are the standard backup medium. Unless you specify a different device using the **backup -f** command, the **backup** command automatically writes its output to the **/dev/rfd0** device, which is the diskette drive. To back up to the default tape device, type **/dev/rmt0** and press Enter.

Be careful when you handle diskettes. Because each piece of information occupies such a small area on the diskette, small scratches, dust, food, or tobacco particles can make the information unusable. Be sure to remember the following:

- Do not touch the recording surfaces.
- Keep diskettes away from magnets and magnetic field sources such as telephones, dictation equipment, and electronic calculators.
- Keep diskettes away from extreme heat and cold. The recommended temperature range is 10 degrees Celsius to 60 degrees Celsius (50 degrees Fahrenheit to 140 degrees Fahrenheit).
- Proper care helps prevent loss of information.
- Make back-up copies of your diskettes regularly.

**Attention:** Diskette drives and diskettes must be the correct type to store data successfully. If you use the wrong diskette in your 3.5-inch diskette drive, the data on the diskette could be destroyed.

The diskette drive uses the following 3.5-inch diskettes:

- 1 MB capacity (stores approximately 720 KB of data)
- 2 MB capacity (stores approximately 1.44 MB of data).

### Tapes

Because of its high capacity and durability, tape is often chosen for storing large files or many files, such as archive copies of file systems. It is also used for transferring many files from one system to another. Tape is not widely used for storing frequently accessed files because other media provide much faster access times.

Tape files are created using commands such as **backup**, **cpio**, and **tar**, which open a tape drive, write to it, and close it.

---

## Formatting Diskettes (format or fdformat Command)

**Attention:** Formatting a diskette destroys any existing data on that diskette.

You can format diskettes in the diskette drive specified by the *Device* parameter (the **/dev/rfd0** device by default) with the **format** and **fdformat** commands. The **format** command determines the device type, which is one of the following:

- 5.25-inch low-density diskette (360 KB) containing 40x2 tracks, each with 9 sectors
- 5.25-inch high-capacity diskette (1.2 MB) containing 80x2 tracks, each with 15 sectors
- 3.5-inch low-density diskette (720 KB) containing 80x2 tracks, each with 9 sectors
- 3.5-inch high-capacity diskette (2.88 MB) containing 80x2 tracks, each with 36 sectors

The sector size is 512 bytes for all diskette types.

The **format** command formats a diskette for high density unless the *Device* parameter specifies a different density.



The **fdformat** command formats a diskette for low density unless the **-h** flag is specified. The *Device* parameter specifies the device containing the diskette to be formatted (such as the **/dev/rfd0** device for drive 0).

Before formatting a diskette, the **format** and **fdformat** commands prompt for verification. This allows you to end the operation cleanly if necessary.

For example, to format a diskette in the **/dev/rfd0** device, type:

```
format -d /dev/rfd0
```

Press Enter.

For example, to format a diskette without checking for bad tracks, type:

```
format -f
```

Press Enter.

For example, to format a 360 KB diskette in a 5.25-inch, 1.2 MB diskette drive in the **/dev/rfd1** device, type:

```
format -l -d /dev/rfd1
```

Press Enter.

For example, to force high-density formatting of a diskette when using the **fdformat** command, type:

```
fdformat -h
```

Press Enter.

See the **format** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Checking the Integrity of the File System (fsck Command)

You can check and interactively repair inconsistent file systems with the **fsck** command. It is important run this command on every file system as part of system initialization. You must be able to read the device file on which the file system resides (for example, the **/dev/hd0** device). Normally, the file system is consistent, and the **fsck** command merely reports on the number of files, used blocks, and free blocks in the file system. If the file system is inconsistent, the **fsck** command displays information about the inconsistencies found and prompts you for permission to repair them. The **fsck** command is conservative in its repair efforts and tries to avoid actions that might result in the loss of valid data. In certain cases, however, the **fsck** command recommends the destruction of a damaged file.

**Attention:** Always run the **fsck** command on file systems after a system malfunction. Corrective actions can result in some loss of data. The default action for each consistency correction is to wait for the operator to enter yes or no. If you do not have write permission for an affected file, the **fsck** command will default to a no response.

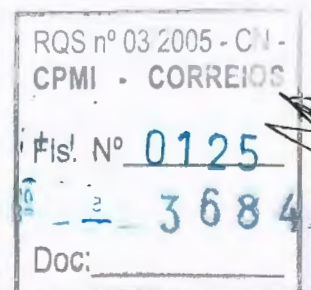
For example, to check all the default file systems, type:

```
fsck
```

Press Enter.

This form of the **fsck** command asks you for permission before making any changes to a file system.

For example, to fix minor problems automatically with the default file systems, type:





`fsck -p`

Press Enter.

For example, to check the `/dev/hd1` file system, type:

`fsck /dev/hd1`

Press Enter.

This checks the unmounted file system located on the `/dev/hd1` device.

**Note:** The **fsck** command does not make corrections to a mounted file system.

See the **fsck** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Copying to or from Diskettes (flcopy Command)

You can copy a diskette (opened as `/dev/rfd0`) to a file named `floppy` created in the current directory with the **flcopy** command. The message: Change floppy, hit return when done displays as needed. The **flcopy** command then copies the floppy file to the diskette.

For example, to copy `/dev/rfd1` to the `floppy` file in the current directory, type:

`flcopy -f /dev/rfd1 -r`

Press Enter.

For example, to copy the first 100 tracks of the diskette, type:

`flcopy -f /dev/rfd1 -t 100`

Press Enter.

See the **flcopy** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Copying Files to Tape or Disk (cpio -o Command)

You can use the **cpio -o** Command to read file path names from standard input and copy these files to standard output, along with path names and status information. Path names cannot exceed 128 characters. Avoid giving the **cpio** command path names made up of many uniquely linked files, as it might not have enough memory to keep track of the path names and would lose linking information.

For example, to copy files in the current directory whose names end with `.c` onto diskette, type:

`ls *.c | cpio -ov >/dev/rfd0`

Press Enter. The **-v** flag displays the names of each file.

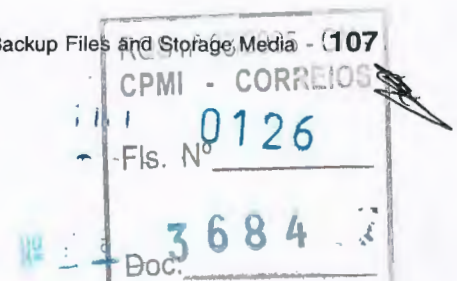
For example, to copy the current directory and all subdirectories onto diskette, type:

`find . -print | cpio -ov >/dev/rfd0`

Press Enter.

This saves the directory tree that starts with the current directory (`.`) and includes all of its subdirectories and files. To use a shorter command string, type:

`find . -cpio /dev/rfd0 -print`



Press Enter.

The `-print` entry displays the name of each file as it is copied.

See the **cpio** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Copying Files from Tape or Disk (**cpio -i** Command)

The **cpio -i** command reads from standard input an archive file created by the **cpio -o** command and copies from it the files with names that match the *Pattern* parameter. These files are copied into the current directory tree. You can list more than one *Pattern* parameter, using the file name notation described in the **ksh** command. The default for the *Pattern* parameter is an asterisk (\*), selecting all files in the current directory. In an expression such as `[a-z]`, the hyphen (-) means *through* according to the current collating sequence.

**Note:** The patterns `"*.c"` and `"*.o"` must be enclosed in quotation marks to prevent the shell from treating the asterisk (\*) as a pattern-matching character. This is a special case in which the **cpio** command itself decodes the pattern-matching characters.

For example, to list the files that have been saved onto a diskette with the **cpio** command, type:

```
cpio -itv </dev/rfd0
```

Press Enter.

This displays the table of contents of the data previously saved onto the `/dev/rfd0` file in the **cpio** command format. The listing is similar to the long directory listing produced by the **ls -l** command. To list only the file path names, use only the `-it` flags.

For example, to copy the files previously saved with the **cpio** command from a diskette, type:

```
cpio -idmv </dev/rfd0
```

Press Enter.

This copies the files previously saved onto the `/dev/rfd0` file by the **cpio** command back into the file system (specify the `-i` flag). The `-d` flag allows the **cpio** command to create the appropriate directories if a directory tree is saved. The `-m` flag maintains the last modification time in effect when the files are saved. The `-v` flag causes the **cpio** command to display the name of each file as it is copied.

For example, to copy selected files from diskette, type:

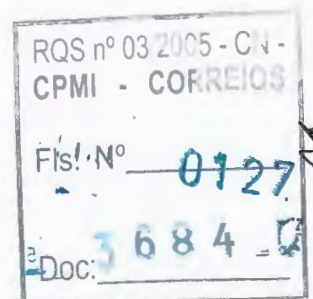
```
cpio -i "*.c" "*.o" </dev/rfd0
```

Press Enter.

This copies the files that end with `.c` or `.o` from diskette.

See the **cpio** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

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## Copying to or from Tapes (tcopy Command)

You can use the **tcopy** command to copy magnetic tapes.

For example, to copy from one streaming tape to a 9-track tape, type:

```
tcopy /dev/rmt0 /dev/rmt8
```

Press Enter.

See the **tcopy** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Checking the Integrity of a Tape (tapechk Command)

You can perform rudimentary consistency checking on an attached streaming tape device with the **tapechk** command. Some hardware malfunctions of a streaming tape drive can be detected by simply reading a tape. The **tapechk** command provides a way to perform tape reads at the file level.

For example, to check the first three files on a streaming tape device, type:

```
tapechk 3
```

Press Enter.

See the **tapechk** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Compressing Files (compress and pack Commands)

You can compress files for storage with the **compress** Command and **pack** Command, and use the **uncompress** and **unpack** to expand the restored files. The process of compressing and expanding files takes time but, after the files are packed, the data uses less space on the backup medium.

To compress a file system, use one of the following methods:

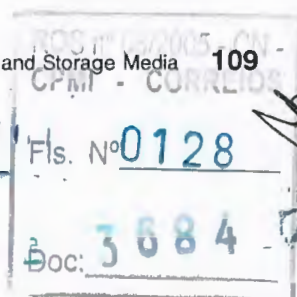
- Use the **-p** option with the **backup** command
- Use the **compress** or **pack** commands

The reasons for compressing files generally fall into the following categories:

- Saving storage and archiving system resources:
  - Compress file systems before doing backups to preserve tape space.
  - Compress log files created by shell scripts that run at night; it is easy to have the script compress the file before it exits.
  - Compress files that are not currently being accessed. For example, the files belonging to a user who is away for extended leave can be compressed and placed into a **tar** archive on disk or to a tape and later be restored.
- Saving money and time by compressing files before sending them over a network.

### Notes:

1. The **compress** command might run out of working space in the file system while compressing. The command creates the compressed files before it deletes any of the uncompressed files so it needs a space about 50% larger than the total size of the files.
2. A file might fail to compress because it is already compressed. If the **compress** command cannot reduce file sizes, the command fails.





## Using the compress Command

The **compress** command reduces the size of files using adaptive Lempel-Zev coding. Each original file specified by the *File* parameter is replaced by a compressed file with a **.Z** appended to its name. The compressed file retains the same ownership, modes, and access and modification times of the original file. If no files are specified, the standard input is compressed to the standard output. If compression does not reduce the size of a file, a message is written to standard error and the original file is not replaced.

To restore compressed files to their original form, use the **uncompress** command.

The amount of compression depends on the size of the input, the number of bits per code specified by the *Bits* variable, and the distribution of common substrings. Typically, source code or English text is reduced by 50 to 60 percent. The compression of the **compress** command is generally more compact and takes less time to compute than the compression achieved by the **pack** command, which uses adaptive Huffman coding.

For example, to compress the **foo** file and write the percentage compression to standard error, type:  
`compress -v foo`

Press Enter.

See the **compress** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Using the pack Command

The **pack** command stores the file or files specified by the *File* parameter in a compressed form using Huffman coding. The input file is replaced by a packed file with a name derived from the original file name (*File.z*), with the same access modes, access and modification dates, and owner as the original file. The input file name can contain no more than 253 bytes to allow space for the added **.z** suffix. If the **pack** command is successful, the original file is removed. To restore packed files to their original form, use the **unpack** command.

If the **pack** command cannot create a smaller file, it stops processing and reports that it is unable to save space. (A failure to save space generally happens with small files or files with uniform character distribution.) The amount of space saved depends on the size of the input file and the character frequency distribution. Because a decoding tree forms the first part of each **.z** file, you do not save space with files smaller than three blocks. Typically, text files are reduced 25 to 40 percent.

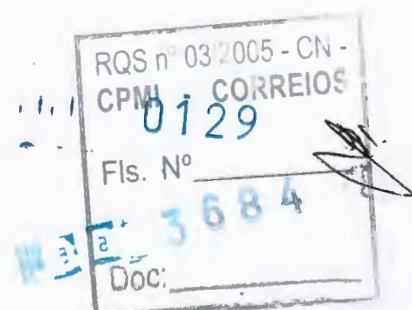
The exit value of the **pack** command is the number of files that it could not pack. Packing is not done under any of the following conditions:

- The file is already packed.
- The input file name has more than 253 bytes.
- The file has links.
- The file is a directory.
- The file cannot be opened.
- No storage blocks are saved by packing.
- A file called *File.z* already exists.
- The **.z** file cannot be created.
- An I/O error occurred during processing.

For example, to compress the files **chap1** and **chap2**, type:

`pack chap1 chap2`

Press Enter.



This compresses chap1 and chap2, replacing them with files named **chap1.z** and **chap2.z**. The **pack** command displays the percent decrease in size for each file.

See the **pack** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Expanding Compressed Files (uncompress and unpack Commands)

You can expand compressed files with the **uncompress** and **unpack** commands.

### Using the uncompress Command

The **uncompress** command restores original files that were compressed by the **compress** command. Each compressed file specified by the *File* variable is removed and replaced by an expanded copy. The expanded file has the same name as the compressed version, but without the **.z** extension. The expanded file retains the same ownership, modes, and access and modification times as the original file. If no files are specified, standard input is expanded to standard output.

Although similar to the **uncompress** command, the **zcat** command always writes the expanded output to standard output.

For example, to uncompress the foo file, type:

```
uncompress foo
```

Press Enter.

See the **uncompress** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

### Using the unpack Command

The **unpack** command expands files created by the **pack** command. For each file specified, the **unpack** command searches for a file called *File.z*. If this file is a packed file, the **unpack** command replaces it by its expanded version. The **unpack** command renames the new file by removing the **.z** suffix from *File*. The new file has the same access modes, access and modification dates, and owner as the original packed file.

The **unpack** command operates only on files ending in **.z**. As a result, when you specify a file name that does not end in **.z**, the **unpack** command adds the suffix and searches the directory for a file name with that suffix.

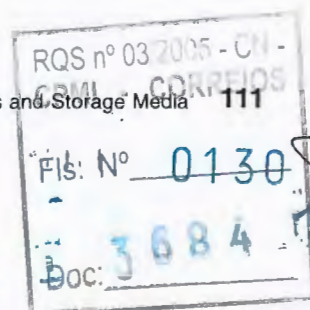
The exit value is the number of files that the **unpack** command was unable to unpack. A file cannot be unpacked if any of the following situations exists:

- The file name (exclusive of **.z**) has more than 253 bytes.
- The file cannot be opened.
- The file is not a packed file.
- A file with the unpacked file name already exists.
- The unpacked file cannot be created.

**Note:** The **unpack** command writes a warning to standard error if the file it is unpacking has links. The new unpacked file has a different i-node (index node) number than the packed file from which it was created. However, any other files linked to the original i-node number of the packed file still exist and are still packed.

For example, to unpack the packed files chap1.z and chap2, type:

```
unpack chap1.z chap2
```





Press Enter.

This expands the packed files chap1.z and chap2.z, and replaces them with files named chap1 and chap2. Note that you can provide the **unpack** command with file names with or without the .z suffix.

See the **unpack** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Backing Up Files (backup Command)

**Attention:** If you attempt to back up a mounted file system, a message displays. The **backup** command continues, but inconsistencies in the file system can occur. This situation does not apply to the root (/) file system.

You can create copies of your files on backup media, such as a magnetic tape or diskette, with the **backup** Command or **smit** Command. The copies are in one of the following backup formats:

- Specific files backed up by name, using the **-i** flag.
- Entire file system backed up by i-node number, using the **-Level** and **FileSystem** parameters.

### Notes:

1. The possibility of data corruption always exists when a file is modified during system backup. Therefore, make sure that system activity is at a minimum during the system backup procedure.
2. If a backup is made to 8-mm tape with the device block size set to 0 (zero), it is not possible to directly restore from the tape. If you have done backups with the 0 setting, you can restore from them by using special procedures described under the **restore** command.

**Attention:** Be sure the flags you specify match the backup media.

## Using the backup Command

For example, to back up selected files in your **\$HOME** directory by name, type:

```
find $HOME -print | backup -i -v
```

Press Enter.

The **-i** flag prompts the system to read from standard input the names of files to be backed up. The **find** command generates a list of files in the user's directory. This list is piped to the **backup** command as standard input. The **-v** flag displays a progress report as each file is copied. The files are backed up on the default backup device for the local system.

For example, to back up the root file system, type:

```
backup -0 -u /
```

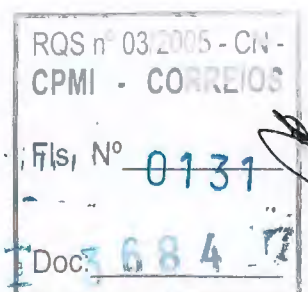
Press Enter.

The 0 level and the / tell the system to back up the / (root) file system. The file system is backed up to the **/dev/rfd0** file. The **-u** flag tells the system to update the current backup level record in the **/etc/dumpdates** file.

For example, to back up all files in the / (root) file system that were modified since the last 0 level backup, type:

```
backup -1 -u /
```

Press Enter.





See the **backup** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Using the smit Command

You can also use **smit** to run the **backup** command.

1. At the prompt, type:

```
smit backup
```

Press Enter.

2. Type the path name of the directory on which the file system is normally mounted in the **DIRECTORY full pathname** field:

```
/home/bill
```

Press Enter.

3. In the **BACKUP** device or **FILE** fields, type the output device name, as in the following example for a raw magnetic tape device:

```
/dev/rmt0
```

Press Enter.

4. Use the Tab key to toggle the optional **REPORT each phase of the backup** field if you want error messages printed to the screen.
5. In a system management environment, use the default for the **MAX number of blocks to write on backup medium** field, because this field does not apply to tape backups.
6. Press Enter to back up the named directory or file system.
7. Run the **restore -t** command. If this command generates an error message, you must repeat the entire backup.

---

## Restoring Backed-Up Files (restore Command)

You can read files written by the **backup** command from backup media and restore them on your local system with the **restore** command or **smit** command.

### Notes:

1. Files must be restored using the same method by which they were backed up. For example, if a file system was backed up by name, it must be restored by name.
2. When more than one diskette is required, the **restore** command reads the diskette that is mounted, prompts you for a new one, and waits for your response. After inserting the new diskette, press the Enter key to continue restoring files.

## Using the restore Command

For example, to list the names of files previously backed up, type:

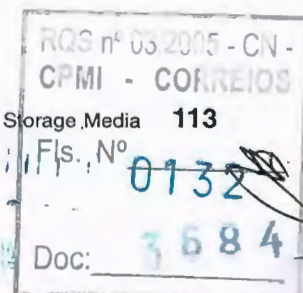
```
restore -T
```

Press Enter.

Information is read from the **/dev/rfd0** default backup device. If individual files are backed up, only the file names are displayed. If an entire file system is backed up, the i-node number is also shown.

For example, to restore files to the main file system, type:

```
restore -x -v
```



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Press Enter.

The **-x** flag extracts all the files from the backup media and restores them to their proper places in the file system. The **-v** flag displays a progress report as each file is restored. If a file system backup is being restored, the files are named with their i-node numbers. Otherwise, only the names are displayed.

For example, to copy the **/home/mike/manual/chap1** file, type:

```
restore -xv /home/mike/manual/chap1
```

Press Enter.

This command extracts the **/home/mike/manual/chap1** file from the backup medium and restores it. The **/home/mike/manual/chap1** file must be a name that the **restore -T** command can display.

For example, to copy all the files in a directory named **manual**, type:

```
restore -xdv manual
```

Press Enter.

This command restores the **manual** directory and the files in it. If the directory does not exist, a directory named **manual** is created in the current directory to hold the files being restored.

See the **restore** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Using the smit Command

You can also use **smit** to run the **restore** command.

1. At the prompt, type:

```
smit restore
```

Press Enter.

2. Make your entry in the **Target DIRECTORY** field. This is the directory where you want the restored files to reside.
3. Proceed to the **BACKUP device** or **FILE** field and type the output device name, and press Enter, as in the following example for a raw magnetic tape device:

```
/dev/rmt0
```

If the device is not available, a message similar to the following is displayed:

```
Cannot open /dev/rmtX, no such file or directory.
```

This message indicates that the system cannot reach the device driver because there is no file for **rmtX** in the **/dev** directory. Only items in the available state are in the **/dev** directory.

4. For the **NUMBER of blocks to read in a single input** field, the default is recommended.
5. Press Enter to restore the specified file system or directory.

---

## Archiving Files (tar Command)

The archive backup is another form of backing you can use; this method is used for a copy of one or more files, or an entire database that is saved for future reference, historical purposes, or for recovery if the original data is damaged or lost. Usually an archive is used when that specific data is removed from the system.

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You can write files to or retrieve files from an archive storage with the **tar** command. The **tar** command looks for archives on the default device (usually tape), unless you specify another device.

When writing to an archive, the **tar** command uses a temporary file (the **/tmp/tar\*** file) and maintains in memory a table of files with several links. You receive an error message if the **tar** command cannot create the temporary file or if there is not enough memory available to hold the link tables.

For example, to write the **file1** and **file2** files to a new archive on the default tape drive, type:

```
tar -c file1 file2
```

Press Enter.

For example, to extract all files in the **/tmp** directory from the archive file on the **/dev/rmt2** tape device and use the time of extraction as the modification time, type:

```
tar -xm -f/dev/rmt2 /tmp
```

Press Enter.

For example, to display the names of the files in the **out.tar** disk archive file from the current directory, type:

```
tar -vtf out.tar
```

Press Enter.

See the **tar** command in the *AIX 5L Version 5.2 Commands Reference* for more information and the exact syntax.

---

## Command Summary for Backup Files and Storage Media

<b>backup</b>	Backs up files and file systems
<b>compress</b>	Compresses and expands data
<b>cpio</b>	Copies files into and out of archive storage and directories
<b>fdformat</b>	Formats diskettes
<b>flcopy</b>	Copies to and from diskettes
<b>format</b>	Formats diskettes
<b>fsck</b>	Checks file system consistency and interactively repairs the file system
<b>pack</b>	Compresses files
<b>restore</b>	Copies previously backed-up file systems or files, created by the <b>backup</b> command, from a local device
<b>tapechk</b>	Checks consistency of the streaming tape device
<b>tar</b>	Manipulates archives
<b>tcopy</b>	Copies a magnetic tape
<b>uncompress</b>	Compresses and expands data
<b>unpack</b>	Expands files

## Related Information

"Commands Overview" on page 26

"Processes Overview" on page 35

Chapter 5, "Input and Output Redirection" on page 45

"File Systems" on page 53

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"Directory Overview" on page 56

Chapter 7, "Files" on page 67

Chapter 10, "File and System Security" on page 117

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## Chapter 10. File and System Security

The goal of computer security is the protection of information stored on the computer system, a valuable resource. Information security is aimed at the following:

<b>Integrity</b>	The value of all information depends upon its accuracy. If unauthorized changes are made to data, this data loses some or all of its value.
<b>Privacy</b>	The value of much information depends upon its secrecy.
<b>Availability</b>	Information must be readily available.

It is helpful to plan and implement your security policies before you begin using the system. Security policies are very time-consuming to change later, so upfront planning can save a lot of time later.

This chapter discusses the following:

- "Security Threats"
- "File Ownership and User Groups" on page 119
  - "Changing File or Directory Ownership (chown Command)" on page 119
  - "File and Directory Access Modes" on page 119
  - "Displaying Group Information (lsgroup Command)" on page 121
  - "Changing File or Directory Permissions (chmod Command)" on page 123
- "Access Control Lists" on page 123
  - "Base Permissions" on page 124
  - "Extended Permissions" on page 124
  - "Access Control List Example" on page 125
  - "Access Authorization" on page 126
  - "Displaying Access Control Information (aclget Command)" on page 127
  - "Setting Access Control Information (aclput Command)" on page 127
  - "Editing Access Control Information (acledit Command)" on page 127
- "Locking Your Terminal (lock or xlock Command)" on page 128
- "Command Summary for File and System Security" on page 128

### Security Threats

Threats to information security can arise from the following types of behavior:

<b>Carelessness</b>	Information security is often violated due to the carelessness of the authorized users of the system. If you are careless with your password, for instance, no other security mechanisms can prevent unauthorized access to your account and data.
<b>Browsing</b>	Many security problems are caused by browsers, authorized users of the system exploring the system looking for carelessly protected data.
<b>Penetration</b>	Penetration represents deliberate attacks upon the system. An individual trying to penetrate the system will study it for security vulnerabilities and deliberately plan attacks designed to exploit those weaknesses.

Although system penetration usually represents the greatest threat to information security, do not underestimate problems caused by carelessness or browsing.

### Basic Security

Every system should maintain the level of security represented by the following basic security policies:

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## Backups

Physically secure, reliable, and up-to-date system backups are the single most important security policy. With a good system backup, you can recover from any system problems with minimal loss. Document your backup policy and include information regarding the following:

- How often backups will be made
- What types of backups (system, data, or incremental) will be made
- How backup tapes will be verified
- How backup tapes will be stored

For more information, see "Chapter 9, "Backup Files and Storage Media" on page 103".

## Identification and Authentication

Identification and authentication establish your identity. You are required to log in to the system. You supply your user name and a password, if the account has one (in a secure system, all accounts should either have passwords or be invalidated). If the password is correct, you are logged in to that account; you acquire the access rights and privileges of the account.

Because the password is the only protection for your account, select and guard your password carefully. Many attempts to break into a system start with attempts to guess passwords. The operating system provides significant password protection by storing user passwords separately from other user information. The encrypted passwords and other security-relevant data for users are stored in the `/etc/security/passwd` file. This file should be accessible only by the root user. With this restricted access to the encrypted passwords, an attacker cannot decipher the password with a program that simply cycles through all possible or likely passwords.

It is still possible to guess passwords by repeatedly attempting to log in to an account. If the password is trivial or is infrequently changed, such attempts might easily succeed.

## Login User IDs

The operating system also identifies users by their login user ID. The login user ID allows the system to trace all user actions to their source. After a user logs in to the system but before the initial user program is run, the system sets the login ID of the process to the user ID found in the user database. All subsequent processes during the login session are tagged with this ID. These tags provide a trail of all activities performed by the login user ID.

The user can reset the effective user ID, real user ID, effective group ID, real group ID, and supplementary group ID during the session, but cannot change the login user ID.

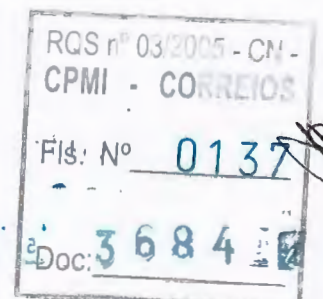
## Unattended Terminals

All systems are vulnerable if terminals are left logged in and unattended. The most serious problem occurs when a system manager leaves a terminal unattended that has been enabled with root authority. In general, users should log out anytime they leave their terminals.

You can force a terminal to log out after a period of inactivity by setting the **TMOUT** and **TIMEOUT** parameters in the `/etc/profile` file. The **TMOUT** parameter works in the **ksh** (Korn) shell, and the **TIMEOUT** parameter works in the **bsh** (Bourne) shell. For more information about the **TMOUT** parameter, see "Parameter Substitution in the Korn Shell or POSIX Shell" on page 152. For more information about the **TIMEOUT** parameter, see "Variable Substitution in the Bourne Shell" on page 193.

The following example, taken from a `.profile` file, forces the terminal to log out after an hour of inactivity:

```
T0=3600
echo "Setting Autologout to $T0"
TIMEOUT=$T0
TMOUT=$T0
export TIMEOUT TMOUT
```





**Note:** Users can override the **TMOU** and **TIMEOUT** values in the **/etc/profile** file by specifying different values in the **.profile** file in your home directory.

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## File Ownership and User Groups

Initially, a file's owner is identified by the user ID of the person who created the file. The owner of a file determines who may read, write (modify), or execute the file. Ownership can be changed with the **chown** command.

Every user ID is assigned to a group with a unique group ID. The system manager creates the groups of users when setting up the system. When a new file is created, the operating system assigns permissions to the user ID that created it, to the group ID containing the file owner, and to a group called others, consisting of all other users. The **id** command shows your user ID (UID), group ID (GID), and the names of all groups you belong to.

In file listings (such as the listings shown by the **ls** command), the groups of users are always represented in the following order: user, group, and others. If you need to find out your group name, the **groups** command shows all the groups for a user ID.

## Changing File or Directory Ownership (chown Command)

To change the owner of your files, use the **chown** command.

When the **-R** option is specified, the **chown** command recursively descends through the directory structure from the specified directory. When symbolic links are encountered, the ownership of the file or directory pointed to by the link is changed; the ownership of the symbolic link is not changed.

**Note:** Only the root user can change the owner of another file. Errors are not displayed when the **-f** option is specified.

For example, to change the owner of the **program.c** file, type:

```
chown jim program.c
```

Press Enter.

The user-access permissions for the **program.c** file now apply to **jim**. As the owner, **jim** can use the **chmod** command to permit or deny other users access to the **program.c** file.

See the **chown** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## File and Directory Access Modes

Every file has an owner. For new files, the user who creates the file is the owner of that file. The owner assigns an access mode to the file. Access modes grant other system users permission to read, modify, or execute the file. Only the file's owner or users with root authority can change the access mode of a file.

There are the three classes of users: user/owner, group, and all others. Access is granted to these user classes in some combination of three modes: read, write, or execute. When a new file is created, the default permissions are read, write, and execute permission for the user who created the file. The other two groups have read and execute permission. The following table illustrates the default file-access modes for the three classes of user groups:

Classes	Read	Write	Execute
Owner	Yes	Yes	Yes

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Group	Yes	No	Yes
Others	Yes	No	Yes

The system determines who has permission and the level of permission they have for each of these activities. Access modes are represented both symbolically and numerically in the operating system.

## Symbolic Representation of Access Modes

Access modes are represented symbolically, as follows:

- r** Indicates read permission, which allows users to view the contents of a file.
- w** Indicates write permission, which allows users to modify the contents of a file.
- x** Indicates execute permission. For executable files (ordinary files that contain programs), execute permission means that the program can be run. For directories, execute permission means the contents of the directory can be searched.

The access modes for files or directories are represented by nine characters. The first three characters represent the current **Owner** permissions, the second set of three characters represents the current **Group** permissions, and the third set of three characters represents the current settings for the **Other** permissions. A Hyphen (-) in the nine character set indicates that no permission is given. For example, a file with the access modes set to `rw-r-xr-x` gives read and execute permission to all three groups, but write permission only to the owner of the file. This is the symbolic representation of the default setting.

The **ls** command, when used with the **-l** (lower case L) flag, gives a detailed listing of the current directory. The first 10 characters in the **ls -l** listing show the file type and permissions for each of the three groups. The **ls -l** command also tells you the owner and group associated with each file and directory.

The first character indicates the type of file. The remaining nine characters contain the file permission information for each of the three classes of users. The following symbols are used to represent the type of file:

- Regular files
- d** Directory
- b** Block special files
- c** Character special files
- p** Pipe special files
- l** Symbolic links
- s** Sockets.

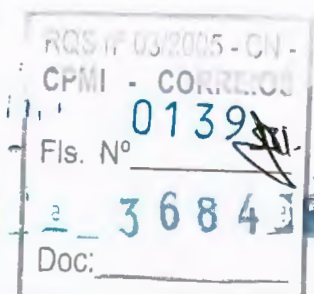
For example, this is a sample **ls -l** listing:

```
-rwxrwxr-x 2 janet acct 512 Mar 01 13:33 january
```

Here, the first hyphen (-) indicates a regular file. The next nine characters (`rw-rwxr-x`) represent the User, Group, and Other access modes, as discussed above. `janet` is the file owner and `acct` is the name of Janet's group. `512` is the file size in bytes, `Mar 01 13:33` is the last date and time of modification, and `january` is the file name. The `2` indicates how many links exist to the file.

## Numeric Representation of Access Modes

Numerically, read access is represented by a value of 4, write permission is represented by a value of 2, and execute permission is represented by a value of 1. The total value between 1 and 7 represents the access mode for each group (user, group, and other). The following table illustrates the numeric values for each level of access:





Total Value	Read	Write	Execute
0	-	-	-
1	-	-	1
2	-	2	-
3	-	2	1
4	4	-	-
5	4	-	1
6	4	2	-
7	4	2	1

When a file is created, the default file access mode is 755. This means the user has read, write, and execute permissions (4+2+1=7), the group has read and execute permission (4+1=5), and all others have read and execute permission (4+1=5). To change access permission modes for files you own, run the **chmod** (change mode) command.

## Displaying Group Information (lsgroup Command)

To display the attributes of all the groups on the system (or of specified groups), use the **lsgroup** command. If one or more attributes cannot be read, the **lsgroup** command lists as much information as possible. The attribute information displays as *Attribute=Value* definitions, each separated by a blank space.

### Listing All of the Groups on the System

To list all of the groups on the system, type:

```
lsgroup ALL
```

Press Enter.

The system displays each group, group ID, and all of the users in the group in a list similar to the following:

```
system 0      arne,pubs,ctw,geo,root,chucka,noer,su,dea,
backup,build,janice,denise
staff  1      john,ryan,flynn,daveb,jzitt,glover,maple,ken
gordon,mbrady
bin    2      root,bin
sys    3      root,su,bin,sys
```

### Displaying Specific Attributes for All Groups

To display specific attributes for all groups, do either of the following:

- You can list attributes in the form *Attribute=Value* separated by a blank space. This is the default style. For example, to list the ID and users for all of the groups on the system, type:

```
lsgroup -a id users ALL | pg
```

Press Enter. The addition of the lists the attributes.

A list similar to the following displays:

```
system id=0 users=arne,pubs,ctw,geo,root,chucka,noer,su,dea,backup,build
staff id=1 users=john,ryan,flynn,daveb,jzitt,glover,maple,ken
```

- You can also list the information in stanza format. For example, to list the ID and users for all of the groups on the system in stanza format, type:

```
lsgroup -a -f id users ALL | pg
```



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Press Enter.

A list similar to the following displays:

```
system:
  id=0
  users=pubs,ctw,geo,root,chucka,noer,su,dea,backup,build

staff:
  id=1
  users=john,ryan,flynn,daveb,jzitt,glover,maple,ken

bin:
  id=2
  users=root,bin

sys:
  id=3
  users=root,su,bin,sys
```

### Displaying All Attributes for a Specific Group

To display all attributes for a specific group, you can use one of two styles for listing specific attributes for all groups:

- You can list each attribute in the form Attribute=Value separated by a blank space. This is the default style. For example, to list all attributes for the group system, type:

```
lsgroup system
```

Press Enter.

A list similar to the following displays:

```
system id=0 users=arne,pubs,ctw,geo,root,chucka,noer,su,dea,backup,build,janice,denise
```

- You can also list the information in stanza format. For example, to list all attributes for the group bin in stanza format, type:

```
lsgroup -f system
```

Press Enter.

A list similar to the following displays:

```
system:
  id=0  users=arne,pubs,ctw,geo,root,chucka,noer,su,dea,
  backup,build,janice,denise
```

### Listing Specific Attributes for a Specific Group

To list specific attributes for a specific group, type:

```
lsgroup -a Attributes Group
```

Press Enter.

For example, to list the ID and users for group bin, type:

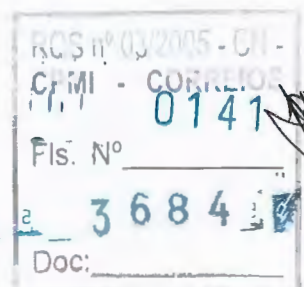
```
lsgroup -a id users bin
```

Press Enter.

A list similar to the following displays:

```
bin id=2 users=root,bin
```

See the **lsgroup** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.



## Changing File or Directory Permissions (chmod Command)

To modify the read, write, and execute permissions of specified files and modify the search permission modes of specified directories, use the **chmod** command.

- For example, to add a type of permission to the **chap1** and **chap2** files, type:

```
chmod g+w chap1 chap2
```

Press Enter.

This adds write permission for group members to the files **chap1** and **chap2**.

- For example, to make several permission changes at once to the **mydir** directory, type:

```
chmod go-w+x mydir
```

Press Enter.

This denies (-) group members (**g**) and others (**o**) the permission to create or delete files (**w**) in the **mydir** directory and allows (+) group members and others to search the **mydir** directory or use (**x**) it in a path name. This is equivalent to the following command sequence:

```
chmod g-w mydir
chmod o-w mydir
chmod g+x mydir
chmod o+x mydir
```

- For example, to permit only the owner to use a shell procedure named **cmd** as a command, type:

```
chmod u=rwx,go= cmd
```

Press Enter.

This gives read, write, and execute permission to the user who owns the file (**u=rwx**). It also denies the group and others the permission to access **cmd** in any way (**go=**).

- For example, to use the numeric mode form of the **chmod** command to change the permissions of the text, file type:

```
chmod 644 text
```

Press Enter.

This sets read and write permission for the owner, and it sets read-only mode for the group and others.

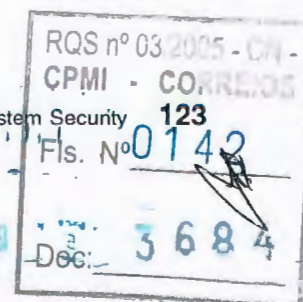
See the **chmod** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Access Control Lists

Access control consists of protected information resources that specify who can be granted access to such resources. The operating system allows for need-to-know or discretionary security. The owner of an information resource can grant other users read or write access rights for that resource. A user who is granted access rights to a resource can transfer those rights to other users. This security allows for user-controlled information flow in the system; the owner of an information resource defines the access permissions to the object.

Users have user-based access only to the objects that they own. Typically, users receive either the group permissions or the default permissions for a resource. The major task in administering access control is to define the group memberships of users, because these memberships determine the users' access rights to the files that they do not own.





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Access control lists (ACLs) increase the quality of file access controls by adding extended permissions that modify the base permissions assigned to individuals and groups. With extended permissions, you can permit or deny file access to specific individuals or groups without changing the base permissions.

**Note:** The access control list for a file cannot exceed one memory page (approximately 4096 bytes) in size.

To maintain access control lists, use the **aclget**, **acledit**, and the **aclput** commands.

The **chmod** command in numeric mode (with octal notations) can set base permissions and attributes. The **chmod** subroutine, which the command calls, disables extended permissions. If you use the numeric mode of the **chmod** command on a file that has an ACL, extended permissions are disabled. The symbolic mode of the **chmod** command does not disable extended permissions. For information on numeric and symbolic mode, refer to the **chmod** command.

## Base Permissions

Base permissions are the traditional file-access modes assigned to the file owner, file group, and other users. The access modes are: read (r), write (w), and execute/search (x).

In an access control list, base permissions are in the following format, with the *Mode* parameter expressed as rwx (with a hyphen (-) replacing each unspecified permission):

```
base permissions:
  owner(name): Mode
  group(group): Mode
  others: Mode
```

## Attributes

Three attributes can be added to an access control list:

### setuid (SUID)

Set-user-ID mode bit. This attribute sets the effective and saved user IDs of the process to the owner ID of the file on execution.

### setgid (SGID)

Set-group-ID mode bit. This attribute sets the effective and saved group IDs of the process to the group ID of the file on execution.

### savetext (SVTX)

Saves the text in a text file format.

These attributes are added in the following format:

```
attributes: SUID, SGID, SVTX
```

## Extended Permissions

Extended permissions allow the owner of a file to define access to that file more precisely. Extended permissions modify the base file permissions (owner, group, others) by permitting, denying, or specifying access modes for specific individuals, groups, or user and group combinations. Permissions are modified through the use of keywords.

The **permit**, **deny**, and **specify** keywords are defined as follows:

<b>permit</b>	Grants the user or group the specified access to the file
<b>deny</b>	Restricts the user or group from using the specified access to the file
<b>specify</b>	Precisely defines the file access for the user or group



If a user is denied a particular access by either a **deny** or a **specify** keyword, no other entry can override that access denial.

The **enabled** keyword must be specified in the ACL for the extended permissions to take effect. The default value is the **disabled** keyword.

In an ACL, extended permissions are in the following format:

```
extended permissions:
  enabled | disabled
  permit  Mode  UserInfo...:
  deny    Mode  UserInfo...:
  specify Mode  UserInfo...:
```

Use a separate line for each **permit**, **deny**, or **specify** entry. The *Mode* parameter is expressed as **rw****x** (with a hyphen (-) replacing each unspecified permission). The *UserInfo* parameter is expressed as **u:UserName**, or **g:GroupName**, or a comma-separated combination of **u:UserName** and **g:GroupName**.

**Note:** If more than one user name is specified in an entry, that entry cannot be used in an access control decision, because a process has only one user ID.

## Access Control List Example

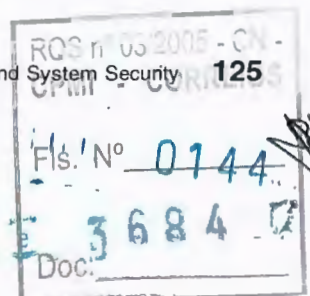
The following is an example of an ACL:

```
attributes: SUID
base permissions:
  owner(frank): rw-
  group(system): r-x
  others: ---
extended permissions:
  enabled
  permit rw- u:dhs
  deny   r-- u:chas, g:system
  specify r-- u:john, g:gateway, g:mail
  permit rw- g:account, g:finance
```

The parts of the ACL and their meanings are the following:

- The first line indicates that the **setuid** bit is turned on.
- The next line, which introduces the base permissions, is optional.
- The next three lines specify the base permissions. The owner and group names in parentheses are for information only. Changing these names does not alter the file owner or file group. Only the **chown** command and the **chgrp** command can change these file attributes.
- The next line, which introduces the extended permissions, is optional.
- The next line indicates that the extended permissions that follow are enabled.
- The last four lines are the extended entries. The first extended entry grants user dhs read (r) and write (w) permission on the file.
- The second extended entry denies read (r) access to user chas only when he is a member of the system group.
- The third extended entry specifies that as long as user john is a member of both the gateway group and the mail group, has read (r) access. If user john is not a member of both groups, this extended permission does not apply.
- The last extended entry grants any user in *both* the account group and the finance group read (r) and write (w) permission.

**Note:** More than one extended entry can be applied to a process, with restrictive modes taking precedence over permissive modes.





See the **acledit** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Access Authorization

The owner of the information resource is responsible for managing access rights. Resources are protected by permission bits, which are included in the mode of the object. The permission bits define the access permissions granted to the owner of the object, the group of the object, and for the others default class. The operating system supports three different modes of access (read, write, and execute) that can be granted separately.

When a user logs in to an account (using the **login** or **su** commands), the user IDs and group IDs assigned to that account are associated with the user's processes. These IDs determine the access rights of the process.

For files, directories, named pipes, and devices (special files), access is authorized as follows:

- For each access control entry (ACE) in the access control list (ACL), the identifier list is compared to the identifiers of the process. If there is a match, the process receives the permissions and restrictions defined for that entry. The logical unions for both permissions and restrictions are computed for each matching entry in the ACL. If the requesting process does not match any of the entries in the ACL, it receives the permissions and restrictions of the default entry.
- If the requested access mode is permitted (included in the union of the permissions) and is not restricted (included in the union of the restrictions), access is granted. Otherwise, access is denied.

A process with a user ID of 0 is known as a *root user process*. These processes are generally allowed all access permissions. But if a root user process requests execute permission for a program, access is granted only if execute permission is granted to at least one user.

The identifier list of an ACL matches a process if all identifiers in the list match the corresponding type of effective identifier for the requesting process. A USER-type identifier matched is equal to the effective user ID of the process, and a GROUP-type identifier matches if it is equal to the effective group ID of the process or to one of the supplementary group IDs. For instance, an ACE with an identifier list such as the following:

USER:fred, GROUP:philosophers, GROUP:software\_programmer

would match a process with an effective user ID of fred and a group set of:

philosophers, philanthropists, software\_programmer, doc\_design

but would not match for a process with an effective user ID of fred and a group set of:

philosophers, iconoclasts, hardware\_developer, graphic\_design

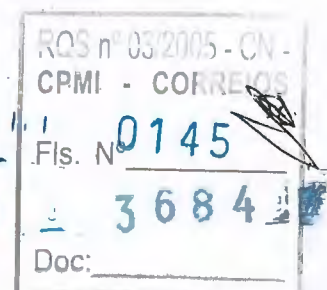
Note that an ACE with an identifier list of the following would match for both processes:

USER:fred, GROUP:philosophers

In other words, the identifier list in the ACE functions is a set of conditions that must hold for the specified access to be granted.

All access permission checks for these objects are made at the system call level when the object is first accessed. Because System V Interprocess Communication (SVIPC) objects are accessed statelessly, checks are made for every access. For objects with file system names, it is necessary to be able to resolve the name of the actual object. Names are resolved either relatively (to the process' working directory) or absolutely (to the process' root directory). All name resolution begins by searching one of these.

The discretionary access control mechanism allows for effective access control of information resources and provides for separate protection of the confidentiality and integrity of the information. Owner-controlled



access control mechanisms are only as effective as users make them. All users must understand how access permissions are granted and denied, and how these are set.

## Displaying Access Control Information (aclget Command)

To display the access control information of a file, use the **aclget** command. The information that you view includes attributes, base permissions, and extended permissions.

For example, to display the access control information for the **status** file, type:

```
aclget status
```

Press Enter. The access control information that displays includes a list of attributes, base permissions, and extended permissions. For an example, see "Access Control List Example" on page 125.

See the **aclget** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Setting Access Control Information (aclput Command)

To set the access control information for a file, use the **aclput** command.

**Note:** The access control list for a file cannot exceed one memory page (approximately 4096 bytes) in size.

For example, to set the access control information for the **status** file with the access control information stored in the **aclddefs** file, type:

```
aclput -i acldefs status
```

Press Enter.

For example, to set the access control information for the **status** file with the same information used for the **plans** file, type:

```
aclget plans | aclput status
```

Press Enter.

See the **aclput** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Editing Access Control Information (acledit Command)

To change the access control information of a file, use the **acledit** command. The command displays the current access control information and lets the file owner change it. Before making any changes permanent, the command asks if you want to proceed.

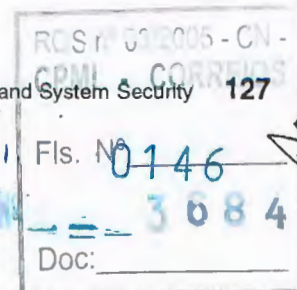
**Note:** The **EDITOR** environment variable must be specified with a complete path name; otherwise, the **acledit** command will fail.

The access control information that displays includes a list of attributes, base permissions, and extended permissions. For an example, see "Access Control List Example" on page 125.

For example, to edit the access control information of the **plans** file, type:

```
acledit plans
```

Press Enter.





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See the **acledit** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Locking Your Terminal (lock or xlock Command)

To lock your terminal, use the **lock** command. The **lock** command requests your password, reads it, and requests the password a second time to verify it. In the interim, the command locks the terminal and does not relinquish it until the password is received the second time. The timeout default value is 15 minutes, but this can be changed with the *-Number* flag.

**Note:** If your interface is AIXwindows, use the **xlock** command in the same manner.

For example, to lock your terminal under password control, type:

```
lock
```

Press Enter. You are prompted for the password twice so the system can verify it. If the password is not repeated within 15 minutes, the command times out.

To reserve a terminal under password control with a timeout interval of 10 minutes, type:

```
lock -10
```

Press Enter.

See the **lock** or the **xlock** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

---

## Command Summary for File and System Security

<b>acledit</b>	Edits the access control information of a file
<b>aclget</b>	Displays the access control information of a file
<b>aclput</b>	Sets the access control information of a file
<b>chmod</b>	Changes permission modes
<b>chown</b>	Changes the user associated with a file
<b>lock</b>	Reserves a terminal
<b>lsgroup</b>	Displays the attributes of groups
<b>xlock</b>	Locks the local X display until a password is entered

## Related Information

"Commands Overview" on page 26

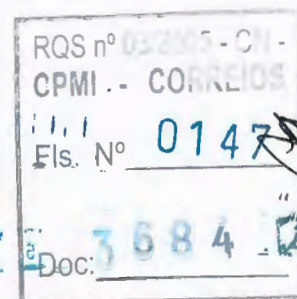
"Processes Overview" on page 35

"File Systems" on page 53

"Directory Overview" on page 56

Chapter 7, "Files" on page 67

Chapter 9, "Backup Files and Storage Media" on page 103



## Chapter 11. Customizing the User Environment

The operating system provides various commands and initialization files that enable you to customize the behavior and the appearance of your user environment.

You can also customize some of the default resources of the applications you use on your system. Defaults are initiated by the program at startup. When you change the defaults, you must exit and then restart the program for the new defaults take effect.

For information about customizing the behavior and appearance of the Common Desktop Environment, see the *Common Desktop Environment 1.0: Advanced User's and System Administrator's Guide*.

This chapter discusses the following:

- "System Startup Files Overview"
  - "/etc/profile File" on page 130
  - "/etc/environment File" on page 130
  - ".profile File" on page 131
  - ".env File" on page 131
- "XWindows Startup Files Overview" on page 132
  - ".xinitrc File" on page 132
  - ".Xdefaults File" on page 133
  - ".mwmrc File" on page 134
- "Customization Procedures" on page 135
  - "Exporting Shell Variables (export Shell Command)" on page 135
  - "Changing the Display's Font (chfont Command)" on page 136
  - "Changing Control Keys (stty Command)" on page 137
  - "Changing Your System Prompt" on page 137
- "Summary for User Environment Customization" on page 138

### System Startup Files Overview

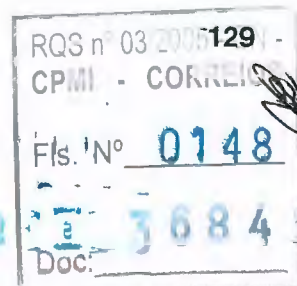
When you log in, the shell defines your user environment after reading the initialization files that you have set up. The characteristics of your user environment are defined by the values given to your environment variables. You maintain this environment until you log out of the system.

The shell uses two types of profile files when you log in to the operating system. It evaluates the commands contained in the files and then executes the commands to set up your system environment. The files have similar functions except that the **/etc/profile** file controls profile variables for all users on a system whereas the **.profile** file allows you to customize your own environment.

The shell first evaluates the commands contained in the **/etc/profile** file and then runs the commands to set up your system environment in the **/etc/environment** file. After these files are run, the system then checks to see if you have a **.profile** file in your home directory. If the **.profile** file exists, it runs this file. The **.profile** file will specify if there also exists an environment file. If an environment file exists, (usually called **.env**), the system then runs this file and sets up your environment variables.

The **/etc/profile**, **/etc/environment**, and the **.profile** files are run once at login time. The **.env** file, on the other hand, is run every time you open a new shell or a window.

This section discusses the following initialization files:





- “/etc/profile File”
- “/etc/environment File”
- “.profile File” on page 131
- “.env File” on page 131

## /etc/profile File

The first file that the operating system uses at login time is the **/etc/profile** file. This file controls systemwide default variables, such as:

- Export variables
- File creation mask (umask)
- Terminal types
- Mail messages to indicate when new mail has arrived

The system administrator configures the **profile** file for all users on the system. Only the system administrator can change this file.

The following example is a typical **/etc/profile** file:

```
#Set file creation mask
umask 022
#Tell me when new mail arrives
MAIL=/usr/mail/$LOGNAME
#Add my /bin directory to the shell search sequence
PATH=/usr/bin:/usr/sbin:/etc::
#Set terminal type
TERM=lt
#Make some environment variables global
export MAIL PATH TERM
```

See the *AIX 5L Version 5.2 Files Reference* for detailed information about the **/etc/profile** file.

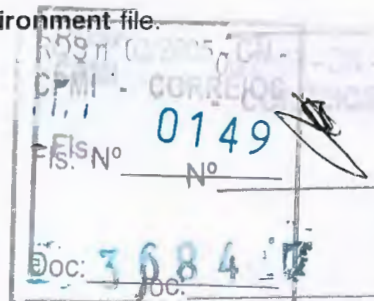
## /etc/environment File

The second file that the operating system uses at login time is the **/etc/environment** file. The **/etc/environment** file contains variables specifying the basic environment for all processes. When a new process begins, the **exec** subroutine makes an array of strings available that have the form *Name=Value*. This array of strings is called the *environment*. Each name defined by one of the strings is called an *environment variable* or *shell variable*. The **exec** subroutine allows the entire environment to be set at one time.

When you log in, the system sets environment variables from the **environment** file before reading your login profile, named **.profile**. The following variables make up the basic environment:

<b>HOME</b>	The full path name of the user's login or <b>HOME</b> directory. The <b>login</b> program sets this to the name specified in the <b>/etc/passwd</b> file.
<b>LANG</b>	The locale name currently in effect. The <b>LANG</b> variable is initially set in the <b>/etc/profile</b> file at installation time.
<b>NLSPATH</b>	The full path name for message catalogs.
<b>LOCPATH</b>	The full path name of the location of National Language Support tables.
<b>PATH</b>	The sequence of directories that commands, such as <b>sh</b> , <b>time</b> , <b>nice</b> and <b>nohup</b> , search when looking for a command whose path name is incomplete.
<b>TZ</b>	The time zone information. The <b>TZ</b> environment variable is initially set by the <b>/etc/profile</b> file, the system login profile.

See the *AIX 5L Version 5.2 Files Reference* for detailed information about the **/etc/environment** file.



## .profile File

The third file that the operating system uses at login time is the **.profile** file. The **.profile** file is present in your home (**\$HOME**) directory and enables you to customize your individual working environment. Because the **.profile** file is hidden, use the **ls -a** command to list it.

After the **login** program adds the **LOGNAME** (login name) and **HOME** (login directory) variables to the environment, the commands in the **\$HOME/.profile** file are executed if the file is present. The **.profile** file contains your individual profile that overrides the variables set in the **/etc/profile** file. The **.profile** file is often used to set exported environment variables and terminal modes. You can tailor your environment by modifying the **.profile** file. Use the **.profile** file to control the following defaults:

- Shells to open
- Prompt appearance
- Keyboard sound

The following example is a typical **.profile** file:

```
PATH=/usr/bin:/etc:/home/bin1:/usr/lpp/tps4.0/user::
epath=/home/gsc/e3:
export PATH epath
csh
```

This example has defined two path variables (**PATH** and **epath**), exported them, and opened a C shell (**csh**).

You can also use the **.profile** file (or if it is not present, the **/etc/profile** file) to determine login shell variables. You can also customize other shell environments. For example, use the **.cshrc** file and **.kshrc** file to tailor a C shell and a Korn shell, respectively, when each type of shell is started.

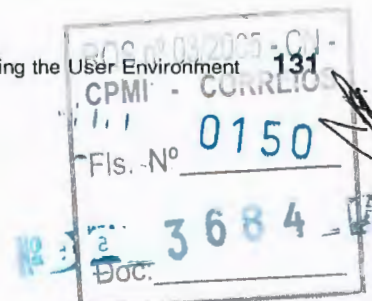
## .env File

A fourth file that the operating system uses at login time is the **.env** file, if your **.profile** contains the following line: **export ENV=\$HOME/.env**

The **.env** file enables you to customize your individual working environment variables. Because the **.env** file is hidden, use the **ls -a** command to list it. The **.env** file contains the individual user environment variables that override the variables set in the **/etc/environment** file. You can tailor your environment variables as desired by modifying your **.env** file.

The following example is a typical **.env** file:

```
export myid=`id | sed -n -e 's/).*$/' -e 's/^.*(//p'`
#set prompt: login & system name & path
if [ $myid = root ]
then    typeset -x PSCH='#:${PWD}> '
        PS1="#:${PWD}> "
else    typeset -x PSCH='>'
        PS1="$LOGNAME@$UNAME:${PWD}> "
        PS2=">"
        PS3="#?"
fi
export PS1 PS2 PS3
#setup my command aliases
alias  ls="/bin/ls -CF" \
       d="/bin/ls -Fal | pg" \
       rm="/bin/rm -i" \
       up="cd .."
```





**Note:** When modifying the `.env` file, ensure that newly created environment variables do not conflict with standard variables such as **MAIL**, **PS1**, **PS2**, and **IFS**.

## AIXwindows Startup Files Overview

Because different computer systems have different ways of starting the X server and AIXwindows, consult with your system administrator to learn how to get started. Usually, the X server and AIXwindows are started from a shell script that runs automatically when you log in. You might, however, find that you need to start the X server or AIXwindows, or both.

If you log in and find that your display is functioning as a single terminal, with no windows displayed, you can start the X server by typing the following:

```
xinit
```

Press Enter.

If this command does not start the X server, check with your system administrator to ensure that your search path contains the `X11` directory containing executable programs. The appropriate path might differ from one system to another.

**Note:** Before entering this command, make sure that the pointer rests within a window that has a system prompt.

If you log in and find one or more windows without frames, you can start AIXwindows Window Manager by typing the following:

```
mwm &
```

Press Enter.

Because AIXwindows permits customization both by programmers writing AIXwindows applications and by users, you might find that mouse buttons or other functions do not operate as you might expect from reading this documentation. You can reset your AIXwindows environment to the default behavior by pressing and holding the following four keys:

Alt-Ctrl-Shift-I

You can return to the customized behavior by pressing this key sequence again. If your system does not permit this combination of keystrokes, you can also restore default behavior from the default root menu.

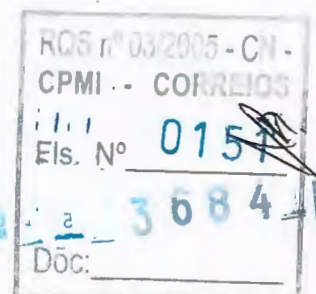
## .xinitrc File

The `xinit` command uses a customizable shell script file that lists the X client programs to start. The `.xinitrc` file in your home directory controls the windows and applications that start when you start AIXwindows.

The `xinit` command first looks for the `$XINITRC` environment variable to start AIXwindows. If the `$XINITRC` environment variable is not found, it looks for the `$HOME/.xinitrc` shell script. If the `$HOME/.xinitrc` shell script is not found, the `xinit` command starts the `/usr/lib/X11/$LANG/xinitrc` shell script. If `/usr/lib/X11/$LANG/xinitrc` is not found, it looks for the `/usr/lpp/X11/defaults/$LANG/xinitrc` shell script. If that script is not found, it searches for the `/usr/lpp/X11/defaults/xinitrc` shell script.

The `xinitrc` shell script starts commands, such as the `mwm` (AIXwindows Window Manager), `aixterm`, and `xclock` commands.

The `xinit` command performs the following operations:



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- Starts an X server on the current display
- Sets up the **\$DISPLAY** environment variable
- Runs the **xinitrc** file to start the X client programs

The following example shows the part of the **xinitrc** file you can customize:

```
# This script is invoked by /usr/lpp/X11/bin/xinit

.
.
.
#*****
# Start the X clients. Change the following lines to      *
# whatever command(s) you desire!                        *
# The default clients are an analog clock (xclock), an lft *
# terminal emulator (aixterm), and the Motif Window Manager *
# (mwm). *
#*****
exec mwm
```

## .Xdefaults File

If you work in an AIXwindows interface, you can customize this interface with the **.Xdefaults** file. AIXwindows allows you to specify your preferences for visual characteristics, such as colors and fonts.

Many aspects of a windows-based application's appearance and behavior are controlled by sets of variables called *resources*. The visual or behavioral aspect of a resource is determined by its assigned value. There are several different types of values for resources. For example, resources that control color can be assigned predefined values such as *DarkSlateBlue* or *Black*. Resources that specify dimensions are assigned numeric values. Some resources take Boolean values (*True* or *False*).

If you do not have a **.Xdefaults** file in your home directory, you can create one with any text editor. After you have this file in your home directory, you can set resource values in it as you wish. A sample default file called **Xdefaults.tmpl** is in the **/usr/lpp/X11/defaults** directory.

The following example shows part of a typical **.Xdefaults** file:

```
*AutoRaise: on
*DeIconifyWarp: on
*wrap: on
*TitleFont: andysans12
*scrollBar: true
*font: Rom10.500
Mwm*menu*foreground: black
Mwm*menu*background: CornflowerBlue
Mwm*menu*RootMenu*foreground: black
Mwm*menu*RootMenu*background: CornflowerBlue
Mwm*icon*foreground: grey25
Mwm*icon*background: LightGray
Mwm*foreground: black
Mwm*background: LightSkyBlue
Mwm*bottomShadowColor: Blue1
Mwm*topShadowColor: CornflowerBlue
Mwm*activeForeground: white
Mwm*activeBackground: Blue1
Mwm*activeBottomShadowColor: black
Mwm*activeTopShadowColor: LightSkyBlue
Mwm*border: black
Mwm*highlight: white
aixterm.foreground: green
aixterm.background: black
aixterm.fullcursor: true
aixterm.ScrollKey: on
```

RCS n° 03/2005 - CN -  
CPM - CORRIGÉ  
Fils. N° 0152  
Doc: 3684



aixterm.autoRaise: true  
 aixterm.autoRaiseDelay: 2  
 aixterm.boldFont: Rom10.500  
 aixterm.geometry: 80x25  
 aixterm.iconFont: Rom8.500  
 aixterm.iconStartup: false  
 aixterm.jumpScroll: true  
 aixterm.reverseWrap: true  
 aixterm.saveLines: 500  
 aixterm.scrollInput: true  
 aixterm.scrollKey: false  
 aixterm.title: AIX

## .mwmrc File

Most of the features that you want to customize can be set with resources in your **.Xdefaults** file. However, key bindings, mouse button bindings, and menu definitions for your window manager are specified in the supplementary **.mwmrc** file, which is referenced by resources in the **.Xdefaults** file.

If you do not have a **.mwmrc** file in your home directory, you can copy it as follows:

```
cp /usr/lib/X11/system.mwmrc .mwmrc
```

Because the **.mwmrc** file overrides the systemwide effects of the **system.mwmrc** file, your specifications do not interfere with the specifications of other users.

The following example shows part of a typical **system.mwmrc** file:

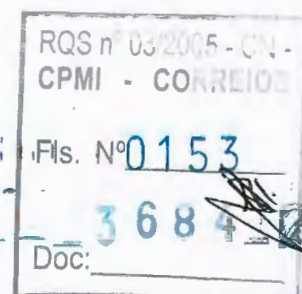
```

# DEFAULT mwm RESOURCE DESCRIPTION FILE (system.mwmrc)
#
# menu pane descriptions
#
# Root Menu Description
Menu RootMenu
{ "Root Menu"          f.title
  no-label              f.separator
  "New Window"          f.exec "aixterm &"
  "Shuffle Up"          f.circle_up
  "Shuffle Down"        f.circle_down
  "Refresh"             f.refresh
  no-label              f.separator
  "Restart"             f.restart
  "Quit"               f.quit_mwm
}

# Default Window Menu Description
Menu DefaultWindowMenu MwmWindowMenu
{ "Restore"    _R  Alt<Key>F5      f.normalize
  "Move"       _M  Alt<Key>F7      f.move
  "Size"       _S  Alt<Key>F8      f.resize
  "Minimize"   _n  Alt<Key>F9      f.minimize
  "Maximize"   _x  Alt<Key>F10     f.maximize
  "Lower"      _L  Alt<Key>F3      f.lower
  no-label     f.separator
  "Close"     _C  Alt<Key>F4      f.kill
}

# no acclerator window menu
Menu NoAccWindowMenu
{
  "Restore"    _R  f.normalize
  "Move"       _M  f.move
  "Size"       _S  f.resize
  "Minimize"   _n  f.minimize
  "Maximize"   _x  f.maximize
}

```



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```

"Lower"      _L      f.lower
no-label     _L      f.separator
"Close"      _C      f.kill
}

Keys DefaultKeyBindings
{
  Shift<Key>Escape      icon|window      f.post_wmenu
  Meta<Key>space         icon|window      f.post_wmenu
  Meta<Key>Tab           root|icon|window  f.next_key
  Meta Shift<Key>Tab     root|icon|window  f.prev_key
  Meta<Key>Escape       root|icon|window  f.next_key
  Meta Shift<Key>Escape  root|icon|window  f.prev_key
  Meta Ctrl Shift<Key>exclam root|icon|window  f.set_behavior
}

#
# button binding descriptions
#

Buttons DefaultButtonBindings
{
  <Btn1Down>      frame|icon      f.raise
  <Btn3Down>      frame|icon      f.post_wmenu
  <Btn1Down>      root            f.menu RootMenu
  <Btn3Down>      root            f.menu RootMenu
  Meta<Btn1Down>  icon|window      f.lower
  Meta<Btn2Down>  window|icon      f.resize
  Meta<Btn3Down>  window          f.move
}

Buttons PointerButtonBindings
{
  <Btn1Down>      frame|icon      f.raise
  <Btn2Down>      frame|icon      f.post_wmenu
  <Btn3Down>      frame|icon      f.lower
  <Btn1Down>      root            f.menu RootMenu
  Meta<Btn2Down>  window|icon      f.resize
  Meta<Btn3Down>  window|icon      f.move
}

#
# END OF mwm RESOURCE DESCRIPTION FILE
#

```

## Customization Procedures

This section discusses the following procedures to customize your system environment:

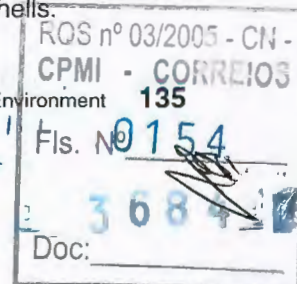
- "Exporting Shell Variables (export Shell Command)"
- "Changing the Display's Font (chfont Command)" on page 136
- "Changing Control Keys (stty Command)" on page 137
- "Changing Your System Prompt" on page 137

### Exporting Shell Variables (export Shell Command)

A *local* shell variable is a variable known only to the shell that created it. If you start a new shell, the old shell's variables are unknown to it. If you want the new shells that you open to use the variables from an old shell, export the variables to make them *global*.

You can use the **export** command to make local variables global. To make your local shell variables global automatically, export them in your **.profile** file.

**Note:** Variables can be exported down to child shells, but not exported up to parent shells.





For example, to make the local shell variable PATH global, type:

```
export path
```

Press Enter.

For example, to list all your exported variables, type:

```
export
```

Press Enter.

The system displays information similar to the following:

```
DISPLAY=unix:0
EDITOR=vi
ENV=$HOME/.env
HISTFILE=/u/denise/.history
HISTSIZE=500
HOME=/u/denise
LANG=En_US
LOGNAME=denise
MAIL=/usr/mail/denise
MAILCHECK=0
MAILMSG=**YOU HAVE NEW MAIL.
USE THE mail COMMAND TO SEE YOUR MAILPATH=/usr/mail/denise?denise has mail !!!
MAILRECORD=/u/denise/.Outmail
PATH=/usr/ucb:/usr/lpp/X11/bin:/bin:/usr/bin:/etc:/u/denise:/u/denise/bin:/u/bin1
PWD=/u/denise
SHELL=/bin/ksh
```

## Changing the Display's Font (chfont Command)

To change the default font at system startup, use the **chfont** or **smit** command. A *font palette* is a file that the system uses to define and identify the fonts it has available.

**Note:** To run the **chfont** command, you must have root authority.

### chfont Command

For example, to change the active font to the fifth font in the font palette, type:

```
chfont -a5
```

Press Enter. Font ID 5 becomes the primary font.

For example, to change the font to an italic, roman, and bold face of the same size, type:

```
chfont -n /usr/lpp/fonts/It114.snf /usr/lpp/fonts/Bld14.snf /usr/lpp/fonts/Rom14.snf
```

Press Enter.

See the **chfont** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

### smit Command

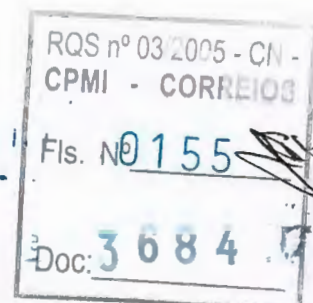
The **chfont** command can also be run using **smit**.

To select the active font, type:

```
smit chfont
```

Press Enter.

To select the font palette, type:





smit chfontpl

Press Enter.

## Changing Control Keys (stty Command)

To change the keys that your terminal uses for control keys, use the **stty** command. Your changes to control keys last until you log out. To make your changes permanent, place them in your **.profile** file.

For example, to assign Ctrl-Z as the interrupt key, type:

```
stty intr ^Z
```

Be sure to place a space character between `intr` and `^Z`. Press Enter.

For example, to reset all control keys to their default values, type:

```
stty sane
```

Press Enter.

For example, to display your current settings, type:

```
stty -a
```

Press Enter.

See the **stty** command in the *AIX 5L Version 5.2 Commands Reference* for the complete syntax.

## Changing Your System Prompt

Your shell uses the following prompt variables:

<b>PS1</b>	Prompt used as the normal system prompt
<b>PS2</b>	Prompt used when the shell expects more input
<b>PS3</b>	Prompt used when you have root authority

You can change any of your prompt characters by changing the value of its shell variable. Your prompt changes remain in effect until you log out. To make your changes permanent, place them in your **.env** file.

For example, to display the current value of the PS1 variable, type:

```
echo "prompt is $PS1"
```

Press Enter. The system displays information similar to the following:

```
prompt is $
```

For example, to change your prompt to Ready> , type:

```
PS1="Ready> "
```

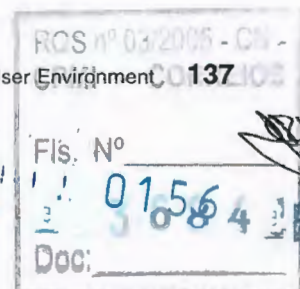
Press Enter.

For example, to change your continuation prompt to Enter more-> , type:

```
PS2="Enter more->"
```

Press Enter.

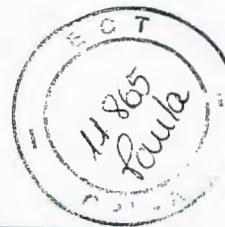
For example, to change your root prompt to Root-> , type:





PS3="Root-> "

Press Enter.



## Summary for User Environment Customization

### System Startup Files

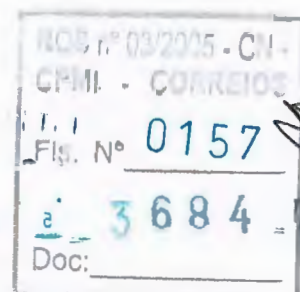
<b>/etc/profile</b>	System file that contains commands that the system executes when you log in
<b>/etc/environment</b>	System file that contains variables specifying the basic environment for all processes
<b>\$HOME/.profile</b>	File in your home directory that contains commands that override the system <b>/etc/profile</b> when you log in. For more information, see ".profile File" on page 131
<b>\$HOME/.env</b>	File in your home directory that overrides the system <b>/etc/environment</b> and contains variables specifying the basic environment for all processes. For more information, see ".env File" on page 131

### AIXwindows Startup Files

<b>\$HOME/.xinitrc</b>	File in your home directory that controls the windows and applications that start up when you start AIXwindows. For more information, see ".xinitrc File" on page 132.
<b>\$HOME/Xdefaults</b>	File in your home directory that controls the visual or behavioral aspect of AIXwindows resources. For more information, see ".Xdefaults File" on page 133.
<b>\$HOME/.mwmrc</b>	File in your home directory that defines key bindings, mouse button bindings, and menu definitions for your window manager. For more information, see ".mwmrc File" on page 134.

### Customization Procedures

<b>PS1</b>	Normal system prompt
<b>PS2</b>	More input system prompt
<b>PS3</b>	Root system prompt
<b>chfont</b>	Changes the font used by a display at system restart
<b>stty</b>	Sets, resets, and reports workstation operating parameters





## Chapter 12. Shells

Your interface to the operating system is called a *shell*. The shell is the outermost layer of the operating system. Shells incorporate a programming language to control processes and files, as well as to start and control other programs. The shell manages the interaction between you and the operating system by prompting you for input, interpreting that input for the operating system, and then handling any resulting output from the operating system.

Shells provide a way for you to communicate with the operating system. This communication is carried out either interactively (input from the keyboard is acted upon immediately) or as a shell script. A *shell script* is a sequence of shell and operating system commands that is stored in a file.

When you log in to the system, the system locates the name of a shell program to execute. After it is executed, the shell displays a command prompt. This prompt is usually a \$ (dollar sign). When you type a command at the prompt and press the Enter key, the shell evaluates the command and attempts to carry it out. Depending on your command instructions, the shell writes the command output to the screen or redirects the output. It then returns the command prompt and waits for you to type another command.

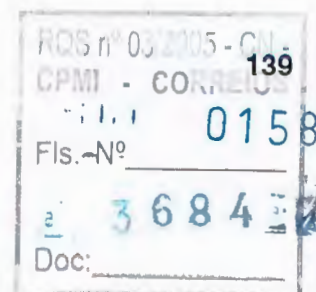
A *command line* is the line on which you type. It contains the shell prompt. The basic format for each line is as follows:

\$ Command Argument(s)

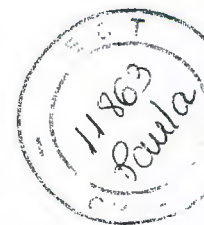
The shell considers the first word of a command line (up to the first blank space) as the command, and all subsequent words as arguments.

This chapter discusses the following:

- "Shell Features" on page 140
- "Korn Shell or POSIX Shell Commands" on page 144
- "Quoting in the Korn Shell or POSIX Shell" on page 149
- "Reserved Words in the Korn Shell or POSIX Shell" on page 151
- "Command Aliasing in the Korn Shell or POSIX Shell" on page 151
- "Parameter Substitution in the Korn Shell or POSIX Shell" on page 152
- "Command Substitution in the Korn Shell or POSIX Shell" on page 157
- "Arithmetic Evaluation in the Korn Shell or POSIX Shell" on page 158
- "Field Splitting in the Korn Shell or POSIX Shell" on page 159
- "File-Name Substitution in the Korn Shell or POSIX Shell" on page 159
- "Input and Output Redirection in the Korn Shell or POSIX Shell" on page 161
- "Exit Status in the Korn Shell or POSIX Shell" on page 163
- "Korn Shell or POSIX Shell Commands" on page 144
- "Korn Shell or POSIX Shell Built-In Commands" on page 163
- "Conditional Expressions for the Korn Shell or POSIX Shell" on page 174
- "Job Control in the Korn Shell or POSIX Shell" on page 175
- "Inline Editing in the Korn Shell or POSIX Shell" on page 176
- "List of Korn Shell or POSIX Shell Built-in Commands" on page 173
- "List of Bourne Shell Built-in Commands" on page 199
- "List of C Shell Built-in Commands" on page 219
- "Bourne Shell" on page 221
- "C Shell" on page 221
- "Bourne Shell" on page 184







- “Restricted Shell” on page 185
- “Bourne Shell Commands” on page 186
- “Variable and File-Name Substitution in the Bourne Shell” on page 193
- “Input and Output Redirection in the Bourne Shell” on page 199
- “C Shell” on page 200
- “C Shell Commands” on page 201
- “History Substitution in the C Shell” on page 209
- “Alias Substitution in the C Shell” on page 212
- “Variable and File-Name Substitution in the C Shell” on page 213
- “Environment Variables in the C Shell” on page 216
- “Input and Output Redirection in the C Shell” on page 218
- “Job Control in the C Shell” on page 219

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## Shell Features

The primary advantages of interfacing to the system through a shell are as follows:

- **Wildcard substitution in file names (pattern-matching)**

Carries out commands on a group of files by specifying a pattern to match, rather than an actual file name.

For more information, see the following:

- “File-Name Substitution in the Korn Shell or POSIX Shell” on page 159
- “File-Name Substitution in the Bourne Shell” on page 198
- “File-Name Substitution in the C Shell” on page 214

- **Background processing**

Sets up lengthy tasks to run in the background, freeing the terminal for concurrent interactive processing.

For more information, see the **bg** command in the following:

- “Job Control in the Korn Shell or POSIX Shell” on page 175
- “C Shell Built-In Commands” on page 202

**Note:** The Bourne shell does not support job control.

- **Command aliasing**

Gives an alias name to a command or phrase. When the shell encounters an alias on the command line or in a shell script, it substitutes the text to which the alias refers.

For more information, see the following:

- “Command Aliasing in the Korn Shell or POSIX Shell” on page 151
- “Alias Substitution in the C Shell” on page 212

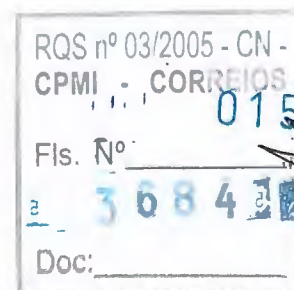
**Note:** The Bourne shell does not support command aliasing.

- **Command history**

Records the commands you enter in a history file. You can use this file to easily access, modify, and reissue any listed command.

For more information, see the **history** command in the following:

- “Korn Shell or POSIX Shell Command History” on page 149
- “C Shell Built-In Commands” on page 202
- “History Substitution in the C Shell” on page 209



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**Note:** The Bourne shell does not support command history.

- **File-name substitution**

Automatically produces a list of file names on a command line using pattern-matching characters.

For more information, see the following:

- “File-Name Substitution in the Korn Shell or POSIX Shell” on page 159
- “File-Name Substitution in the Bourne Shell” on page 198
- “File-Name Substitution in the C Shell” on page 214

- **Input and output redirection**

Redirects input away from the keyboard and redirects output to a file or device other than the terminal. For example, input to a program can be provided from a file and redirected to the printer or to another file.

For more information, see the following:

- “Input and Output Redirection in the Korn Shell or POSIX Shell” on page 161
- “Input and Output Redirection in the Bourne Shell” on page 199
- “Input and Output Redirection in the C Shell” on page 218

- **Piping**

Links any number of commands together to form a complex program. The standard output of one program becomes the standard input of the next.

For more information, see the **pipeline** definition in “Shells Terminology” on page 142.

- **Shell variable substitution**

Stores data in user-defined variables and predefined shell variables.

For more information, see the following:

- “Parameter Substitution in the Korn Shell or POSIX Shell” on page 152
- “Variable Substitution in the Bourne Shell” on page 193
- “Variable Substitution in the C Shell” on page 213

## Available Shells

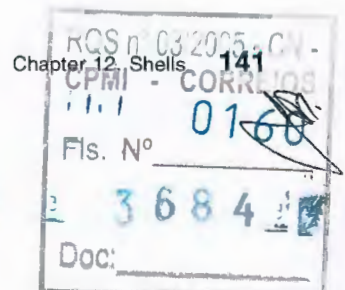
The following shells are provided with the operating system:

- Korn shell (started with the **ksh** command)
- Bourne shell (started with the **bsh** command)
- Restricted shell (a limited version of the Bourne shell started with the **Rsh** command)
- POSIX shell (also known as the Korn Shell, and started with the **psh** command)
- Default shell (started with the **sh** command)
- C shell (started with the **cs** command)
- Trusted shell (a limited version of the Korn shell started with the **tsh** command)
- Remote shell (started with the **rsh** command)

The *login shell* refers to the shell that is loaded when you log in to the computer system. Your login shell is set in the **/etc/passwd** file. The Korn shell is the standard operating system login shell and is backwardly compatible with the Bourne Shell (see “Bourne Shell” on page 184).

The *default or standard shell* refers to the shell linked to and started with the **/usr/bin/sh** command. The Bourne shell is set up as the default shell and is a subset of the Korn shell.

The **/usr/bin/sh** resides as a copy of the Korn shell, which is **/usr/bin/ksh**. Hence, the Korn shell can be substituted as the default shell. The POSIX shell, which is invoked by the **/usr/bin/psh** command, resides as a link to the **/usr/bin/sh** command.





## Shells Terminology

The following definitions are helpful in understanding shells:

<b>blank</b>	A blank is one of the characters in the blank character class defined in the LC_CTYPE category. In the POSIX shell, a blank is either a tab or space.
<b>built-in command</b>	A command that the shell executes without searching for it and creating a separate process.
<b>command</b>	A sequence of characters in the syntax of the shell language. The shell reads each command and carries out the desired action either directly or by invoking separate utilities.
<b>comment</b>	Any word that begins with pound sign (#). The word and all characters that follow it, until the next newline character, are ignored.
<b>identifier</b>	A sequence of letters, digits, or underscores from the portable character set, starting with a letter or underscore. The first character of an identifier must not be a digit. Identifiers are used as names for aliases, functions, and named parameters.
<b>list</b>	A sequence of one or more pipelines separated by one of the following symbols: semicolon (;), ampersand (&), double ampersand (&&), or double bar (  ). The list is optionally ended by one of the following symbols: semicolon (;), ampersand (&), or bar ampersand (  &).

- ;** Sequentially processes the preceding pipeline. The shell carries out each command in turn and waits for the most recent command to complete.
- &** Asynchronously processes the preceding pipeline. The shell carries out each command in turn, processing the pipeline in the background without waiting for it to complete.
- |&** Asynchronously processes the preceding pipeline and establishes a two-way pipe to the parent shell. The shell carries out each command in turn, processing the pipeline in the background without waiting for it to complete. The parent shell can read from and write to the standard input and output of the spawned command by using the **read -p** and **print -p** commands. Only one such command can be active at any given time.
- &&** Processes the list that follows this symbol only if the preceding pipeline returns an exit value of zero (0).
- ||** Processes the list that follows this symbol only if the preceding pipeline returns a nonzero exit value.

The semicolon (;), ampersand (&), and bar ampersand (|&) have a lower priority than the double ampersand (&&) and double bar (||). The ;, &, and |& symbols have equal priority among themselves. The && and || symbols are equal in priority. One or more newline characters can be used instead of a semicolon to delimit two commands in a list.

**Note:** The |& symbol is valid only in the Korn shell.

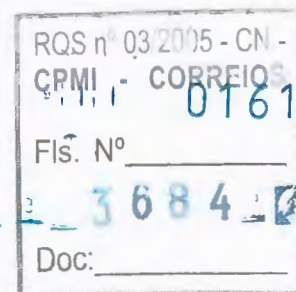
### metacharacter

Each metacharacter has a special meaning to the shell and causes termination of a word unless it is quoted. Metacharacters are: pipe (|), ampersand (&), semicolon (;), less-than sign (<), greater-than sign (>), left parenthesis ((), right parenthesis ()), dollar sign (\$), backquote (`), backslash (\), right quote ('), double quotation marks ("), newline character, space character, and tab character. All characters enclosed between single quotation marks are considered quoted and are interpreted literally by the shell. The special meaning of metacharacters is retained if not quoted. (Metacharacters are also known as *parser metacharacters* in the C shell.)

### parameter assignment list

Includes one or more words of the form *Identifier=Value* in which spaces surrounding the equal sign (=) must be balanced. That is, leading and trailing blanks, or no blanks, must be used.

**Note:** In the C shell, the parameter assignment list is of the form **set Identifier = Value**. The spaces surrounding the equal sign (=) are required.





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## pipeline

A sequence of one or more commands separated by pipe (|). Each command in the pipeline, except possibly the last command, is run as a separate process. However, the standard output of each command that is connected by a pipe becomes the standard input of the next command in the sequence. If a list is enclosed with parentheses, it is carried out as a simple command that operates in a separate subshell.

If the reserved word ! does not precede the pipeline, the exit status will be the exit status of the last command specified in the pipeline. Otherwise, the exit status is the logical NOT of the exit status of the last command. In other words, if the last command returns zero, the exit status will be 1. If the last command returns greater than zero, the exit status will be zero.

The format for a pipeline is as follows:

```
[!] command1 [ | command2 ...]
```

## shell variable

**Note:** Early versions of the Bourne shell used the caret (^) to indicate a pipe.

A name or parameter to which a value is assigned. Assign a variable by typing the variable name, an equal sign (=), and then the value. The variable name can be substituted for the assigned value by preceding the variable name with a dollar sign (\$). Variables are particularly useful for creating a short notation for a long path name, such as \$HOME for the home directory. A predefined variable is one whose value is assigned by the shell. A user-defined variable is one whose value is assigned by a user.

## simple command

A sequence of optional parameter assignment lists and redirections, in any sequence. They are optionally followed by commands, words, and redirections. They are terminated by ;, |, &, ||, &&, |&, or a newline character. The command name is passed as parameter 0 (as defined by the **exec** subroutine). The value of a simple command is its exit status of zero if it terminates normally or nonzero if it terminates abnormally. The **sigaction**, **sigvec**, or **signal** Subroutine in the *AIX 5L Version 5.2 Technical Reference: Base Operating System and Extensions Volume 2* includes a list of signal-exit status values.

## subshell

A shell that is running as a child of the login shell or the current shell.

## wildcard character

Also known as a *pattern-matching character*. The shell associates them with assigned values. The basic wildcards are ?, \*, [set], and [!set]. Wildcard characters are particularly useful when performing file-name substitution.

## word

A sequence of characters that does not contain any blanks. Words are separated by one or more metacharacters.

# Creating and Running a Shell Script

Shell scripts provide an easy way to carry out tedious commands, large or complicated sequences of commands, and routine tasks. A shell script is a file that contains one or more commands. When you type the name of a shell script file, the system executes the command sequence contained by the file.

You can create a shell script using a text editor. Your script can contain both operating system commands and shell built-in commands.

The following steps are general guidelines for writing shell scripts:

1. Using a text editor, create and save a file. You can include any combination of shell and operating system commands in the shell script file. By convention, shell scripts that are not set up for use by many users are stored in the **\$HOME/bin** directory.

**Note:** The operating system does not support the **setuid** or **setgid** subroutines within a shell script.

2. Use the **chmod** command to allow only the owner to run (or execute) the file. For example, if your file is named **script1**, type:

```
chmod u=rwx script1
```

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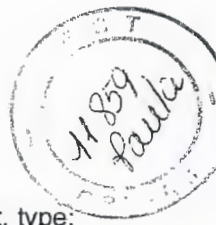
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Press Enter.

3. Enter the script name on the command line to run the shell script. To run the **script1** shell script, type:  
`script1`

Press Enter.

**Note:** You can run a shell script without making it executable if a shell command (**ksh**, **bsh**, or **csh**) precedes the shell script file name on the command line. For example, to run a nonexecutable file named **script1** under the control of the Korn shell, type:

```
ksh script1
```

## Specifying a Shell for a Script File

When you run an executable shell script in either the Korn (the POSIX Shell) or Bourne shell, the commands in the script are carried out under the control of the current shell (the shell from which the script is started) unless you specify a different shell. When you run an executable shell script in the C shell, the commands in the script are carried out under the control of the Bourne shell (**/usr/bin/bsh**) unless you specify a different shell.

You can run a shell script in a specific shell by including the shell within the shell script.

To run an executable shell script under a specific shell, type **#!Path** on the first line of the shell script, and press Enter. The **#!** characters identify the file type. The *Path* variable specifies the path name of the shell from which to run the shell script.

For example, to run the **bsh** script in the Bourne shell, type:

```
#!/usr/bin/bsh
```

Press Enter.

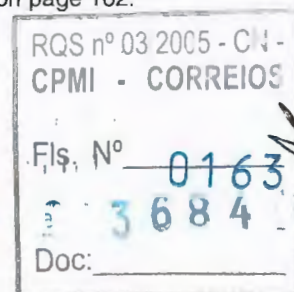
When you precede a shell script file name with a shell command, the shell specified on the command line overrides any shell specified within the script file itself. Therefore, typing **ksh myfile** and pressing Enter runs the file named **myfile** under the control of the Korn shell, even if the first line of **myfile** is **#!/usr/bin/csh**.

---

## Korn Shell or POSIX Shell Commands

The Korn shell is an interactive command interpreter and command programming language. It conforms to the Portable Operating System Interface for Computer Environments (POSIX), an international standard for operating systems. POSIX is not an operating system, but is a *standard* aimed at portability of applications, at the source level, across many systems. POSIX features are built on top of the Korn shell. The Korn shell (also known as the POSIX shell) offers many of the same features as the Bourne and C shells, such as I/O redirection capabilities, variable substitution, and file name substitution. It also includes several additional command and programming language features:

- |                              |  |
|------------------------------|--|
| <b>Arithmetic evaluation</b> | The Korn shell, or POSIX shell, can perform integer arithmetic using the built-in <b>let</b> command, using any base from 2 to 36. "Arithmetic Evaluation in the Korn Shell or POSIX Shell" on page 158 further describes this feature.  |
| <b>Command history</b>       | The Korn shell, or POSIX shell, stores a file that records all of the commands you enter. You can use a text editor to alter a command in this history file and then reissue the command. For more information about the command history feature, see "Korn Shell or POSIX Shell Command History" on page 149. |
| <b>Coprocess facility</b>    | Enables you to run programs in the background and send and receive information to these background processes. For more information, see "Coprocess Facility" on page 162.  |



## Editing

The Korn shell, or POSIX shell, offers inline editing options that enable you to edit the command line. Editors similar to emacs, gmacs, and vi are available. "Inline Editing in the Korn Shell or POSIX Shell" on page 176 further describes this feature.

A Korn shell command is one of the following:

- Simple command
- Pipeline
- List
- Compound command
- Function

When you issue a command in the Korn shell or POSIX shell, the shell evaluates the command and does the following:

- Makes all indicated substitutions.
- Determines whether the command contains a /. If it does, the shell runs the program named by the specified path name.

If the command does not contain a /, the Korn shell or POSIX shell continues with the following actions:

- Determines whether the command is a special built-in command. If it is, the shell runs the command within the current shell process.

For information about special built-in commands, see "'Korn Shell or POSIX Shell Built-In Commands" on page 163".

- Compares the command to user-defined functions. If the command matches a user-defined function, the positional parameters are saved and then reset to the arguments of the **function** call. When the function completes or issues a return, the positional parameter list is restored, and any trap set on **EXIT** within the function is carried out. The value of a function is the value of the last command executed. A function is carried out in the current shell process.
- If the command name matches the name of a regular built-in command, that regular built-in command will be invoked.

For information about regular built-in commands, see "'Korn Shell or POSIX Shell Built-In Commands" on page 163".

- Creates a process and attempts to carry out the command by using the **exec** command (if the command is neither a built-in command nor a user-defined function).

The Korn shell, or POSIX shell, searches each directory in a specified path for an executable file. The **PATH** shell variable defines the search path for the directory containing the command. Alternative directory names are separated with a :. The default path is /usr/bin: (specifying the /usr/bin directory, and the current directory, in that order). The current directory is specified by two or more adjacent colons, or by a colon at the beginning or end of the path list.

If the file has execute permission but is not a directory or an **a.out** file, the shell assumes that it contains shell commands. The current shell process spawns a subshell to read the file. All nonexported aliases, functions, and named parameters are removed from the file. If the shell command file has read permission, or if the **setuid** or **setgid** bits are set on the file, then the shell runs an agent that sets up the permissions and carries out the shell with the shell command file passed down as an open file. A parenthesized command is run in a subshell without removing nonexported quantities.

This section discusses the following:

- "Korn Shell Compound Commands" on page 146
- "Korn Shell Functions" on page 148
- "Korn Shell or POSIX Shell Built-In Commands" on page 163

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- “Conditional Expressions for the Korn Shell or POSIX Shell” on page 174

## Korn Shell Compound Commands

A compound command can be a list of simple commands, a pipeline, or it can begin with a **reserved** word. Most of the time, you will use compound commands such as **if**, **while**, and **for** when you are writing shell scripts.

### List of Korn Shell or POSIX Shell Compound Commands

**for** *Identifier* [**in** *Word ...*] **;do**  
*List* **;done**

Each time a **for** command is executed, the *Identifier* parameter is set to the next word taken from the **in** *Word ...* list. If the **in** *Word ...* command is omitted, then the **for** command executes the **do** *List* command once for each positional parameter that is set. Execution ends when there are no more words in the list. For more information on positional parameters, refer to “Parameter Substitution in the Korn Shell or POSIX Shell” on page 152”.

**select** *Identifier* [**in** *Word ...*]  
**;do** *List* **;done**

A **select** command prints on standard error (file descriptor 2) the set of words specified, each preceded by a number. If the **in** *Word ...* command is omitted, then the positional parameters are used instead. The **PS3** prompt is printed and a line is read from the standard input. If this line consists of the number of one of the listed words, then the value of the *Identifier* parameter is set to the word corresponding to this number.

If the line read from standard input is empty, the selection list is printed again. Otherwise, the value of the *Identifier* parameter is set to null. The contents of the line read from standard input is saved in the **REPLY** parameter. The *List* parameter is executed for each selection until a break or an end-of-file character is encountered. For more information on positional parameters, refer to “Parameter Substitution in the Korn Shell or POSIX Shell” on page 152”.

**case** *Word* **in** [( *Pattern* [ *Pattern* ] ... ) *List* ;;] ... **esac**

A **case** command executes the *List* parameter associated with the first *Pattern* parameter that matches the *Word* parameter. The form of the patterns is the same as that used for file-name substitution.

**if** *List* **;then** *List* [**elif** *List* **;then** *List*] ... [**else** *List*] **;fi**

The *List* parameter specifies a list of commands to be run. The shell executes the **if** *List* command first. If a zero exit status is returned, it executes the **then** *List* command. Otherwise, the commands specified by the *List* parameter following the **elif** command are executed.

If the value returned by the last command in the **elif** *List* command is zero, the **then** *List* command is executed. If the value returned by the last command in the **then** *List* command is zero, the **else** *List* command is executed. If no commands specified by the *List* parameters are executed for the **else** or **then** command, the **if** command returns a zero exit status.

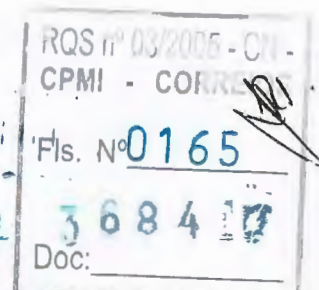
**while** *List* **;do** *List* **;done**  
**until** *List* **;do** *List* **;done**

The *List* parameter specifies a list of commands to be run. The **while** command repeatedly executes the commands specified by the *List* parameter. If the exit status of the last command in the **while** *List* command is zero, the **do** *List* command is executed. If the exit status of the last command in the **while** *List* command is not zero, the loop terminates. If no commands in the **do** *List* command are executed, then the **while** command returns a zero exit status. The **until** command might be used in place of the **while** command to negate the loop termination test.

( *List* )

The *List* parameter specifies a list of commands to run. The shell executes the *List* parameter in a separate environment.

**Note:** If two adjacent open parentheses are needed for nesting, you must insert a space between them in order to differentiate between the command and arithmetic evaluation.





{ *List* ; }

The *List* parameter specifies a list of commands to run. The *List* parameter is simply executed.

**Note:** Unlike the metacharacters ( ), { } denote reserved words (used for special purposes, not as user-declared identifiers). To be recognized, these reserved words must appear at the beginning of a line or after a ;.

[[*Expression*]]

Evaluates the *Expression* parameter. If the expression is true, the command returns a zero exit status.

**function** *Identifier* { *List* ; } or  
**function** *Identifier* () { *List* ; }

Defines a function that is referred to by the *Identifier* parameter. The body of the function is the specified list of commands enclosed by { }. The () consists of two operators, so mixing blank characters with the *identifier*, ( and ) is permitted, but is not necessary.

**time** *Pipeline*

Executes the *Pipeline* parameter. The elapsed time, user time, and system time are printed to standard error.

## Shell Startup

You can start the Korn shell with the **ksh** command, **psh** command (POSIX shell), or the **exec** command.

If the shell is started by the **exec** command, and the first character of zero argument (\$0) is the hyphen (-), then the shell is assumed to be a login shell. The shell first reads commands from the **/etc/profile** file, and then from either the **.profile** file in the current directory or from the **\$HOME/.profile** file, if either file exists. Next, the shell reads commands from the file named by performing parameter substitution on the value of the **ENV** environment variable, if the file exists.

If you specify the *File* [*Parameter*] parameter when invoking the Korn shell or POSIX shell, the shell runs the script file identified by the *File* parameter, including any parameters specified. The script file specified must have read permission; any **setuid** and **setgid** settings are ignored. The shell then reads the commands.

**Note:** Do not specify a script file with the **-c** or **-s** flags when invoking the Korn shell or POSIX shell.

For more information on positional parameters, see "Parameter Substitution in the Korn Shell or POSIX Shell" on page 152.

## Korn Shell Environment

All variables (with their associated values) known to a command at the beginning of its execution constitute its *environment*. This environment includes variables that a command inherits from its parent process and variables specified as keyword parameters on the command line that calls the command. The shell interacts with the environment in several ways. When it is started, the shell scans the environment and creates a parameter for each name found, giving the parameter the corresponding value and marking it for export. Executed commands inherit the environment.

If you modify the values of the shell parameters or create new ones using the **export** or **typeset -x** commands, the parameters become part of the environment. The environment seen by any executed command is therefore composed of any name-value pairs originally inherited by the shell, whose values might be modified by the current shell, plus any additions that resulted from using the **export** or **typeset -x** commands. The executed command (subshell) will see any modifications it makes to the environment variables it has inherited, but for its child shells or processes to see the modified values, the subshell must export these variables.

The environment for any simple command or function is changed by prefixing with one or more parameter assignments. A parameter assignment argument is a word of the form *Identifier=Value*. Thus, the two following expressions are equivalent (as far as the execution of the command is concerned):

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TERM=450 Command arguments  
(export TERM; TERM=450; Command arguments)



## Korn Shell Functions

The **function** reserved word defines shell functions. The shell reads and stores functions internally. Alias names are resolved when the function is read. The shell executes functions in the same manner as commands, with the arguments passed as positional parameters. For more information on positional parameters, refer to "Parameter Substitution in the Korn Shell or POSIX Shell" on page 152.

The Korn shell or POSIX shell executes functions in the environment from which functions are invoked. All of the following are shared by the function and the invoking script, and side effects can be produced:

- Variable values and attributes (unless you use **typeset** command within the function to declare a local variable)
- Working directory
- Aliases, function definitions, and attributes
- Special parameter \$
- Open files

The following are not shared between the function and the invoking script, and there are no side effects:

- Positional parameters.
- Special parameter #.
- Variables in a variable assignment list when the function is invoked.
- Variables declared using **typeset** command within the function.
- Options.
- Traps. However, signals ignored by the invoking script will also be ignored by the function.

**Note:** In earlier versions of the Korn shell, traps other than **EXIT** and **ERR** were shared by the function as well as the invoking script.

If trap on **0** or **EXIT** is executed inside the body of a function, the action is executed after the function completes, in the environment that called the function. If the trap is executed outside the body of a function, the action is executed upon exit from the Korn shell. In earlier versions of the Korn shell, no trap on **0** or **EXIT** outside the body of a function was executed upon exit from the function.

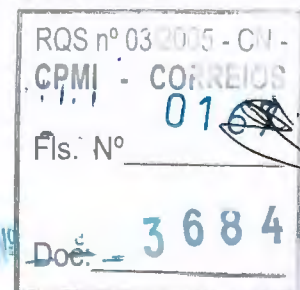
When a function is executed, it has the same syntax-error and variable-assignment properties described in "'Korn Shell or POSIX Shell Built-In Commands" on page 163.

The compound command is executed whenever the function name is specified as the name of a simple command. The operands to the command temporarily will become the positional parameters during the execution of the compound command. The special parameter # will also change to reflect the number of operands. The special parameter 0 will not change.

The **return** special command is used to return from function calls. Errors within functions return control to the caller.

Function identifiers are listed with the **-f** or **+f** option of the **typeset** special command. The **-f** option also lists the text of functions. Functions are undefined with the **-f** option of the **unset** special command.

Ordinarily, functions are unset when the shell executes a shell script. The **-xf** option of the **typeset** special command allows a function to be exported to scripts that are executed without a separate invocation of the shell. Functions that must be defined across separate invocations of the shell should be specified in the **ENV** file with the **-xf** option of the **typeset** special command.



The exit status of a function definition is zero if the function was not successfully declared. Otherwise, it will be greater than zero. The exit status of a function invocation is the exit status of the most recent command executed by the function.

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## Korn Shell or POSIX Shell Command History

The Korn shell or POSIX shell saves commands entered from your terminal device to a history file. If set, the **HISTFILE** variable value is the name of the history file. If the **HISTFILE** variable is not set or cannot be written, the history file used is **\$HOME/.sh\_history**. If the history file does not exist and the Korn shell cannot create it, or if it does exist and the Korn shell does not have permission to append to it, then the Korn shell uses a temporary file as the history file. The shell accesses the commands of all interactive shells using the same named history file with appropriate permissions.

By default, the Korn shell or POSIX shell saves the text of the last 128 commands entered from a terminal device. The history file size (specified by the **HISTSIZE** variable) is not limited, although a very large history file can cause the Korn shell to start slowly.

### Command History Substitution

Use the **fc** built-in command to list or edit portions of the history file. To select a portion of the file to edit or list, specify the number or the first character or characters of the command. You can specify a single command or range of commands.

If you do not specify an editor program as an argument to the **fc** regular built-in command, the editor specified by the **FCEDIT** variable is used. If the **FCEDIT** variable is not defined, then the **/usr/bin/ed** file is used. The edited command or commands are printed and run when you exit the editor.

The editor name hyphen (-) is used to skip the editing phase and run the command again. In this case, a substitution parameter of the form *Old=New* can be used to modify the command before it is run. For example, if **r** is aliased to **fc -e -**, then typing **r bad=good c** runs the most recent command that starts with the letter **c**, and replaces the first occurrence of the **bad** string with the **good** string.

For more information about using the history shell command, see "Listing Previously Entered Commands (history Shell Command)" on page 30 and the **fc** command in the *AIX 5L Version 5.2 Commands Reference*.

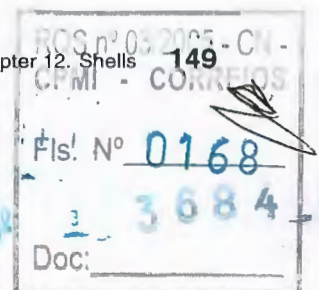
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## Quoting in the Korn Shell or POSIX Shell

When you want the Korn shell or POSIX shell to read a character as a regular character, rather than with any normally associated meaning, you must quote it. To negate the special meaning of a metacharacter, use one of the quoting mechanisms in the following list.

Each metacharacter has a special meaning to the shell and, unless quoted, causes termination of a word. The following characters are considered metacharacters by the Korn shell or POSIX shell and must be quoted if they are to represent themselves:

- pipe (**|**)
- ampersand (**&**)
- semicolon (**;**)
- less-than sign (**\$lt;**) and greater-than sign (**>**)
- left parenthesis (**(**) and right parenthesis (**)**)
- dollar sign (**\$**)
- backquote (**`**) and single quotation mark (**'**)
- backslash (**\**)
- double-quotation marks (**"**)







- newline character
- space character
- tab character

The quoting mechanisms are the backslash (\), single quotation mark ('), and double quotation marks (").

#### Backslash)

A backslash (\) that is not quoted preserves the literal value of the following character, with the exception of a newline character. If a new-line character follows the backslash, the shell interprets this as line continuation.

#### Single Quotation Marks

Enclosing characters in single quotation marks ( ' ') preserves the literal value of each character within the single quotation marks. A single quotation mark cannot occur within single quotation marks.

#### Double Quotation Marks

A backslash cannot be used to escape a single quotation mark in a string that is set in single-quotation marks. An embedded quotation mark can be created by writing, for example: 'a\'b', which yields a'b.

Enclosing characters in double quotation marks ( " ") preserves the literal value of all characters within the double quotation marks, with the exception of the dollar sign, backquote, and backslash characters, as follows:

**\$** The dollar sign retains its special meaning introducing parameter expansion, a form of command substitution, and arithmetic expansion.

The input characters within the quoted string that are also enclosed between \$( and the matching ) will not be affected by the double quotation marks, but define that command whose output replaces the \$(...) when the word is expanded.

Within the string of characters from an enclosed \${ to the matching }, there must be an even number of unescaped double quotation marks or single quotation marks, if any. A preceding backslash character must be used to escape a literal { or }.

The backquote retains its special meaning introducing the other form of command substitution. The portion of the quoted string, from the initial backquote and the characters up to the next backquote that is not preceded by a backslash, defines that command whose output replaces ` ... ` when the word is expanded.

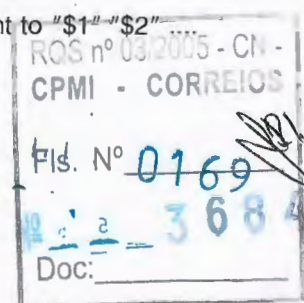
**\** The backslash retains its special meaning as an escape character only when followed by one of the following characters: \$, `, ", \, or a newline character.

A double quotation mark must be preceded by a backslash to be included within double quotation marks. When you use double quotation marks, if a backslash is immediately followed by a character that would be interpreted as having a special meaning, the backslash is deleted, and the subsequent character is taken literally. If a backslash does not precede a character that would have a special meaning, it is left in place unchanged, and the character immediately following it is also left unchanged. For example:

```
"\$"  -> $
"\a"  -> \a
```

The following conditions apply to metacharacters and quoting characters in the Korn or POSIX shell:

- The meanings of dollar sign, asterisk (\$\*) and dollar sign, at sign (\$@) are identical when not quoted, when used as a parameter assignment value, or when used as a file name.
- When used as a command argument, double quotation marks, dollar sign, asterisk, double quotation marks ("\${}") is equivalent to "\$1\${d}\$2...", where d is the first character of the IFS parameter.
- Double quotation marks, at sign, asterisk, double quotation marks ("\${}@") are equivalent to "\$1\${d}\$2"



- Inside backquotes (`), the backslash quotes the characters backslash (\), single quotation mark ('), and dollar sign (\$). If the backquotes occur within double quotation marks (" "), the backslash also quotes the double quotation marks character.
- Parameter and command substitution occurs inside double quotation marks (" ").
- The special meaning of reserved words or aliases is removed by quoting any character of the reserved word. You cannot quote function names or built-in command names.

## Reserved Words in the Korn Shell or POSIX Shell

The following reserved words have special meaning to the shell:

!	case	do
done	elif	else
esac	fi	for
function	if	in
select	then	time
until	while	{
}	[[	]]

The reserved words are recognized only when they appear without quotation marks and when the word is used as the following:

- First word of a command
- First word following one of the reserved words other than **case**, **for**, or **in**
- Third word in a **case** or **for** command (only **in** is valid in this case)

## Command Aliasing in the Korn Shell or POSIX Shell

The Korn shell, or POSIX shell, allows you to create aliases to customize commands. The **alias** command defines a word of the form `Name=String` as an alias. When you use an alias as the first word of a command line, the Korn shell checks to see if it is already processing an alias with the same name. If it is, the Korn shell does not replace the alias name. If an alias with the same name is not already being processed, the Korn shell replaces the alias name by the value of the alias.

The first character of an alias name can be any printable character, except the metacharacters. The remaining characters must be the same as for a valid identifier. The replacement string can contain any valid shell text, including the metacharacters.

If the last character of the alias value is a blank, the shell also checks the word following the alias for alias substitution. You can use aliases to redefine special built-in commands, but not to redefine reserved words. Alias definitions are not inherited across invocations of **ksh**. However, if you specify **alias -x**, the alias stays in effect for scripts invoked by name, that do not invoke a separate shell. To export an alias definition and to cause child processes to have access to them, you must specify the **alias -x**, as well as the alias definition in your environment file.

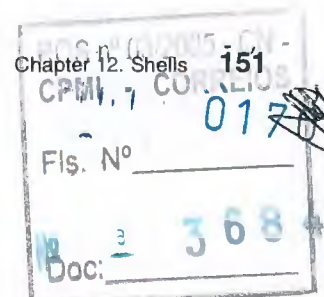
To create, list, and export aliases, use the **alias** command. To remove aliases, use the **unalias** command.

The format for creating an alias is as follows:

```
alias Name=String
```

in which the *Name* parameter specifies the name of the alias and the *String* parameter specifies the value of the alias.

The following exported aliases are predefined by the Korn shell, but can be unset or redefined. It is not recommended that you change them, because this might later confuse anyone who expects the alias to work as predefined by the Korn shell.





```

autoload='typeset -fu'
false='let 0'
functions='typeset -f'
hash='alias -t'
history='fc -l'
integer='typeset -i'
nohup='nohup '
r='fc -e -'
true=':'
type='whence -v'

```

Aliases are not supported on noninteractive invocations of the Korn shell (ksh); for example, in a shell script, or with the **-c** option in **ksh**, as in the following:

```
ksh -c alias
```

For more information about aliasing, see "Creating a Command Alias (alias Shell Command)" on page 33 and the **alias** command in the *AIX 5L Version 5.2 Commands Reference*.

## Tracked Aliases

Frequently, aliases are used as shorthand for full path names. One aliasing facility option allows you to automatically set the value of an alias to the full path name of a corresponding command. This special type of alias is a *tracked* alias. Tracked aliases speed execution by eliminating the need for the shell to search the **PATH** variable for a full path name.

The **set -h** command turns on command *tracking* so that each time a command is referenced, the shell defines the value of a tracked alias. This value is undefined each time you reset the **PATH** variable.

These aliases remain tracked so that the next subsequent reference will redefine the value. Several tracked aliases are compiled into the shell.

## Tilde Substitution

After the shell performs alias substitution, it checks each word to see if it begins with an unquoted tilde (~). If it does, the shell checks the word, up to the first slash (/), to see if it matches a user name in the **/etc/passwd** file. If the shell finds a match, it replaces the ~ character and the name with the login directory of the matched user. This process is called *tilde substitution*.

The shell does not change the original text if it does not find a match. The Korn shell also makes special replacements if the ~ character is the only character in the word or followed by plus sign (+) or hyphen (-):

- ~ Replaced by the value of the **HOME** variable.
- ~+ Replaced by the **\$PWD** variable (the full path name of the current directory).
- Replaced by the **\$OLDPWD** variable (the full path name of the previous directory).

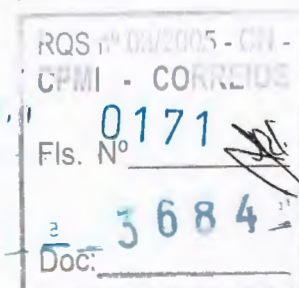
In addition, the shell attempts tilde substitution when the value of a variable assignment parameter begins with a tilde ~ character.

## Parameter Substitution in the Korn Shell or POSIX Shell

The Korn Shell, or POSIX shell, enables you to do parameter substitutions.

This section discusses the following:

- "Parameters in the Korn Shell" on page 153
- "Parameter Substitution" on page 153
- "Predefined Special Parameters" on page 154



- "Variables Set by the Korn Shell or POSIX Shell" on page 155
- "Variables Used by the Korn Shell or POSIX Shell" on page 155



## Parameters in the Korn Shell

A parameter is defined as the following:

- Identifier of any of the characters asterisk (\*), at sign (@), pound sign (#), question mark (?), hyphen (-), dollar sign (\$), and exclamation point (!). These are called *special parameters*.
- Argument denoted by a number (*positional parameter*)
- Parameter denoted by an identifier, with a value and zero or more attributes (*named parameter/variables*).

The **typeset** special built-in command assigns values and attributes to named parameters. The attributes supported by the Korn shell are described with the **typeset** special built-in command. Exported parameters pass values and attributes to the environment.

The value of a named parameter is assigned by:

Name=Value [ Name=Value ] ...

If the **-i** integer attribute is set for the *Name* parameter, the *Value* parameter is subject to arithmetic evaluation. Refer to "Arithmetic Evaluation in the Korn Shell or POSIX Shell" on page 158 for more information about arithmetic expression evaluation.

The shell supports a one-dimensional array facility. An element of an array parameter is referenced by a subscript. A subscript is denoted by an arithmetic expression enclosed by brackets ([ ]). To assign values to an array, use **set -A Name Value ...**. The value of all subscripts must be in the range of 0 through 511. Arrays need not be declared. Any reference to a named parameter with a valid subscript is legal and an array will be created, if necessary. Referencing an array without a subscript is equivalent to referencing the element 0.

Positional parameters are assigned values with the **set** special command. The **\$0** parameter is set from argument 0 when the shell is invoked. The **\$** character is used to introduce parameters that can be substituted.

## Parameter Substitution

The following are substitutable parameters:

**\${Parameter}**

The shell reads all the characters from the **\$**{ to the matching **}** as part of the same word, even if that word contains braces or metacharacters. The value, if any, of the specified parameter is substituted. The braces are required when the *Parameter* parameter is followed by a letter, digit, or underscore that is not to be interpreted as part of its name, or when a named parameter is subscripted.

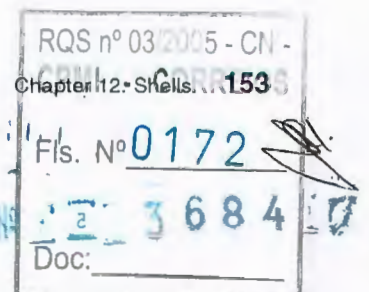
If the specified parameter contains one or more digits, it is a *positional parameter*. A positional parameter of more than one digit must be enclosed in braces. If the value of the variable is an **\*** or an **@**, each positional parameter, starting with **\$1**, is substituted (separated by a field separator character). If an array identifier with a subscript **\*** or an **@** is used, then the value for each of the elements (separated by a field separator character) is substituted.

**\${#Parameter}**

If the value of the *Parameter* parameter is an **\*** or an **@**, the number of positional parameters is substituted. Otherwise, the length specified by the *Parameter* parameter is substituted.

**\${#Identifier[\*]}**

The number of elements in the array specified by the *Identifier* parameter is substituted.





`${Parameter:-Word}`

If the *Parameter* parameter is set and is not null, then its value is substituted; otherwise, the value of the *Word* parameter is substituted.

`${Parameter:=Word}`

If the *Parameter* parameter is not set or is null, then it is set to the value of the *Word* parameter. Positional parameters cannot be assigned in this way.

`${Parameter:?Word}`

If the *Parameter* parameter is set and is not null, then substitute its value.

Otherwise, print the value of the *Word* variable and exit from the shell. If the *Word* variable is omitted, then a standard message is printed.

`${Parameter:+Word}`

If the *Parameter* parameter is set and is not null, then substitute the value of the *Word* variable.

`${Parameter#Pattern} |`

`${Parameter##Pattern}`

If the specified shell *Pattern* parameter matches the beginning of the value of the *Parameter* parameter, then the value of this substitution is the value of the *Parameter* parameter with the matched portion deleted. Otherwise, the value of the *Parameter* parameter is substituted. In the first form, the smallest matching pattern is deleted. In the second form, the largest matching pattern is deleted.

`${Parameter%Pattern} |`

`${Parameter%%Pattern}`

If the specified shell *Pattern* matches the end of the value of the *Parameter* variable, then the value of this substitution is the value of the *Parameter* variable with the matched part deleted. Otherwise, substitute the value of the *Parameter* variable. In the first form, the smallest matching pattern is deleted; in the second form, the largest matching pattern is deleted.

In the previous expressions, the *Word* variable is not evaluated unless it is to be used as the substituted string. Thus, in the following example, the **pwd** command is executed only if the **-d** flag is not set or is null:

```
echo ${d:-$(pwd)}
```

**Note:** If the **:** is omitted from the previous expressions, the shell checks only whether the *Parameter* parameter is set.

## Predefined Special Parameters

The following parameters are automatically set by the shell:

**@** Expands the positional parameters, beginning with **\$1**. Each parameter is separated by a space.

If you place **"** around **\$@**, the shell considers each positional parameter a separate string. If no positional parameters exist, the shell expands the statement to an unquoted null string.

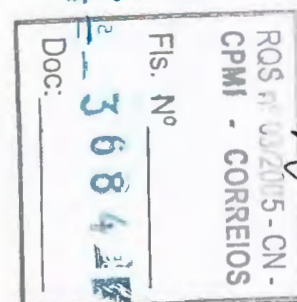
**\*** Expands the positional parameters, beginning with **\$1**. The shell separates each parameter with the first character of the **IFS** parameter value.

If you place **"** around **\$\***, the shell includes the positional parameter values in double quotation marks. Each value is separated by the first character of the **IFS** parameter.

**#** Specifies the number (in decimals) of positional parameters passed to the shell, not counting the name of the shell procedure itself. The **\$#** parameter thus yields the number of the highest-numbered positional parameter that is set. One of the primary uses of this parameter is to check for the presence of the required number of arguments.

**-** Supplies flags to the shell on invocation or with the **set** command.

**?** Specifies the exit value of the last command executed. Its value is a decimal string. Most commands return 0 to indicate successful completion. The shell itself returns the current value of the **\$?** parameter as its exit value.



**\$** Identifies the process number of this shell. Because process numbers are unique among all existing processes, this string of up to 5 digits is often used to generate unique names for temporary files.

The following example illustrates the recommended practice of creating temporary files in a directory used only for that purpose:

```
temp=$HOME/temp/$$  
ls >$temp
```

```
.  
.  
.  
rm $temp
```

**!** Specifies the process number of the most recent background command invoked.  
**zero (0)** Expands to the name of the shell or shell script.

## Variables Set by the Korn Shell or POSIX Shell

The following variables are set by the shell:

<b>underscore (_)</b>	Indicates initially the absolute path name of the shell or script being executed as passed in the environment. Subsequently, it is assigned the last argument of the previous command. This parameter is not set for commands that are asynchronous. This parameter is also used to hold the name of the matching <b>MAIL</b> file when checking for mail.
<b>ERRNO</b>	Specifies a value that is set by the most recently failed subroutine. This value is system-dependent and is intended for debugging purposes.
<b>LINENO</b>	Specifies the line number of the current line within the script or function being executed.
<b>OLDPWD</b>	Indicates the previous working directory set by the <b>cd</b> command.
<b>OPTARG</b>	Specifies the value of the last option argument processed by the <b>getopts</b> regular built-in command.
<b>OPTIND</b>	Specifies index of the last option argument processed by the <b>getopts</b> regular built-in command.
<b>PPID</b>	Identifies the process number of the parent of the shell.
<b>PWD</b>	Indicates the present working directory set by the <b>cd</b> command.
<b>RANDOM</b>	Generates a random integer, uniformly distributed between 0 and 32767. The sequence of random numbers can be initialized by assigning a numeric value to the <b>RANDOM</b> variable.
<b>REPLY</b>	Set by the <b>select</b> statement and by the <b>read</b> regular built-in command when no arguments are supplied.
<b>SECONDS</b>	Specifies the number of seconds since shell invocation is returned. If this variable is assigned a value, then the value returned upon reference will be the value that was assigned plus the number of seconds since the assignment.

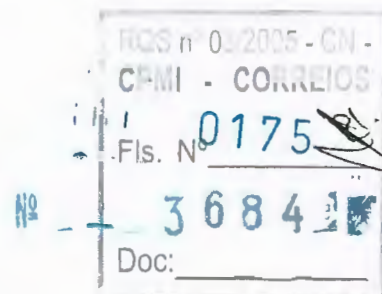
## Variables Used by the Korn Shell or POSIX Shell

The following variables are used by the shell:

<b>CDPATH</b>	Indicates the search path for the <b>cd</b> (change directory) command.
<b>COLUMNS</b>	Defines the width of the edit window for the shell edit modes and for printing <b>select</b> lists.
<b>EDITOR</b>	If the value of this parameter ends in <b>emacs</b> , <b>gmacs</b> , or <b>vi</b> , and the <b>VISUAL</b> variable is not set with the <b>set</b> special built-in command, then the corresponding option is turned on.
<b>ENV</b>	If this variable is set, then parameter substitution is performed on the value to generate the path name of the script that will be executed when the shell is invoked. This file is typically used for alias and function definitions.
<b>FCEDIT</b>	Specifies the default editor name for the <b>fc</b> regular built-in command.



<b>FPATH</b>	Specifies the search path for function definitions. This path is searched when a function with the <b>-u</b> flag is referenced and when a command is not found. If an executable file is found, then it is read and executed in the current environment.
<b>HISTFILE</b>	If this variable is set when the shell is invoked, then the value is the path name of the file that will be used to store the command history.
<b>HISTSIZE</b>	If this variable is set when the shell is invoked, then the number of previously entered commands that are accessible by this shell will be greater than or equal to this number. The default is 128.
<b>HOME</b>	Indicates the name of your login directory, which becomes the current directory upon completion of a login. The <b>login</b> program initializes this variable. The <b>cd</b> command uses the value of the <b>\$HOME</b> parameter as its default value. Using this variable rather than an explicit path name in a shell procedure allows the procedure to be run from a different directory without alterations.
<b>IFS</b>	Specifies IFS (internal field separators), normally space, tab, and newline, used to separate command words that result from command or parameter substitution and for separating words with the regular built-in command <b>read</b> . The first character of the <b>IFS</b> parameter is used to separate arguments for the <b>\$*</b> substitution.
<b>LANG</b>	Provides a default value for the <b>LC_*</b> variables.
<b>LC_ALL</b>	Overrides the value of the <b>LANG</b> and <b>LC_*</b> variables.
<b>LC_COLLATE</b>	Determines the behavior of range expression within pattern matching.
<b>LC_CTYPE</b>	Defines character classification, case conversion, and other character attributes.
<b>LC_MESSAGES</b>	Determines the language in which messages are written.
<b>LINES</b>	Determines the column length for printing select lists. Select lists print vertically until about two-thirds of lines specified by the <b>LINES</b> variable are filled.
<b>MAIL</b>	Specifies the file path name used by the mail system to detect the arrival of new mail. If this variable is set to the name of a mail file and the <b>MAILPATH</b> variable is not set, then the shell informs the user of new mail in the specified file.
<b>MAILCHECK</b>	Specifies how often (in seconds) the shell checks for changes in the modification time of any of the files specified by the <b>MAILPATH</b> or <b>MAIL</b> variables. The default value is 600 seconds. When the time has elapsed, the shell checks before issuing the next prompt.
<b>MAILPATH</b>	Specifies a list of file names separated by colons. If this variable is set, then the shell informs the user of any modifications to the specified files that have occurred during the period, in seconds, specified by the <b>MAILCHECK</b> variable. Each file name can be followed by a <b>?</b> and a message that will be printed. The message will undergo variable substitution with the <b>\$_</b> variable defined as the name of the file that has changed. The default message is you have mail in <b>\$_</b> .
<b>NLSPATH</b>	Determines the location of message catalogs for the processing of <b>LC_MESSAGES</b> .
<b>PATH</b>	Indicates the search path for commands, which is an ordered list of directory path names separated by colons. The shell searches these directories in the specified order when it looks for commands. A null string anywhere in the list represents the current directory.
<b>PS1</b>	Specifies the string to be used as the primary system prompt. The value of this parameter is expanded for parameter substitution to define the primary prompt string, which is a <b>\$</b> by default. The <b>!</b> character in the primary prompt string is replaced by the command number.
<b>PS2</b>	Specifies the value of the secondary prompt string, which is a <b>&gt;</b> by default.
<b>PS3</b>	Specifies the value of the selection prompt string used within a <b>select</b> loop, which is <b>#?</b> by default.
<b>PS4</b>	The value of this variable is expanded for parameter substitution and precedes each line of an execution trace. If omitted, the execution trace prompt is a <b>+</b> .
<b>SHELL</b>	Specifies the path name of the shell, which is kept in the environment.
<b>SHELL PROMPT</b>	When used interactively, the shell prompts with the value of the <b>PS1</b> parameter before reading a command. If at any time a new line is entered and the shell requires further input to complete a command, the shell issues the secondary prompt (the value of the <b>PS2</b> parameter).



## TMOUT

Specifies the number of seconds a shell waits inactive before exiting. If the **TMOUT** variable is set to a value greater than zero (0), the shell exits if a command is not entered within the prescribed number of seconds after issuing the **PS1** prompt. (Note that the shell can be compiled with a maximum boundary that cannot be exceeded for this value.)

**Note:** After the timeout period has expired, there is a 60-second pause before the shell exits.

## VISUAL

If the value of this variable ends in **emacs**, **gmacs**, or **vi**, then the corresponding option is turned on.

The shell gives default values to the **PATH**, **PS1**, **PS2**, **MAILCHECK**, **TMOUT**, and **IFS** parameters, but the **HOME**, **SHELL**, **ENV**, and **MAIL** parameters are *not* set by the shell (although the **HOME** parameter is set by the **login** command).

## Command Substitution in the Korn Shell or POSIX Shell

The Korn Shell, or POSIX Shell, enables you to do command substitution.

In command substitution, the shell executes a specified command in a subshell environment and replaces that command with its output. To execute command substitution in the Korn shell or POSIX shell, perform the following:

`$(command)`

or, for the backquoted version, use:

``command``

**Note:** Although the backquote syntax is accepted by **ksh**, it is considered obsolete by the X/Open Portability Guide Issue 4 and POSIX standards. These standards recommend that portable applications use the `$(command)` syntax.

The shell expands the command substitution by executing *command* in a subshell environment and replacing the command substitution (the text of *command* plus the enclosing `$( )` or backquotes) with the standard output of the command, removing sequences of one or more newline characters at the end of the substitution.

In the following example, the `$( )` surrounding the command indicates that the output of the **whoami** command is substituted:

`echo My name is: $(whoami)`

You can perform the same command substitution with:

`echo My name is: `whoami``

The output from both examples for user **dee** is:

`My name is: dee`

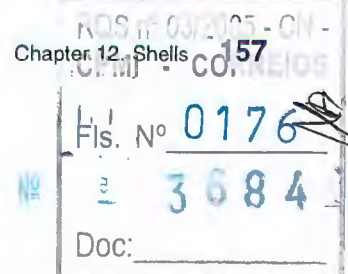
You can also substitute arithmetic expressions by enclosing them in `( )`. For example, the command:

`echo Each hour contains $((60 * 60)) seconds`

produces the following result:

`Each hour contains 3600 seconds`

The Korn shell or POSIX shell removes all trailing newline characters when performing command substitution. For example, if your current directory contains the **file1**, **file2**, and **file3** files, the command:





echo \$(ls)

removes the newline characters and produces the following output:

file1 file2 file3

To preserve newline characters, insert the substituted command in " ":

echo "\$(ls)"

## Arithmetic Evaluation in the Korn Shell or POSIX Shell

The Korn shell or POSIX shell regular built-in **let** command enables you to perform integer arithmetic. Constants are of the form *[Base]Number*. The *Base* parameter is a decimal number between 2 and 36 inclusive, representing the arithmetic base. The *Number* parameter is a number in that base. If you omit the *Base* parameter, the shell uses a base of 10.

Arithmetic expressions use the same syntax, precedence, and associativity of expression as the C language. All of the integral operators, other than double plus (++), double hyphen (--), question mark (?), colon (:), and comma (,), are supported. The following table lists valid Korn shell or POSIX shell operators in decreasing order of precedence:

Operator	Definition
-	Unary minus
!	Logical negation
~	Bitwise negation
*	Multiplication
/	Division
%	Remainder
+	Addition
-	Subtraction
<<, >>	Left shift, right shift
<=, >=, <, >, ==, !=	Comparison
&	Bitwise AND
^	Bitwise exclusive OR
	Bitwise OR
&&	Logical AND
	Logical OR
= *=, /=, &= +=, -=, <<=, >=, &=, ^=,  =	Assignment

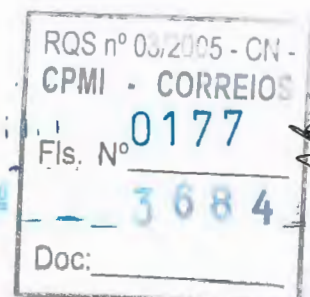
Many arithmetic operators, such as \*, &, <, and >, have special meaning to the Korn shell or POSIX shell. These characters must be quoted. For example, to multiply the current value of *y* by 5 and reassign the new value to *y*, use the expression:

```
let "y = y * 5"
```

Enclosing the expression in quotation marks removes the special meaning of the \* character.

You can group operations inside **let** command expressions to force grouping. For example, in the expression:

```
let "z = q * (z - 10)"
```



the command multiplies *q* by the reduced value of *z*.

The Korn shell or POSIX shell includes an alternative form of the **let** command if only a single expression is to be evaluated. The shell treats commands enclosed in `(( ))` as quoted expressions. Therefore, the expression:

```
((x = x / 3))
```

is equivalent to:

```
let "x = x / 3"
```

Named parameters are referenced by name within an arithmetic expression without using the parameter substitution syntax. When a named parameter is referenced, its value is evaluated as an arithmetic expression.

Specify an internal integer representation of a named parameter with the **-i** flag of the **typeset** special built-in command. Using the **-i** flag, arithmetic evaluation is performed on the value of each assignment to a named parameter. If you do not specify an arithmetic base, the first assignment to the parameter determines the arithmetic base. This base is used when parameter substitution occurs.

---

## Field Splitting in the Korn Shell or POSIX Shell

After performing command substitution, the Korn shell scans the results of substitutions for those field separator characters found in the **IFS** (Internal Field Separator) variable. Where such characters are found, the shell splits the substitutions into distinct arguments. The shell retains explicit null arguments ("`''`" or "`''`") and removes implicit null arguments (those resulting from parameters that have no values).

- If the value of **IFS** is a space, tab and newline character, or if it is not set, any sequence of space, tab and newline characters at the beginning or end of the input will be ignored and any sequence of those characters within the input will delimit a field. For example, the following input yields two fields, **school** and **days**:

```
<newline><space><tab>school<tab><tab>days<space>
```

- Otherwise, and if the value of **IFS** is not null, the following rules apply in sequence. **IFS white space** is used to mean any sequence (zero or more instances) of white-space characters that are in the **IFS** value (for example, if **IFS** contains space/comma/tab, any sequence of space and tab characters is considered **IFS white space**).
  1. **IFS white space** is ignored at the beginning and end of the input.
  2. Each occurrence in the input of an **IFS** character that is not **IFS white space**, along with any adjacent **IFS white space**, delimits a field.
  3. Non-zero length **IFS white space** delimits a field.

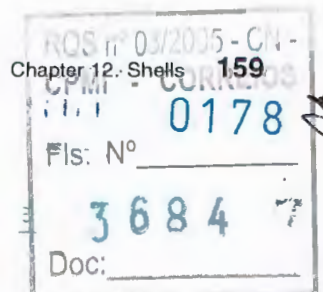
---

## File-Name Substitution in the Korn Shell or POSIX Shell

The Korn shell, or POSIX shell, performs file-name substitution by scanning each command word specified by the *Word* variable for certain characters. If a command word includes the `*`, `?` or `[` characters, and the **-f** flag has not been set, the shell regards the word as a pattern. The shell replaces the word with file names, sorted according to the collating sequence in effect in the current locale, that match that pattern. If the shell does not find a file name to match the pattern, it does not change the word.

When the shell uses a pattern for file-name substitution, the `.` and `/` characters must be matched explicitly.

**Note:** The Korn shell does not treat these characters specially in other instances of pattern matching.





These pattern-matching characters indicate the following substitutions:

- \* Matches any string, including the null string.
- ? Matches any single character.
- [...] Matches any one of the enclosed characters. A pair of characters separated by a - matches any character lexically within the inclusive range of that pair, according to the collating sequence in effect in the current locale. If the first character following the opening [ is an !, then any character not enclosed is matched. A - can be included in the character set by putting it as the first or last character.

You can also use the [:charclass:] notation to match file names within a range indication. This format instructs the system to match any single character belonging to class. The definition of which characters constitute a specific character class is present through the **LC\_CTYPE** category of the **setlocale** subroutine. All character classes specified in the current locale are recognized.

The names of some of the character classes are as follows:

- **alnum**
- **alpha**
- **cntrl**
- **digit**
- **graph**
- **lower**
- **print**
- **punct**
- **space**
- **upper**
- **xdigit**

For example, [:upper:] matches any uppercase letter.

The Korn shell supports file-name expansion based on collating elements, symbols, or equivalence classes.

A *PatternList* is a list of one or more patterns separated from each other with a |. Composite patterns are formed with one or more of the following:

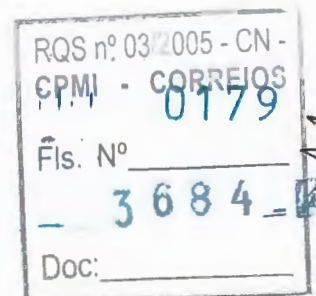
- |                |  |
|----------------|--|
| ?(PatternList) | Optionally matches any one of the given patterns       |
| *(PatternList) | Matches zero or more occurrences of the given patterns |
| +(PatternList) | Matches one or more occurrences of the given patterns  |
| @(PatternList) | Matches exactly one of the given patterns              |
| !(PatternList) | Matches anything, except one of the given patterns     |

Pattern matching has some restrictions. If the first character of a file name is a dot (.), it can be matched only by a pattern that also begins with a dot. For example, \* matches the file names myfile and yourfile but not the file names .myfile and .yourfile. To match these files, use a pattern such as the following:

.\*file

If a pattern does not match any file names, then the pattern itself is returned as the result of the attempted match.

File and directory names should not contain the characters \*, ? , [ , or ] because they can cause infinite recursion (that is, infinite loops) during pattern-matching attempts.



## Quote Removal

The quote characters, backslash (\), single quote ('), and double quote (") that were present in the original word will be removed unless they have themselves been quoted.

## Input and Output Redirection in the Korn Shell or POSIX Shell

Before the Korn shell executes a command, it scans the command line for redirection characters. These special notations direct the shell to redirect input and output. Redirection characters can appear anywhere in a simple command or can precede or follow a command. They are not passed on to the invoked command.

The shell performs command and parameter substitution before using the *Word* or *Digit* parameter except as noted. File-name substitution occurs only if the pattern matches a single file and blank interpretation is not performed.

< <i>Word</i>	Uses the file specified by the <i>Word</i> parameter as standard input (file descriptor 0).
> <i>Word</i>	Uses the file specified by the <i>Word</i> parameter as standard output (file descriptor 1). If the file does not exist, the shell creates it. If the file exists and the <b>noclobber</b> option is on, an error results; otherwise, the file is truncated to zero length.
>  <i>Word</i>	Same as the > <i>Word</i> command, except that this redirection statement overrides the <b>noclobber</b> option.
>> <i>Word</i>	Uses the file specified by the <i>Word</i> parameter as standard output. If the file currently exists, the shell appends the output to it (by first seeking the end-of-file character). If the file does not exist, the shell creates it.
<> <i>Word</i>	Opens the file specified by the <i>Word</i> parameter for reading and writing as standard input.
<<[-] <i>Word</i>	Reads each line of shell input until it locates a line containing only the value of the <i>Word</i> parameter or an end-of-file character. The shell does not perform parameter substitution, command substitution, or file name substitution on the file specified. The resulting document, called a <i>here document</i> , becomes the standard input. For more information on here documents, see "Using Inline Input (Here) Documents" on page 48". If any character of the <i>Word</i> parameter is quoted, no interpretation is placed upon the characters of the document.

The here document is treated as a single word that begins after the next newline character and continues until there is a line containing only the delimiter, with no trailing blank characters. Then the next here document, if any, starts. The format is as follows:

```
[n]<<word
    here document
delimiter
```

If any character in *word* is quoted, the delimiter is formed by removing the quote on *word*. The here document lines will not be expanded. Otherwise, the delimiter is the *word* itself. If no characters in *word* are quoted, all lines of the here document will be expanded for parameter expansion, command substitution, and arithmetic expansion.

The shell performs parameter substitution for the redirected data. To prevent the shell from interpreting the \, \$, and single quotation mark (') characters and the first character of the *Word* parameter, precede the characters with a \ character.

If a - is appended to <<, the shell strips all leading tabs from the *Word* parameter and the document.

<& <i>Digit</i>	Duplicates standard input from the file descriptor specified by the <i>Digit</i> parameter
>& <i>Digit</i>	Duplicates standard output in the file descriptor specified by the <i>Digit</i> parameter
<&-	Closes standard input
>&-	Closes standard output
<&p	Moves input from the coprocess to standard input

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>&p

Moves output to the coprocess to standard output

If one of these redirection options is preceded by a digit, then the file descriptor number referred to is specified by the digit (instead of the default 0 or 1). In the following example, the shell opens file descriptor 2 for writing as a duplicate of file descriptor 1:

```
... 2>&1
```

The order in which redirections are specified is significant. The shell evaluates each redirection in terms of the (*FileDescriptor*, *File*) association at the time of evaluation. For example, in the statement:

```
... 1>File 2>&1
```

the file descriptor 1 is associated with the file specified by the *File* parameter. The shell associates file descriptor 2 with the file associated with file descriptor 1 (*File*). If the order of redirections were reversed, file descriptor 2 would be associated with the terminal (assuming file descriptor 1 had previously been) and file descriptor 1 would be associated with the file specified by the *File* parameter.

If a command is followed by an ampersand (&) and job control is not active, the default standard input for the command is the empty file, */dev/null*. Otherwise, the environment for the execution of a command contains the file descriptors of the invoking shell as modified by input and output specifications.

For more information about redirection, see Chapter 5, "Input and Output Redirection" on page 45.

## Coprocess Facility

The Korn shell, or POSIX shell, allows you to run one or more commands as background processes. These commands, run from within a shell script, are called *coprocesses*.

Designate a coprocess by placing the **I&** operator after a command. Both standard input and output of the command are piped to your script.

A coprocess must meet the following restrictions:

- Include a newline character at the end of each message
- Send each output message to standard output
- Clear its standard output after each message

The following example demonstrates how input is passed to and returned from a coprocess:

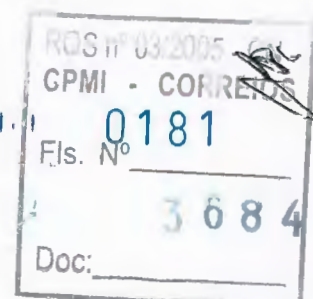
```
echo "Initial process"
./FileB.sh |&
read -p a b c d
echo "Read from coprocess: $a $b $c $d"
print -p "Passed to the coprocess"
read -p a b c d
echo "Passed back from coprocess: $a $b $c $d"

FileB.sh
  echo "The coprocess is running"
  read a b c d
  echo $a $b $c $d
```

The resulting standard output is as follows:

```
Initial process
Read from coprocess: The coprocess is running
Passed back from coprocess: Passed to the coprocess
```

To write to the coprocess, use the **print -p** command. To read from the coprocess, use the **read -p** command.



## Redirecting Coprocess Input and Output

The standard input and output of a coprocess is reassigned to a numbered file descriptor by using I/O redirection. For example, the command:

```
exec 5>&p
```

moves the input of the coprocess to file descriptor 5.

After this has completed, you can use standard redirection syntax to redirect command output to the coprocess. You can also start another coprocess. Output from both coprocesses is connected to the same pipe and is read with the **read -p** command. To stop the coprocess, type:

```
read -u5
```

---

## Exit Status in the Korn Shell or POSIX Shell

Errors detected by the shell, such as syntax errors, cause the shell to return a nonzero exit status. Otherwise, the shell returns the exit status of the last command carried out. The shell reports detected run-time errors by printing the command or function name and the error condition. If the number of the line on which an error occurred is greater than 1, then the line number is also printed in [ ] (brackets) after the command or function name.

For a noninteractive shell, an error encountered by a special built-in or other type of command will cause the shell to write a diagnostic message as shown in the following table:

Error	Special Built-In	Other Utilities
Shell language syntax error	will exit	will exit
Utility syntax error (option or operand error)	will exit	will not exit
Redirection error	will exit	will not exit
Variable assignment error	will exit	will not exit
Expansion error	will exit	will exit
Command not found	not applicable	may exit
Dot script not found	will exit	not applicable

If any of the errors shown as "will (may) exit" occur in a subshell, the subshell will (may) exit with a nonzero status, but the script containing the subshell will not exit because of the error.

In all cases shown in the table, an interactive shell will write a diagnostic message to standard error, without exiting.

---

## Korn Shell or POSIX Shell Built-In Commands

Special commands are built in to the Korn shell and POSIX shell and executed in the shell process. Unless otherwise indicated, the output is written to file descriptor 1 and the exit status is zero (0) if the command does not contain any syntax errors. Input and output redirection is permitted. There are two types of built-in commands, *special built-in commands* and *regular built-in commands*.

Special built-in commands differ from regular built-in commands in the following ways:

- A syntax error in a special built-in command might cause the shell executing the command to end. This does not happen if you have a syntax error in a regular built-in command. If a syntax error in a special built-in command does not end the shell program, the exit value is nonzero.



- Variable assignments specified with special built-in commands remain in effect after the command completes.
- I/O redirections are processed after parameter assignments.

In addition, words that are in the form of a parameter assignment following the **export**, **readonly**, and **typeset** special commands are expanded with the same rules as a parameter assignment. Tilde substitution is performed after the =, and word-splitting and file-name substitution are not performed.

For an alphabetical listing of these commands, refer to the "List of Korn Shell or POSIX Shell Built-in Commands" on page 173

## Special Built-in Command Descriptions

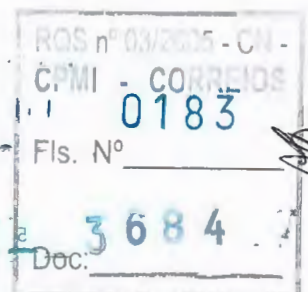
The Korn Shell provides the following special built-in commands:

:	eval	newgrp	shift
.	exec	readonly	times
break	exit	return	trap
continue	export	set	typeset
			unset

- :** *[Argument ...]* Expands only arguments. It is used when a command is necessary, as in the *then* condition of an *if* command, but nothing is to be done by the command.
- .** *File [Argument ...]* Reads the complete specified file and then executes the commands. The commands are executed in the current shell environment. The search path specified by the **PATH** variable is used to find the directory containing the specified file. If any arguments are specified, they become the positional parameters. Otherwise, the positional parameters are unchanged. The exit status is the exit status of the most recent command executed. Refer to "Parameter Substitution in the Korn Shell or POSIX Shell" on page 152 for more information on positional parameters.

**Note:** The *.File [Argument ...]* command reads the entire file before any commands are carried out. Therefore, the **alias** and **unalias** commands in the file do not apply to any functions defined in the file.

- break** *[n]* Exits from the enclosing **for**, **while**, **until**, or **select** loop, if one exists. If you specify the *n* parameter, the command breaks the number of levels specified by the *n* parameter. The value of *n* is any integer equal to or greater than 1.
- continue** *[n]* Resumes the next iteration of the enclosing **for**, **while**, **until**, or **select** loop. If you specify the *n* variable, the command resumes at the *n*th enclosing loop. The value of *n* is any integer equal to or greater than 1.
- eval** *[Argument ...]* Reads the specified arguments as input to the shell and executes the resulting command or commands.
- exec** *[Argument ...]* Executes the command specified by the argument in place of this shell (without creating a new process). Input and output arguments can appear and affect the current process. If you do not specify an argument, the **exec** command modifies file descriptors as prescribed by the input and output redirection list. In this case, any file descriptor numbers greater than 2 that are opened with this mechanism are closed when invoking another program.
- exit** *[n]* Exits the shell with the exit status specified by the *n* parameter. The *n* parameter must be an unsigned decimal integer with range 0-255. If you omit the *n* parameter, the exit status is that of the most recent command executed. An end-of-file character also exits the shell, unless the **ignoreeof** option of the **set** special command is turned on.
- export -p** *[Name[= Value]] ...* Marks the specified names for automatic export to the environment of subsequently executed commands.
- p** writes to standard output the names and values of all exported variables, in the following format:
- "export %s= %s\n", <name> <value>



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**newgrp** [*Group*]

Equivalent to the **exec/usr/bin/newgrp** [*Group*] command.

**readonly -p** [*Name*[=*Value*]] ...

**Note:** This command does not return.

Marks the names specified by the *Name* parameter as read-only. These names cannot be changed by subsequent assignment.

**-p** writes to standard output the names and values of all exported variables, in the following format:

"export %s= %s\n", <name> <value>

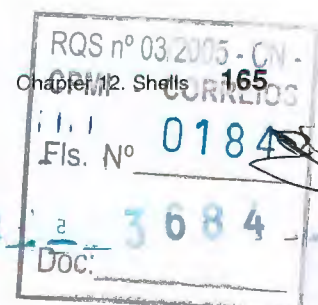
**return** [*n*]

Causes a shell function to return to the invoking script. The return status is specified by the *n* variable. If you omit the *n* variable, the return status is that of the most recent command executed. If you invoke the **return** command outside of a function or a script, then it is the same as an **exit** command.

**set** [+  
|-abCefhkmnostuvx ]  
[+ |-o *Option*]... [+ |-A  
*Name*] [*Argument* ...]

If no options or arguments are specified, the **set** command writes the names and values of all shell variables in the collation sequence of the current locale. When options are specified, they will set or unset attributes of the shell, described as follows:

- A** Array assignment. Unsets the *Name* parameter and assigns values sequentially from the specified *Argument* parameter list. If the **+A** flag is used, the *Name* parameter is not unset first.
- a** Exports automatically all subsequent parameters that are defined.
- b** Notifies the user asynchronously of background job completions.
- C** Equivalent to set -o noclobber.
- e** Executes the **ERR** trap, if set, and exits if a command has a nonzero exit status. This mode is disabled while reading profiles.
- f** Disables file name substitution.
- h** Designates each command as a tracked alias when first encountered.
- k** Places all parameter-assignment arguments in the environment for a command, not only those arguments that precede the command name.
- m** Runs background jobs in a separate process and prints a line upon completion. The exit status of background jobs is reported in a completion message. On systems with job control, this flag is turned on automatically for interactive shells. For more information, see "Job Control in the Korn Shell or POSIX Shell" on page 175.
- n** Reads commands and checks them for syntax errors, but does not execute them. This flag is ignored for interactive shells.





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**-o Option**

Prints current option settings and an error message if you do not specify an argument. You can set more than one option on a single **ksh** command line. If the **+o** flag is used, the specified option is unset. When arguments are specified, they will cause positional parameters to be set or unset. Arguments, as specified by the *Option* variable, can be one of the following:

**allexport**

Same as the **-a** flag.

**bgnice**

Runs all background jobs at a lower priority. This is the default mode.

**emacs**

Enters an emacs-style inline editor for command entry.

**errexit** Same as the **-e** flag.

**gmacs**

Enters a gmacs-style inline editor for command entry.

**ignoreeof**

Does not exit the shell when it encounters an end-of-file character. To exit the shell, you must use the **exit** command, or press the Ctrl-D key sequence more than 11 times.

**keyword**

Same as the **-k** flag.

**Note:** This flag is for backward compatibility with the Bourne shell only. Its use is strongly discouraged.

**markdirs**

Appends a / to all directory names that are a result of file-name substitution.

**monitor**

Same as the **-m** flag.

**noclobber**

Prevents redirection from truncating existing files. When you specify this option, a vertical bar must follow the redirection symbol (>|) to truncate a file.

**noexec**

Same as the **-n** flag.

**noglob**

Same as the **-f** flag.

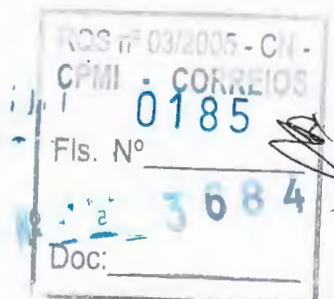
**nolog** Prevents function definitions in .profile and \$ENV files from being saved in the history file.

**nounset**

Same as the **-u** flag.

**privileged**

Same as the **-p** flag.



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**trackall**

Same as the **-h** flag.

**verbose**

Same as the **-v** flag.

**vi**

Enters the insert mode of a vi-style inline editor for command entry. Entering escape character 033 puts the editor into the move mode. A return sends the line.

**viraw**

Processes each character as it is typed in vi mode.

**xtrace**

Same as the **-x** flag.

**-p**

Disables processing of the **\$HOME/.profile** file and uses the **/etc/suid\_profile** file instead of the **ENV** file. This mode is enabled whenever the effective user ID (UID) or group ID (GID) is not equal to the real UID or GID. Turning off this option sets the effective UID or GID to the real UID and GID.

**Note:** The system does not support the **-p** option since the operating system does not support **setuid** shell scripts.

**-s**

Sorts the positional parameters lexicographically.

**-t**

Exits after reading and executing one command.

**Note:** This flag is for backward compatibility with the Bourne shell only. Its use is strongly discouraged.

**-u**

Treats unset parameters as errors when substituting.

**-v**

Prints shell input lines as they are read.

**-x**

Prints commands and their arguments as they are executed.

**-**

Turns off the **-x** and **-v** flags and stops examining arguments for flags.

**—**

Prevents any flags from being changed. This option is useful in setting the **\$1** parameter to a value beginning with a **-**. If no arguments follow this flag, the positional parameters are not set.

Preceding any of the **set** command flags with a **+** rather than a **-** turns off the flag. You can use these flags when you invoke the shell. The current set of flags is found in the **\$-** parameter. Unless you specify the **-A** flag, the remaining arguments are positional parameters and are assigned, in order, to **\$1**, **\$2**, ..., and so forth. If no arguments are given, the names and values of all named parameters are printed to standard output.

Renames the positional parameters, beginning with **\$n+1** ... through **\$1** .... The default value of the **n** parameter is 1. The **n** parameter is any arithmetic expression that evaluates to a nonnegative number less than or equal to the **\$#** parameter.

Prints the accumulated user and system times for the shell and for processes run from the shell.

shift [n]

times

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**trap** [*Command*]  
[*Signal*] ...

Runs the specified command when the shell receives the specified signal or signals. The *Command* parameter is read once when the trap is set and once when the trap is taken. The *Signal* parameter can be given as a number or as the name of the signal. Trap commands are executed in order of signal number. Any attempt to set a trap on a signal that was ignored on entry to the current shell is ineffective.

If the command is a -, all traps are reset to their original values. If you omit the command and the first signal is a numeric signal number, then the **ksh** command resets the value of the *Signal* parameter or parameters to the original values.

**Note:** If you omit the command and the first signal is a symbolic name, the signal is interpreted as a command.

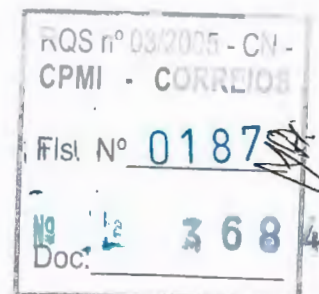
If the value of the *Signal* parameter is the **ERR** signal, the specified command is carried out whenever a command has a nonzero exit status. If the signal is **DEBUG**, then the specified command is carried out after each command. If the value of the *Signal* parameter is the **0** or **EXIT** signal and the **trap** command is executed inside the body of a function, the specified command is carried out after the function completes. If the *Signal* parameter is **0** or **EXIT** for a **trap** command set outside any function, the specified command is carried out on exit from the shell. The **trap** command with no arguments prints a list of commands associated with each signal number.

For a complete list of *Signal* parameter values, used in the **trap** command without the **SIG** prefix, refer to the **sigaction**, **sigvec**, or **signal** subroutine in the *AIX 5L Version 5.2 Technical Reference: Base Operating System and Extensions Volume 2*.

**typeset** [+HLRZfirtux  
[*n*]] [*Name*[= *Value*]] ...

Sets attributes and values for shell parameters. When invoked inside a function, a new instance of the *Name* parameter is created. The parameter value and type are restored when the function completes. You can specify the following flags with the **typeset** command:

- H** Provides AIX-to-host-file mapping on non-AIX machines.
- L** Left-justifies and removes leading blanks from the *Value* parameter. If the *n* parameter has a nonzero value, it defines the width of the field; otherwise, it is determined by the width of the value of its first assignment. When the parameter is assigned, it is filled on the right with blanks or truncated, if necessary, to fit into the field. Leading zeros are removed if the **-Z** flag is also set. The **-R** flag is turned off.
- R** Right-justifies and fills with leading blanks. If the *n* parameter has a nonzero value, it defines the width of the field; otherwise, it is determined by the width of the value of its first assignment. The field remains filled with blanks or is truncated from the end if the parameter is reassigned. The **L** flag is turned off.
- Z** Right-justifies and fills with leading zeros if the first nonblank character is a digit and the **-L** flag has not been set. If the *n* parameter has a nonzero value, it defines the width of the field; otherwise, it is determined by the width of the value of its first assignment.
- f** Indicates that the names refer to function, rather than parameter, names. No assignments can be made and the only other valid flags are **-t**, **-u**, and **-x**. The **-t** flag turns on execution tracing for this function. The **-u** flag causes this function to be marked undefined. The **FPATH** variable is searched to find the function definition when the function is referenced. The **-x** flag allows the function definition to remain in effect across shell scripts that are not a separate invocation of the **ksh** command.
- i** Identifies the parameter as an integer, making arithmetic faster. If the *n* parameter has a nonzero value, it defines the output arithmetic base; otherwise, the first assignment determines the output base.
- l** Converts all uppercase characters to lowercase. The **-u** uppercase conversion flag is turned off.
- r** Marks the names specified by the *Name* parameter as read-only. These names cannot be changed by subsequent assignment.



- t Tags the named parameters. Tags can be defined by the user and have no special meaning to the shell.
- u Converts all lowercase characters to uppercase characters. The -l lowercase flag is turned off.
- x Marks the name specified by the *Name* parameter for automatic export to the environment of subsequently executed commands.

Using a + rather than a - turns off the **typeset** command flags. If you do not specify *Name* parameters but do specify flags, a list of names (and optionally the values) of the parameters that have these flags set is printed. (Using a + rather than a - keeps the values from being printed.) If you do not specify any names or flags, the names and attributes of all parameters are printed.

**unset [-fv ] *Name* ...**

Unsets the values and attributes of the parameters given by the list of names. If -v is specified, *Name* refers to a variable name, and the shell will unset it and remove it from the environment. Read-only variables cannot be unset. Unsetting the **ERRNO**, **LINENO**, **MAILCHECK**, **OPTARG**, **OPTIND**, **RANDOM**, **SECONDS**, **TMOU**, and underscore ( `_` ) variables removes their special meanings even if they are subsequently assigned.

If the -f flag is set, then *Name* refers to a function name, and the shell will unset the function definition.

## Regular Built-in Command Descriptions

The Korn Shell provides the following regular built-in commands:

alias	fg	print	ulimit
bg	getopts	pwd	umask
cd	jobs	read	unalias
command	kill	setgroups	wait
echo	let	test	whence
fc			

**alias [-t ] [-x ]**  
**[*AliasName*[= *String*]]**  
 ...

Creates or redefines alias definitions or writes existing alias definitions to standard output.

For more information, refer to the **alias** command in the *AIX 5L Version 5.2 Commands Reference*.

**bg [*JobID*...]**

Puts each specified job into the background. The current job is put in the background if a *JobID* parameter is not specified. Refer to "Job Control in the Korn Shell or POSIX Shell" on page 175 for more information about job control.

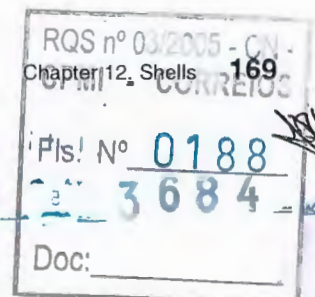
For more information about running jobs in the background, refer to the **bg** command in the *AIX 5L Version 5.2 Commands Reference*.

**cd [*Argument*]**  
**cd *Old New***

This command can be in either of two forms. In the first form, it changes the current directory to the one specified by the *Argument* parameter. If the value of the *Argument* parameter is -, the directory is changed to the previous directory. The **HOME** shell variable is the default value of the *Argument* parameter. The **PWD** variable is set to the current directory.

The **CDPATH** shell variable defines the search path for the directory containing the value of the *Argument* parameter. Alternative directory names are separated by a :. The default path is null, specifying the current directory. The current directory is specified by a null path name, which appears immediately after the equal sign or between the colon delimiters anywhere in the path list. If the specified argument begins with a /, the search path is not used. Otherwise, each directory in the path is searched for the argument.

The second form of the **cd** command substitutes the string specified by the *New* variable for the string specified by the *Old* variable in the current directory name, **PWD**, and tries to change to this new directory.





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**command** [-p ]

*CommandName*

[*Argument ...*]

**command** [-v | -V ]

*CommandName*

Causes the shell to treat the specified command and arguments as a simple command, suppressing shell-function lookup.

For more information, refer to the **command** command in the *AIX 5L Version 5.2 Commands Reference*.

**echo** [*String ...*]

Writes character strings to standard output. Refer to the **echo** command for usage and description. The **-n** flag is not supported.

**fc** [-r ] [-e *Editor*] [*First*

[*Last*]

**fc** -l [-n ] [-r ] [*First*

[*Last*]

**fc** -s [*Old= New*] [*First*]

Displays the contents of your command history file or invokes an editor to modify and re-executes commands previously entered in the shell.

For more information, refer to the **fc** command in the *AIX 5L Version 5.2 Commands Reference*.

**fg** [*JobID*]

Brings each job specified into the foreground. If you do not specify any jobs, the command brings the current job into the foreground.

For more information about running jobs in the foreground, refer to the **fg** command in the *AIX 5L Version 5.2 Commands Reference*.

**getopts** *OptionString*

*Name* [*Argument ...*]

Checks the *Argument* parameter for legal options.

For more information, refer to the **getopts** command in the *AIX 5L Version 5.2 Commands Reference*.

**jobs** [-l | -n | -p ]

[*JobID ...*]

Displays the status of jobs started in the current shell environment. If no specific job is specified with the *JobID* parameter, status information for all active jobs is displayed. If a job termination is reported, the shell removes that job's process ID from the list of those known by the current shell environment.

For more information, refer to the **jobs** command in the *AIX 5L Version 5.2 Commands Reference*.

**kill** [ -s { *SignalName* |

*SignalNumber* } ]

*ProcessID...*

**kill** [ -*SignalName* |

-*SignalNumber* ]

*ProcessID...*

**kill** -l [ *ExitStatus* ]

Sends a signal (by default, the **SIGTERM** signal) to a running process. This default action normally stops processes. If you want to stop a process, specify the process ID (PID) in the *ProcessID* variable. The shell reports the PID of each process that is running in the background (unless you start more than one process in a pipeline, in which case the shell reports the number of the last process). You can also use the **ps** command to find the process ID number of commands.

Lists signal names.

For more information, refer to the **kill** command in the *AIX 5L Version 5.2 Commands Reference*.

**let** *Expression ...*

Evaluates specified arithmetic expressions. The exit status is 0 if the value of the last expression is nonzero, and 1 otherwise. Refer to "Arithmetic Evaluation in the Korn Shell or POSIX Shell" on page 158 for more information.

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**print** [-Rnprsu *[n]*]  
[*Argument ...*]

Prints shell output. If you do not specify any flags, or if the hyphen (-) or double hyphen (==) flags are specified, the arguments are printed to standard output as described by the **echo** command. The flags do the following:

- R Prints in raw mode (the escape conventions of the **echo** command are ignored). The -R flag prints all subsequent arguments and flags other than -n.
- n Prevents a new-line character from being added to the output.
- p Writes the arguments to the pipe of the process run with **I&** instead of to standard output.
- r Prints in raw mode. The escape conventions of the **echo** command are ignored.
- s Writes the arguments to the history file instead of to standard output.
- u Specifies a one-digit file descriptor unit number, *n*, on which the output is placed. The default is 1.

**pwd**

Equivalent to **print -r - \$PWD**.

**read** [-prsu *[n]*]  
[*Name?Prompt*]  
[*Name...*]

**Note:** The internal Korn shell **pwd** command does not support symbolic links.

Takes shell input. One line is read and broken up into fields, using the characters in the **IFS** variable as separators.

For more information, refer to the **read** command in the *AIX 5L Version 5.2 Commands Reference*.

**setgroups**

Executes the **/usr/bin/setgroups** command, which runs as a separate shell. See the **setgroups** command for information on this command. There is one difference, however. The **setgroups** built-in command invokes a subshell, but the **setgroups** command replaces the currently executing shell. Because the built-in command is supported only for compatibility, it is recommended that scripts use the absolute path name **/usr/bin/setgroups** rather than the shell built-in command.

**test**

Same as [*expression*]. See "Conditional Expressions for the Korn Shell or POSIX Shell" on page 174 for usage and description.

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**ulimit** [-HSacdfmst ]  
[Limit]

Sets or displays user-process resource limits as defined in the **/etc/security/limits** file. This file contains the following default limits:

```
fsize = 2097151
core = 2048
cpu = 3600
data = 131072
rss = 65536
stack = 8192
```

These values are used as default settings when a user is added to the system. The values are set with the **mkuser** command when the user is added to the system, or changed with the **chuser** command.

Limits are categorized as either soft or hard. Users might change their soft limits, up to the maximum set by the hard limits, with the **ulimit** command. You must have root user authority to change resource hard limits.

Many systems do not contain one or more of these limits. The limit for a specified resource is set when the *Limit* parameter is specified. The value of the *Limit* parameter can be a number in the unit specified with each resource, or the value **unlimited**. You can specify the following **ulimit** command flags:

- H** Specifies that the hard limit for the given resource is set. If you have root user authority, you can increase the hard limit. Any user can decrease it.
- S** Specifies that the soft limit for the given resource is set. A soft limit can be increased up to the value of the hard limit. If neither the **-H** or **-S** options are specified, the limit applies to both.
- a** Lists all of the current resource limits.
- c** Specifies the number of 512-byte blocks on the size of core dumps.
- d** Specifies the size, in KB, of the data area.
- f** Specifies the number of 512-byte blocks for files written by child processes (files of any size can be read).
- m** Specifies the number of KB for the size of physical memory.
- n** Specifies the limit on the number of file descriptors a process might have open.
- s** Specifies the number of KB for the size of the stack area.
- t** Specifies the number of seconds to be used by each process.

The current resource limit is printed when you omit the *Limit* variable. The soft limit is printed unless you specify the **-H** flag. When you specify more than one resource, the limit name and unit is printed before the value. If no option is given, the **-f** flag is assumed. When you change the value, set both hard and soft limits to *Limit* unless you specify **-H** or **-S**.

For more information about user and system resource limits, refer to the **getrlimit**, **setrlimit**, or **vlimit** subroutine in the *AIX 5L Version 5.2 Technical Reference: Base Operating System and Extensions Volume 1*.

**umask** [-S ] [Mask]

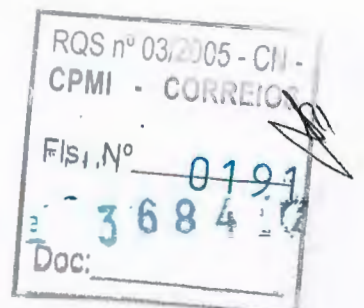
Determines file permissions. This value, along with the permissions of the creating process, determines a file's permissions when the file is created. The default is 022. If the *Mask* parameter is not specified, the **umask** command displays to standard output the file-mode creation mask of the current shell environment.

For more information about file permissions, refer to the **umask** command in the *AIX 5L Version 5.2 Commands Reference*.

**unalias** { -a |  
AliasName... }

Removes the definition for each alias name specified, or removes all alias definitions if the **-a** flag is used. Alias definitions are removed from the current shell environment.

For more information, refer to the **unalias** command in the *AIX 5L Version 5.2 Commands Reference*.



**wait** [*ProcessID*...]

Waits for the specified job and terminates. If you do not specify a job, the command waits for all currently active child processes. The exit status from this command is that of the process for which it waits.

For more information, refer to the **wait** command in the *AIX 5L Version 5.2 Commands Reference*.

**whence** [-pv] *Name*  
...

Indicates, for each name specified, how it would be interpreted if used as a command name. When used without either flag, **whence** will display the absolute path name, if any, that corresponds to each name.

**-p** Does a path search for the specified name or names even if these are aliases, functions, or reserved words.

**-v** Produces a more verbose report that specifies which type each name is.

## List of Korn Shell or POSIX Shell Built-in Commands

### Special Built-in Commands

<b>:</b> (colon)	Expands only arguments.
<b>.</b> (dot)	Reads a specified file and then executes the commands.
<b>break</b>	Exits from the enclosing <b>for</b> , <b>while</b> , <b>until</b> , or <b>select</b> loop, if one exists.
<b>continue</b>	Resumes the next iteration of the enclosing <b>for</b> , <b>while</b> , <b>until</b> , or <b>select</b> loop.
<b>eval</b>	Reads the arguments as input to the shell and executes the resulting command or commands.
<b>exec</b>	Executes the command specified by the <i>Argument</i> parameter, instead of this shell, without creating a new process.
<b>exit</b>	Exits the shell whose exit status is specified by the <i>n</i> parameter.
<b>export</b>	Marks names for automatic export to the environment of subsequently executed commands.
<b>newgrp</b>	Equivalent to the <b>exec /usr/bin/newgrp</b> [ <i>Group</i> ...] command.
<b>readonly</b>	Marks the specified names read-only.
<b>return</b>	Causes a shell to return to the invoking script.
<b>set</b>	Unless options or arguments are specified, writes the names and values of all shell variables in the collation sequence of the current locale.
<b>shift</b>	Renames positional parameters.
<b>times</b>	Prints the accumulated user and system times for both the shell and the processes run from the shell.
<b>trap</b>	Runs a specified command when the shell receives a specified signal or signals.
<b>typeset</b>	Sets attributes and values for shell parameters.
<b>unset</b>	Unsets the values and attributes of the specified parameters.

### Regular Built-in Commands

<b>alias</b>	Prints a list of aliases to standard output.
<b>bg</b>	Puts specified jobs in the background.
<b>cd</b>	Changes the current directory to the specified directory or substitutes the current string with the specified string.
<b>echo</b>	Writes character strings to standard output.
<b>fc</b>	Selects a range of commands from the last HISTSIZE variable command typed at the terminal. Re-executes the specified command after old-to-new substitution is performed.
<b>fg</b>	Brings the specified job to the foreground.
<b>getopts</b>	Checks the <i>Argument</i> parameter for legal options.
<b>jobs</b>	Lists information for the specified jobs.
<b>kill</b>	Sends the <b>TERM</b> (terminate) signal to specified jobs or processes.
<b>let</b>	Evaluates specified arithmetic expressions.
<b>print</b>	Prints shell output.

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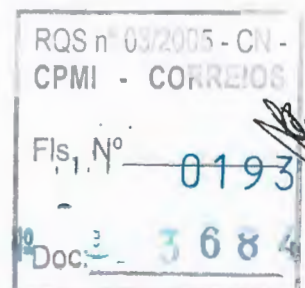
<b>pwd</b>	Equivalent to the <b>print -r -\$PWD</b> command.
<b>read</b>	Takes shell input.
<b>ulimit</b>	Sets or displays user process resource limits as defined in the <b>/etc/security/limits</b> file.
<b>umask</b>	Determines file permissions.
<b>unalias</b>	Removes the parameters in the list of names from the alias list.
<b>wait</b>	Waits for the specified job and terminates.
<b>whence</b>	Indicates how each specified name would be interpreted if used as a command name.

For more information, see "Korn Shell or POSIX Shell Built-In Commands" on page 163.

## Conditional Expressions for the Korn Shell or POSIX Shell

A conditional expression is used with the **[[** compound command to test attributes of files and to compare strings. Word splitting and file name substitution are not performed on words appearing between **[[** and **]]**. Each expression is constructed from one or more of the following unary or binary expressions:

<b>-a File</b>	True, if the specified file is a symbolic link that points to another file that does exist.
<b>-b File</b>	True, if the specified file exists and is a block special file.
<b>-c File</b>	True, if the specified file exists and is a character special file.
<b>-d File</b>	True, if the specified file exists and is a directory.
<b>-e File</b>	True, if the specified file exists.
<b>-f File</b>	True, if the specified file exists and is an ordinary file.
<b>-g File</b>	True, if the specified file exists and its <b>setgid</b> bit is set.
<b>-h File</b>	True, if the specified file exists and is a symbolic link.
<b>-k File</b>	True, if the specified file exists and its sticky bit is set.
<b>-n String</b>	True, if the length of the specified string is nonzero.
<b>-o Option</b>	True, if the specified option is on.
<b>-p File</b>	True, if the specified file exists and is a FIFO special file or a pipe.
<b>-r File</b>	True, if the specified file exists and is readable by the current process.
<b>-s File</b>	True, if the specified file exists and has a size greater than 0.
<b>-t FileDescriptor</b>	True, if specified file descriptor number is open and associated with a terminal device.
<b>-u File</b>	True, if the specified file exists and its <b>setuid</b> bit is set.
<b>-w File</b>	True, if the specified file exists and the write bit is on. However, the file will not be writable on a read-only file system even if this test indicates true.
<b>-x File</b>	True, if the specified file exists and the <b>execute</b> flag is on. If the specified file exists and is a directory, then the current process has permission to search in the directory.
<b>-z String</b>	True, if length of the specified string is 0.
<b>-L File</b>	True, if the specified file exists and is a symbolic link.
<b>-O File</b>	True, if the specified file exists and is owned by the effective user ID of this process.
<b>-G File</b>	True, if the specified file exists and its group matches the effective group ID of this process.
<b>-S File</b>	True, if the specified file exists and is a socket.
<b>File1 -nt File2</b>	True, if <i>File1</i> exists and is newer than <i>File2</i> .
<b>File1 -ot File2</b>	True, if <i>File1</i> exists and is older than <i>File2</i> .
<b>File1 -ef File2</b>	True, if <i>File1</i> and <i>File2</i> exist and refer to the same file.
<b>String1 = String2</b>	True, if <i>String1</i> is equal to <i>String2</i> .
<b>String1 != String2</b>	True, if <i>String1</i> is not equal to <i>String2</i> .
<b>String = Pattern</b>	True, if the specified string matches the specified pattern.
<b>String != Pattern</b>	True, if the specified string does not match the specified pattern.
<b>String1 &lt; String2</b>	True, if <i>String1</i> comes before <i>String2</i> based on the ASCII value of their characters.
<b>String1 &gt; String2</b>	True, if <i>String1</i> comes after <i>String2</i> based on the ASCII value of their characters.
<b>Expression1 -eq Expression2</b>	True, if <i>Expression1</i> is equal to <i>Expression2</i> .
<b>Expression1 -ne Expression2</b>	True, if <i>Expression1</i> is not equal to <i>Expression2</i> .



<i>Expression1</i> -lt <i>Expression2</i>	True, if <i>Expression1</i> is less than <i>Expression2</i> .
<i>Expression1</i> -gt <i>Expression2</i>	True, if <i>Expression1</i> is greater than <i>Expression2</i> .
<i>Expression1</i> -le <i>Expression2</i>	True, if <i>Expression1</i> is less than or equal to <i>Expression2</i> .
<i>Expression1</i> -ge <i>Expression2</i>	True, if <i>Expression1</i> is greater than or equal to <i>Expression2</i> .

**Note:** In each of the previous expressions, if the *File* variable is similar to */dev/fd/n*, where *n* is an integer, then the test is applied to the open file whose descriptor number is *n*.

You can construct a compound expression from these primitives, or smaller parts, by using any of the following expressions, listed in decreasing order of precedence:

( <i>Expression</i> )	True, if the specified expression is true. Used to group expressions.
! <i>Expression</i>	True, if the specified expression is false.
<i>Expression1</i> && <i>Expression2</i>	True, if <i>Expression1</i> and <i>Expression2</i> are both true.
<i>Expression1</i>    <i>Expression2</i>	True, if either <i>Expression1</i> or <i>Expression2</i> is true.

## Job Control in the Korn Shell or POSIX Shell

The Korn shell, or POSIX shell, provides a facility to control command sequences, or *jobs*. When you execute the **set -m** special command, the Korn shell associates a job with each pipeline. It keeps a table of current jobs, printed by the **jobs** command, and assigns them small integer numbers.

When a job is started in the background with an **&**, the shell prints a line that looks like the following:

```
[1] 1234
```

This output indicates that the job, which was started in the background, was job number 1. It also shows that the job had one (top-level) process with a process ID of 1234.

If you are running a job and want to do something else, use the Ctrl-Z key sequence. This key sequence sends a **STOP** signal to the current job. The shell normally indicates that the job has been stopped and then displays a shell prompt. You can then manipulate the state of this job (putting it in the background with the **bg** command), run other commands, and then eventually return the job to the foreground with the **fg** command. The Ctrl-Z key sequence takes effect immediately, and is like an interrupt in that the shell discards pending output and unread input when you type the sequence.

A job being run in the background stops if it tries to read from the terminal. Background jobs are normally allowed to produce output. You can disable this option by issuing the **stty tostop** command. If you set this terminal option, then background jobs stop when they try to produce output or read input.

You can refer to jobs in the Korn shell in several ways. A job is referenced by the process ID of any of its processes, or in one of the following ways:

% <i>Number</i>	Specifies the job with the given number
% <i>String</i>	Specifies any job whose command line begins with the <i>String</i> variable
%? <i>String</i>	Specifies any job whose command line contains the <i>String</i> variable
%%	Specifies the current job
%+	Equivalent to %%
%-	Specifies the previous job



This shell immediately recognizes changes in the process state. It normally informs you whenever a job becomes blocked so that no further progress is possible. The shell does this just before it prints a prompt so that it does not otherwise disturb your work.

When the monitor mode is on, each completed background job triggers traps set for the **CHLD** signal.

If you try to leave the shell (either by typing `exit` or using the `Ctrl-D` key sequence) while jobs are stopped or running, the system warns you with the message `There are stopped (running) jobs. Use the jobs command to see which jobs are affected.` If you immediately try to exit again, the shell terminates the stopped and running jobs without warning.

## Signal Handling

The **SIGINT** and **SIGQUIT** signals for an invoked command are ignored if the command is followed by **&** and the job **monitor** option is not active. Otherwise, signals have the values that the shell inherits from its parent.

When a signal for which a trap has been set is received while the shell is waiting for the completion of a foreground command, the trap associated with that signal will not be executed until after the foreground command has completed. Therefore, a trap on a **CHILD** signal is not performed until the foreground job terminates.

---

## Inline Editing in the Korn Shell or POSIX Shell

Normally, you type each command line from a terminal device and follow it by a new-line character (RETURN or LINE FEED). When you activate the `emacs`, `gmacs`, or `vi` inline editing option, you can edit the command line.

The following commands enter edit modes:

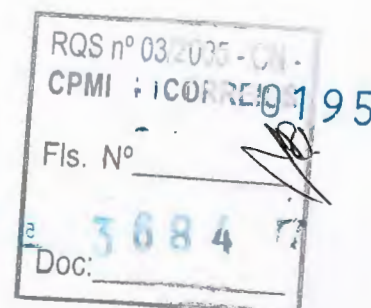
<b>set -o emacs</b>	Enters emacs editing mode and initiates an emacs-style inline editor. For more information, see "emacs Editing Mode" on page 177.
<b>set -o gmacs</b>	Enters emacs editing mode and initiates a gmacs-style inline editor. For more information, see "emacs Editing Mode" on page 177.
<b>set -o vi</b>	Enters vi editing mode and initiates a vi-style inline editor. For more information, see "vi Editing Mode" on page 178.

An editing option is automatically selected each time the **VISUAL** or **EDITOR** variable is assigned a value that ends in any of these option names.

**Note:** To use the editing features, your terminal must accept RETURN as a carriage return without line feed. A space must overwrite the current character on the screen.

Each editing mode opens a window at the current line. The window width is the value of the **COLUMNS** variable if it is defined; otherwise, the width is 80 character spaces. If the line is longer than the window width minus two, the system notifies you by displaying a mark at the end of the window. As the cursor moves and reaches the window boundaries, the window is centered about the cursor. The marks displayed are as follows:

>	Indicates that the line extends on the right side of the window.
<	Indicates that the line extends on the left side of the window.
*	Indicates that the line extends on both sides of the window.



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The search commands in each edit mode provide access to the Korn shell history file. Only strings are matched. If the leading character in the string is a ^, the match must begin at the first character in the line.

## emacs Editing Mode

The emacs editing mode is entered when you enable either the **emacs** or **gmacs** option. The only difference between these two modes is the way each handles the Ctrl-T edit command. To edit, move the cursor to the point needing correction and insert or delete characters or words, as needed. All of the editing commands are control characters or escape sequences.

Edit commands operate from any place on a line (not only at the beginning). Do not press the Enter key or line-feed (Down Arrow) key after edit commands, except as noted.

<b>Ctrl-F</b>	Moves the cursor forward (right) one character.
<b>Esc-F</b>	Moves the cursor forward one word (a string of characters consisting of only letters, digits, and underscores).
<b>Ctrl-B</b>	Moves the cursor backward (left) one character.
<b>Esc-B</b>	Moves the cursor backward one word.
<b>Ctrl-A</b>	Moves the cursor to the beginning of the line.
<b>Ctrl-E</b>	Moves the cursor to the end of the line.
<b>Ctrl-] c</b>	Moves the cursor forward on the current line to the indicated character.
<b>Esc-Ctrl-] c</b>	Moves the cursor backward on the current line to the indicated character.
<b>Ctrl-X Ctrl-X</b>	Interchanges the cursor and the mark.
<b>ERASE</b>	Deletes the previous character. (User-defined erase character as defined by the <b>stty</b> command, usually the Ctrl-H key sequence.)
<b>Ctrl-D</b>	Deletes the current character.
<b>Esc-D</b>	Deletes the current word.
<b>Esc-Backspace</b>	Deletes the previous word.
<b>Esc-H</b>	Deletes the previous word.
<b>Esc-Delete</b>	Deletes the previous word. If your interrupt character is the Delete key, this command does not work.
<b>Ctrl-T</b>	Transposes the current character with the next character in emacs mode. Transposes the two previous characters in gmacs mode.
<b>Ctrl-C</b>	Capitalizes the current character.
<b>Esc-C</b>	Capitalizes the current word.
<b>Esc-L</b>	Changes the current word to lowercase.
<b>Ctrl-K</b>	Deletes from the cursor to the end of the line. If preceded by a numeric parameter whose value is less than the current cursor position, this editing command deletes from the given position up to the cursor. If preceded by a numeric parameter whose value is greater than the current cursor position, this editing command deletes from the cursor up to the given cursor position.
<b>Ctrl-W</b>	Deletes from the cursor to the mark.
<b>Esc-P</b>	Pushes the region from the cursor to the mark on the stack.
<b>KILL</b>	User-defined kill character as defined by the <b>stty</b> command, usually the Ctrl-G key sequence or an @. Kills the entire current line. If two kill characters are entered in succession, all subsequent kill characters cause a line feed (useful when using paper terminals).
<b>Ctrl-Y</b>	Restores the last item removed from the line. (Yanks the item back to the line.)
<b>Ctrl-L</b>	Line feeds and prints the current line.
<b>Ctrl-@</b>	(Null character) Sets a mark.
<b>Esc-space</b>	Sets a mark.
<b>Ctrl-J</b>	(New line) Executes the current line.
<b>Ctrl-M</b>	(Return) Executes the current line.
<b>EOF</b>	Processes the end-of-file character, normally the Ctrl-D key sequence, as an end-of-file only if the current line is null.

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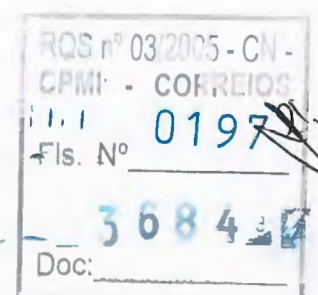
<b>Ctrl-P</b>	Fetches the previous command. Each time the Ctrl-P key sequence is entered, the previous command back in time is accessed. Moves back one line when not on the first line of a multiple-line command.
<b>Esc-&lt;</b>	Fetches the least recent (oldest) history line.
<b>Esc-&gt;</b>	Fetches the most recent (youngest) history line.
<b>Ctrl-N</b>	Fetches the next command line. Each time the Ctrl-N key sequence is entered, the next command line forward in time is accessed.
<b>Ctrl-R <i>String</i></b>	Reverses search history for a previous command line containing the string specified by the <i>String</i> parameter. If a value of 0 is given, the search is forward. The specified string is terminated by an Enter or new-line character. If the string is preceded by a ^, the matched line must begin with the <i>String</i> parameter. If the <i>String</i> parameter is omitted, then the next command line containing the most recent <i>String</i> parameter is accessed. In this case, a value of 0 reverses the direction of the search.
<b>Ctrl-O</b>	(Operate) Executes the current line and fetches the next line relative to the current line from the history file.
<b>Esc <i>Digits</i></b>	(Escape) Defines the numeric parameter. The digits are taken as a parameter to the next command. The commands that accept a parameter are <b>Ctrl-F</b> , <b>Ctrl-B</b> , <b>ERASE</b> , <b>Ctrl-C</b> , <b>Ctrl-D</b> , <b>Ctrl-K</b> , <b>Ctrl-R</b> , <b>Ctrl-P</b> , <b>Ctrl-N</b> , <b>Ctrl-J</b> , <b>Esc-.</b> , <b>Esc-Ctrl-J</b> , <b>Esc-__</b> , <b>Esc-B</b> , <b>Esc-C</b> , <b>Esc-D</b> , <b>Esc-F</b> , <b>Esc-H</b> , <b>Esc-L</b> , and <b>Esc-Ctrl-H</b> .
<b>Esc <i>Letter</i></b>	(Soft-key) Searches the alias list for an alias named <i>_Letter</i> . If an alias of this name is defined, its value is placed into the input queue. The <i>Letter</i> parameter must not specify one of the escape functions.
<b>Esc-[ <i>Letter</i></b>	(Soft-key) Searches the alias list for an alias named double underscore <i>Letter</i> ( <i>__Letter</i> ). If an alias of this name is defined, its value is placed into the input queue. This command can be used to program function keys on many terminals.
<b>Esc-.</b>	Inserts on the line the last word of the previous command. If preceded by a numeric parameter, the value of this parameter determines which word to insert rather than the last word.
<b>Esc-__</b>	Same as the <b>Esc-.</b> key sequence.
<b>Esc-*</b>	Attempts file-name substitution on the current word. An asterisk is appended if the word does not match any file or contain any special pattern characters.
<b>Esc-Esc</b>	File-name completion. Replaces the current word with the longest common prefix of all file names that match the current word with an asterisk appended. If the match is unique, a / is appended if the file is a directory and a space is appended if the file is not a directory.
<b>Esc==</b>	Lists the files that match the current word pattern as if an asterisk were appended.
<b>Ctrl-U</b>	Multiplies the parameter of the next command by 4.
<b>\</b>	Escapes the next character. Editing characters and the ERASE, KILL and INTERRUPT (normally the Delete key) characters can be entered in a command line or in a search string if preceded by a \. The backslash removes the next character's editing features, if any.
<b>Ctrl-V</b>	Displays the version of the shell.
<b>Esc-#</b>	Inserts a # at the beginning of the line and then executes the line. This causes a comment to be inserted in the history file.

## vi Editing Mode

The vi editing mode has two typing modes. When you enter a command, you are in Input mode. To edit, you must enter the Control mode by pressing the Esc key.

Most control commands accept an optional repeat *Count* parameter prior to the command. When in vi mode on most systems, canonical processing is initially enabled. The command is echoed again if one or more of the following are true:

- The speed is 1200 baud or greater.
- The command contains any control characters.
- Less than one second has elapsed since the prompt was printed.



The Esc character terminates canonical processing for the remainder of the command, and you can then modify the command line. This scheme has the advantages of canonical processing with the type-ahead echoing of raw mode. If the **viraw** option is also set, canonical processing is always disabled. This mode is implicit for systems that do not support two alternate end-of-line delimiters and might be helpful for certain terminals.

Available vi edit commands are grouped into categories. The categories are as follows:

- "Input Edit Commands"
- "Motion Edit Commands"
- "Search Edit Commands"
- "Text-Modification Edit Commands" on page 180
- "Miscellaneous Edit Commands" on page 181

## Input Edit Commands

**Note:** By default, the editor is in input mode.

<b>ERASE</b>	(User-defined erase character as defined by the <b>stty</b> command, usually Ctrl-H or #.) Deletes the previous character.
<b>Ctrl-W</b>	Deletes the previous blank separated word.
<b>Ctrl-D</b>	Terminates the shell.
<b>Ctrl-V</b>	Escapes the next character. Editing characters, such as the ERASE or KILL characters, can be entered in a command line or in a search string if preceded by a Ctrl-V key sequence. The Ctrl-V key sequence removes the next character's editing features (if any).
<b>\</b>	Escapes the next ERASE or KILL character.

## Motion Edit Commands

Motion edit commands move the cursor as follows:

<b>[Count]l</b>	Moves the cursor forward (right) one character.
<b>[Count]w</b>	Moves the cursor forward one alphanumeric word.
<b>[Count]W</b>	Moves the cursor to the beginning of the next word that follows a blank.
<b>[Count]e</b>	Moves the cursor to the end of the current word.
<b>[Count]E</b>	Moves the cursor to the end of the current blank-separated word.
<b>[Count]h</b>	Moves the cursor backward (left) one character.
<b>[Count]b</b>	Moves the cursor backward one word.
<b>[Count]B</b>	Moves the cursor to the previous blank-separated word.
<b>[Count]l</b>	Moves the cursor to the column specified by the <i>Count</i> parameter.
<b>[Count]fc</b>	Finds the next character <i>c</i> in the current line.
<b>[Count]Fc</b>	Finds the previous character <i>c</i> in the current line.
<b>[Count]tc</b>	Equivalent to <b>f</b> followed by <b>h</b> .
<b>[Count]Tc</b>	Equivalent to <b>F</b> followed by <b>l</b> .
<b>[Count];</b>	Repeats for the number of times specified by the <i>Count</i> parameter the last single-character find command: <b>f</b> , <b>F</b> , <b>t</b> , or <b>T</b> .
<b>[Count],</b>	Reverses the last single-character find command the number of times specified by the <i>Count</i> parameter.
<b>0</b>	Moves the cursor to the start of a line.
<b>^</b>	Moves the cursor to the first nonblank character in a line.
<b>\$</b>	Moves the cursor to the end of a line.

## Search Edit Commands

Search edit commands access your command history, as follows:

<b>[Count]k</b>	Fetches the previous command.
<b>[Count]-</b>	Equivalent to the <b>k</b> command.
<b>[Count]j</b>	Fetches the next command. Each time the <b>j</b> command is entered, the next command is accessed.

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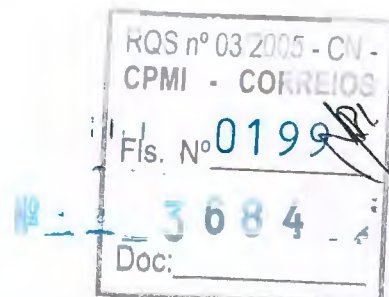
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[Count]+	Equivalent to the <b>j</b> command.
[Count]G	Fetches the command whose number is specified by the <i>Count</i> parameter. The default is the least recent history command.
/String	Searches backward through history for a previous command containing the specified string. The string is terminated by a RETURN or newline character. If the specified string is preceded by a ^, the matched line must begin with the <i>String</i> parameter. If the value of the <i>String</i> parameter is null, the previous string is used.
?String	Same as <i>/String</i> except that the search is in the forward direction.
n	Searches for the next match of the last pattern to <i>/String</i> or <i>?String</i> commands.
N	Searches for the next match of the last pattern to <i>/String</i> or <i>?String</i> commands, but in the opposite direction. Searches history for the string entered by the previous <i>/String</i> command.

## Text-Modification Edit Commands

Text-modification edit commands modify the line as follows:

a	Enters the input mode and enters text after the current character.
A	Appends text to the end of the line. Equivalent to the <b>\$a</b> command.
[Count]cMotion	
c[Count]Motion	Deletes the current character through the character to which the <i>Motion</i> parameter specifies to move the cursor, and enters input mode. If the value of the <i>Motion</i> parameter is <b>c</b> , the entire line is deleted and the input mode is entered.
C	Deletes the current character through the end of the line and enters input mode. Equivalent to the <b>c\$</b> command.
S	Equivalent to the <b>cc</b> command.
D	Deletes the current character through the end of line. Equivalent to the <b>d\$</b> command.
[Count]dMotion	
d[Count]Motion	Deletes the current character up to and including the character specified by the <i>Motion</i> parameter. If <i>Motion</i> is <b>d</b> , the entire line is deleted.
i	Enters the input mode and inserts text before the current character.
I	Inserts text before the beginning of the line. Equivalent to the <b>0i</b> command.
[Count]P	Places the previous text modification before the cursor.
[Count]p	Places the previous text modification after the cursor.
R	Enters the input mode and types over the characters on the screen.
[Count]rc	Replaces the number of characters specified by the <i>Count</i> parameter, starting at the current cursor position, with the characters specified by the <i>c</i> parameter. This command also advances the cursor after the characters are replaced.
[Count]x	Deletes the current character.
[Count]X	Deletes the preceding character.
[Count].	Repeats the previous text-modification command.
[Count]~	Inverts the case of the number of characters specified by the <i>Count</i> parameter, starting at the current cursor position, and advances the cursor.
[Count]_	Appends the word specified by the <i>Count</i> parameter of the previous command and enters input mode. The last word is used if the <i>Count</i> parameter is omitted.
*	Appends an * to the current word and attempts file-name substitution. If no match is found, it rings the bell. Otherwise, the word is replaced by the matching pattern and input mode is entered.
\	File name completion. Replaces the current word with the longest common prefix of all file names matching the current word with an asterisk appended. If the match is unique, a / is appended if the file is a directory. A space is appended if the file is not a directory.



## Miscellaneous Edit Commands

The most commonly used edit commands include the following:

<code>[Count]yMotion</code>	
<code>y[Count]Motion</code>	Yanks the current character up to and including the character marked by the cursor position specified by the <i>Motion</i> parameter and puts all of these characters into the delete buffer. The text and cursor are unchanged.
<code>Y</code>	Yanks from the current position to the end of the line. Equivalent to the <code>y\$</code> command.
<code>u</code>	Undoes the last text-modifying command.
<code>U</code>	Undoes all the text-modifying commands performed on the line.
<code>[Count]v</code>	Returns the command <code>fc -e \${VISUAL:-\${EDITOR:-vi}}</code> Count in the input buffer. If the <i>Count</i> parameter is omitted, then the current line is used.
<code>Ctrl-L</code>	Line feeds and prints the current line. This command is effective only in control mode.
<code>Ctrl-J</code>	(New line) Executes the current line, regardless of the mode.
<code>Ctrl-M</code>	(Return) Executes the current line, regardless of the mode.
<code>#</code>	Sends the line after inserting a <code>#</code> in front of the line. Useful if you want to insert the current line in the history without executing it.
	If the command line contains a pipe or semicolon or newline character, then additional <code>#</code> s will be inserted in front of each of these symbols. To delete all pound signs, retrieve the command line from history and enter another <code>#</code> .
<code>=</code>	Lists the file names that match the current word as if an asterisk were appended to it.
<code>@Letter</code>	Searches the alias list for an alias named <code>_Letter</code> . If an alias of this name is defined, its value is placed into the input queue for processing.

## Enhanced Korn Shell (ksh93)

In addition to the default system Korn shell (`/usr/bin/ksh`), AIX provides an enhanced version available as `/usr/bin/ksh93`. This enhanced version is upwardly compatible with the current default version, and includes a few additional features that are not available in `/usr/bin/ksh`.

The following features are available in `/usr/bin/ksh93`:

<b>Arithmetic Enhancements</b>	You can use libm functions (math functions typically found in the C programming language), within arithmetic expressions, such as <code>\$ value=\$((sqrt(9)))</code> . More arithmetic operators are available, including the unary <code>+</code> , <code>++</code> , <code>--</code> , and the <code>?:</code> construct (for example, " <code>x ? y : z</code> "), as well as the <code>,</code> (comma) operator. Arithmetic bases are supported up to base 64. Floating point arithmetic is also supported. " <code>typeset -E</code> " (exponential) can be used to specify the number of significant digits and " <code>typeset -F</code> " (float) can be used to specify the number of decimal places for an arithmetic variable. The <code>SECONDS</code> variable now displays to the nearest hundredth of a second, rather than to the nearest second.
<b>Compound Variables</b>	Compound variables are supported. A compound variable allows a user to specify multiple values within a single variable name. The values are each assigned with a subscript variable, separated from the parent variable with a <code>.</code> (period). For example:  <pre>\$ myvar=( x=1 y=2 ) \$ print "\${myvar.x}" 1</pre>
<b>Compound Assignments</b>	Compound assignments are supported when initializing arrays, both for indexed arrays and associative arrays. The assignment values are placed in parentheses, as shown in the following example:  <pre>\$ numbers=( zero one two three ) \$ print \${numbers[0]} \${numbers[3]} zero three</pre>



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<b>Associative Arrays</b>	<p>An associative array is an array with a string as an index.</p> <p>The <b>typeset</b> command used with the <b>-A</b> flag allows you to specify associative arrays within ksh93. For example:</p> <pre>\$ typeset -A teammates \$ teammates=( [john]=smith [mary]=jones ) \$ print \${teammates[mary]} jones</pre>
<b>Variable Name References</b>	<p>The <b>typeset</b> command used with the <b>-n</b> flag allows you to assign one variable name as a reference to another. In this way, modifying the value of a variable will in turn modify the value of the variable that is referenced. For example:</p> <pre>\$ greeting="hello" \$ typeset -n welcome=greeting      # establishes the reference \$ welcome="hi there"               # overrides previous value \$ print \$greeting hi there</pre>
<b>Parameter Expansions</b>	<p>The following parameter-expansion constructs are available:</p> <ul style="list-style-type: none"> <li>• <code>\${!varname}</code> is the name of the variable itself.</li> <li>• <code>\${!varname[@]}</code> names the indexes for the <i>varname</i> array.</li> <li>• <code>\${param:offset}</code> is a substring of <i>param</i>, starting at <i>offset</i>.</li> <li>• <code>\${param:offset:num}</code> is a substring of <i>param</i>, starting at <i>offset</i>, for <i>num</i> number of characters.</li> <li>• <code>\${@:offset}</code> indicates all positional parameters starting at <i>offset</i>.</li> <li>• <code>\${@:offset:num}</code> indicates <i>num</i> positional parameters starting at <i>offset</i>.</li> <li>• <code>\${param/pattern/repl}</code> evaluates to <i>param</i>, with the first occurrence of <i>pattern</i> replaced by <i>repl</i>.</li> <li>• <code>\${param//pattern/repl}</code> evaluates to <i>param</i>, with every occurrence of <i>pattern</i> replaced by <i>repl</i>.</li> <li>• <code>\${param/#pattern/repl}</code> if <i>param</i> begins with <i>pattern</i>, then <i>param</i> is replaced by <i>repl</i>.</li> <li>• <code>\${param/%pattern/repl}</code> if <i>param</i> ends with <i>pattern</i>, then <i>param</i> is replaced by <i>repl</i>.</li> </ul>

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## Discipline Functions

A discipline function is a function that is associated with a specific variable. This allows you to define and call a function every time that variable is referenced, set, or unset. These functions take the form of *varname.function*, where *varname* is the name of the variable and *function* is the discipline function. The predefined discipline functions are **get**, **set**, and **unset**.

- The *varname.get* function is invoked every time *varname* is referenced. If the special variable **.sh.value** is set within this function, then the value of *varname* is changed to this value. A simple example is the time of day:

```
$ function time.get
> {
>     .sh.value=$(date +%r)
> }
$ print $time
09:15:58 AM
$ print $time    # it will change in a few seconds
09:16:04 AM
```

- The *varname.set* function is invoked every time *varname* is set. The **.sh.value** variable is given the value that was assigned. The value assigned to *varname* is the value of **.sh.value** when the function completes. For example:

```
$ function adder.set
> {
>     let .sh.value="
$ { .sh.value} + 1"
> }
$ adder=0
$ echo $adder
1
$ adder=$adder
$ echo $adder
2
```

- The *varname.unset* function is executed every time *varname* is unset. The variable is not actually unset unless it is unset within the function itself; otherwise it retains its value.

Within all discipline functions, the special variable **.sh.name** is set to the name of the variable, while **.sh.subscript** is set to the value of the variables subscript, if applicable.

<b>Function Environments</b>	Functions declared with the <i>function myfunc</i> format are executed in a separate function environment. Functions declared as <i>myfunc()</i> execute with the same environment as the parent shell.
<b>Variables</b>	Variables beginning with <b>.sh.</b> are reserved by the shell and have special meaning. See the description of Discipline Functions in this table for an explanation of <b>.sh.name</b> , <b>.sh.value</b> , and <b>.sh.subscript</b> . Also available is <b>.sh.version</b> , which represents the version of the shell.
<b>Command Return Values</b>	Return values of commands are as follows: <ul style="list-style-type: none"> <li>If the command to be executed is not found, the return value is set to 127.</li> <li>If the command to be executed is found, but not executable, the return value is 126.</li> <li>If the command is executed, but is terminated by a signal, the return value is 256 plus the signal number.</li> </ul>
<b>PATH Search Rules</b>	Special built-in commands are searched for first, followed by all functions (including those in <b>FPATH</b> directories), followed by other built-ins.
<b>Shell History</b>	The <b>hist</b> command allows you to display and edit the shells command history. In the ksh shell, the <b>fc</b> command was used. The <b>fc</b> command is an alias to <b>hist</b> . Variables are <b>HISTCMD</b> , which increments once for each command executed in the shells current history, and <b>HISTEDIT</b> , which specifies which editor to use when using the <b>hist</b> command.

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## Built-In Commands

The enhanced Korn shell contains the following built-in commands:

- The **builtin** command lists all available built-in commands.
- The **printf** command works in a similar manner as the `printf()` C library routine. Refer to the **printf** command.
- The **disown** blocks the shell from sending a SIGHUP to the specified command.
- The **getconf** command works in the same way as the stand-alone command `/usr/bin/getconf`. Refer to the **getconf** command.
- The **read** built-in command has the following flags:
  - **read -d {char}** allows you to specify a character delimiter instead of the default newline.
  - **read -t {seconds}** allows you to specify a time limit in seconds after which the **read** command will time out. If **read** times out, it will return **FALSE**.
- The **exec** built-in command has the following flags:
  - **exec -a {name} {cmd}** specifies that argument 0 of *cmd* be replaced with *name*.
  - **exec -c {cmd}** tells **exec** to clear the environment before executing *cmd*.
- The **kill** built-in command has the following flags:
  - **kill -n {signal}** is used for specifying a signal number to send to a process, while **kill -s {signame}** is used to specify a signal name.
  - **kill -l**, with no arguments, lists all signal names but not their numbers.
- The **whence** built-in command has the following flags:
  - The **-a** flag displays all matches, not only the first one found.
  - The **-f** flag tells **whence** not to search for any functions.
- An escape character sequence is used for use by the **print** and **echo** commands. The Esc (Escape) key can be represented by the sequence `\E`.
- All regular built-in commands recognize the **-?** flag, which shows the syntax for the specified command.

## Bourne Shell

The Bourne shell is an interactive command interpreter and command programming language. The **bash** command runs the Bourne shell.

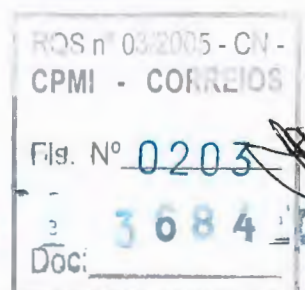
The Bourne shell can be run either as a login shell or as a subshell under the login shell. Only the **login** command can call the Bourne shell as a login shell. It does this by using a special form of the **bash** command name: **-bash**. When called with an initial hyphen (-), the shell first reads and runs commands found in the system `/etc/profile` file and your `$HOME/.profile`, if one exists. The `/etc/profile` file sets variables needed by all users. Finally, the shell is ready to read commands from your standard input.

If the *File* [*Parameter*] parameter is specified when the Bourne shell is started, the shell runs the script file identified by the *File* parameter, including any parameters specified. The script file specified must have read permission; any **setuid** and **setgid** settings are ignored. The shell then reads the commands. If either the **-c** or **-s** flag is used, do not specify a script.

## Bourne Shell Environment

All variables (with their associated values) known to a command at the beginning of its execution constitute its *environment*. This environment includes variables that a command inherits from its parent process and variables specified as keyword parameters on the command line that calls the command.

The shell passes to its child processes the variables named as arguments to the built-in **export** command. This command places the named variables in the environments of both the shell and all its future child processes.



Keyword parameters are variable-value pairs that appear in the form of assignments, normally before the procedure name on a command line (but see also the flag for the **set** command). These variables are placed in the environment of the procedure being called.

For example, consider the following procedure, which displays the values of two variables (saved in a command file named `key_command`):

```
# key_command
echo $a $b
```

The following command lines produce the output shown:

Input	Output
a=key1 b=key2 key_command	key1 key2
a=tom b=john key_command	tom john

A procedure's keyword parameters are not included in the parameter count stored in `$#`.

A procedure can access the values of any variables in its environment. If it changes any of these values, however, the changes are not reflected in the shell environment. The changes are local to the procedure in question. To place the changes in the environment that the procedure passes to its child processes, you must export the new values within that procedure.

To obtain a list of variables that are exportable from the current shell, type:

`export`

Press Enter.

To obtain a list of read-only variables from the current shell, type:

`readonly`

Press Enter.

To obtain a list of variable-value pairs in the current environment, type:

`env`

Press Enter.

For more information about user environments, see “/etc/environment File” on page 130

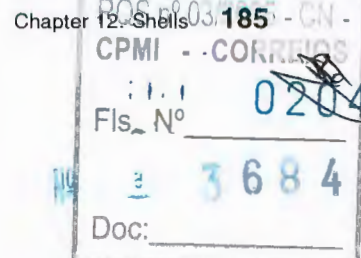
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## Restricted Shell

The restricted shell is used to set up login names and execution environments whose capabilities are more controlled than those of the regular Bourne shell. The **Rsh** or **bsh -r** command opens the restricted shell. The behavior of these commands is identical to those of the **bsh** command, except that the following actions are not allowed:

- Changing the directory (with the **cd** command)
- Setting the value of **PATH** or **SHELL** variables
- Specifying path or command names containing a slash (/)
- Redirecting output

If the restricted shell determines that a command to be run is a shell procedure, it uses the Bourne shell to run the command. In this way, it is possible to provide an end user with shell procedures that access the full power of the Bourne shell while imposing a limited menu of commands. This situation assumes that the end user does not have write and execute permissions in the same directory.





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If the *File* [*Parameter*] parameter is specified when the Bourne shell is started, the shell runs the script file identified by the *File* parameter, including any parameters specified. The script file specified must have read permission. Any **setuid** and **setgid** settings for script files are ignored. The shell then reads the commands. If using either the **-c** or **-s** flag is used, do not specify a script file.

When started with the **Rsh** command, the shell enforces restrictions after interpreting the **.profile** and **/etc/environment** files. Therefore, the writer of the **.profile** file has complete control over user actions by performing setup actions and leaving the user in an appropriate directory (probably not the login directory). An administrator can create a directory of commands in the **/usr/rbin** directory that the **Rsh** command can use by changing the **PATH** variable to contain the directory. If it is started with the **bsh -r** command, the shell applies restrictions when interpreting the **.profile** files.

When called with the name **Rsh**, the restricted shell reads the user's **.profile** file (**\$HOME/.profile**). It acts as the regular Bourne shell while doing this, except that an interrupt causes an immediate exit instead of a return to command level.

---

## Bourne Shell Commands

When you issue a command in the Bourne shell, it first evaluates the command and makes all indicated substitutions. It then runs the command provided that:

- The command name is a Bourne shell special built-in command.
- OR
- The command name matches the name of a defined function. If this is the case, the shell sets the positional parameters to the parameters of the function.

If the command name matches neither a built-in command nor the name of a defined function and the command names an executable file that is a compiled (binary) program, the shell (as *parent*) spawns a new (*child*) process that immediately runs the program. If the file is marked executable but is not a compiled program, the shell assumes that it is a shell procedure. In this case, the shell spawns another instance of itself (a *subshell*), to read the file and execute the commands included in it. The shell also runs a parenthesized command in a subshell. To the end user, a compiled program is run in exactly the same way as a shell procedure. The shell normally searches for commands in file system directories, in this order:

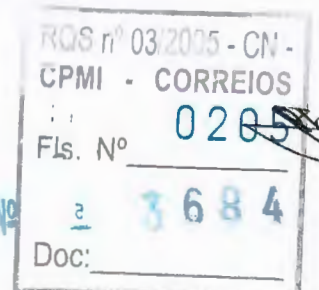
1. **/usr/bin**
2. **/etc**
3. **/usr/sbin**
4. **/usr/ucb**
5. **\$HOME/bin**
6. **/usr/bin/X11**
7. **/sbin**
8. Current directory

The shell searches each directory, in turn, continuing with the next directory if it fails to find the command.

**Note:** The **PATH** variable determines the order in which the shell searches directories. You can change the particular sequence of directories searched by resetting the **PATH** variable.

If you give a specific path name when you run a command (for example, **/usr/bin/sort**), the shell does not search any directories other than the one you specify. If the command name contains a slash (/), the shell does not use the search path.

You can give a full path name that begins with the root directory (such as **/usr/bin/sort**). You can also specify a path name relative to the current directory. If you specify, for example:



bin/myfile

the shell looks in the current directory for a directory named `bin` and in that directory for the file `myfile`.

**Note:** The restricted shell does not run commands containing a `/` (slash).

The shell remembers the location in the search path of each executed command (to avoid unnecessary **exec** commands later). If it finds the command in a relative directory (one whose name does not begin with `/`), the shell must redetermine the command's location whenever the current directory changes. The shell forgets all remembered locations each time you change the **PATH** variable or run the **hash -r** command.

This section discusses the following:

- "Quoting Characters" on page 188
- "Signal Handling" on page 188
- "Bourne Shell Built-In Commands" on page 189
- "Command Substitution in the Bourne Shell" on page 192

## Quoting Characters

Many characters have a special meaning to the shell. Sometimes you want to conceal that meaning. Single (`'`) and double (`"`) quotation marks surrounding a string, or a backslash (`\`) before a single character allow you to conceal the character's meaning.

All characters (except the enclosing single quotation marks) are taken literally, with any special meaning removed. Thus, the command:

```
stuff='echo $? $*; ls * | wc'
```

assigns the literal string `echo $? $*; ls * | wc` to the variable `stuff`. The shell does not execute the **echo**, **ls**, and **wc** commands or expand the `?` and `$*` variables and the `*` (asterisk) special character.

Within double quotation marks, the special meaning of the `$` (dollar sign), ``` (backquote), and `"` (double quotation) characters remains in effect, while all other characters are taken literally. Thus, within double quotation marks, command and variable substitution takes place. In addition, the quotation marks do not affect the commands within a command substitution that is part of the quoted string, so characters there retain their special meanings.

Consider the following sequence:

```
ls *
file1 file2 file3
message="This directory contains `ls * ` "
echo $message
This directory contains file1 file2 file3
```

This shows that the `*` (asterisk) special character inside the command substitution was expanded.

To hide the special meaning of the `$` (dollar sign), ``` (backquote), and `"` (double quotation) characters within double quotation marks, precede these characters with a `\` (backslash). When you do not use double quotation marks, preceding a character with a backslash is equivalent to placing it within single quotation marks. Hence, a backslash immediately preceding a newline character (that is, a backslash at the end of the line) hides the newline character and allows you to continue the command line on the next physical line.



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## Signal Handling

The shell ignores **INTERRUPT** and **QUIT** signals for an invoked command if the command is terminated with an **&** (ampersand); that is, if it is running in the background. Otherwise, signals have the values inherited by the shell from its parent, with the exception of the **SEGMENTATION VIOLATION** signal. For more information, refer to the Bourne shell built-in **trap** command.

## Bourne Shell Compound Commands

A compound command is one of the following:

- Pipeline (one or more simple commands separated by the **|** (pipe) symbol)
- List of simple commands
- Command beginning with a reserved word
- Command beginning with the control operator **(** (left parenthesis).

Unless otherwise stated, the value returned by a compound command is that of the last simple command executed.

## Reserved Words

The following reserved words are recognized only when they appear without quotation marks as the first word of a command:

<b>for</b>	<b>do</b>	<b>done</b>
<b>case</b>	<b>esac</b>	
<b>if</b>	<b>then</b>	<b>fi</b>
<b>elif</b>	<b>else</b>	
<b>while</b>	<b>until</b>	
<b>{</b>	<b>}</b>	
<b>(</b>	<b>)</b>	

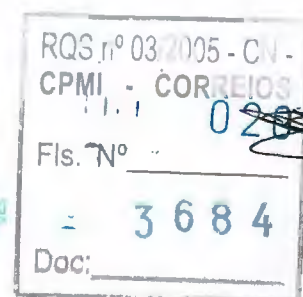
**for** *Identifier* [**in** *Word* . . .] **do** *List* **done** Sets the *Identifier* parameter to the word or words specified by the *Word* parameter (one at a time) and runs the commands specified in the *List* parameter. If you omit **in** *Word* . . ., then the **for** command runs the *List* parameter for each positional parameter that is set, and processing ends when all positional parameters have been used.

**case** *Word* **in** *Pattern* [*Pattern*] . . . ) *List*; [*Pattern* [*Pattern*] . . . ) *List*;] . . . **esac** Runs the commands specified in the *List* parameter that are associated with the first *Pattern* parameter that matches the value of the *Word* parameter. Uses the same character-matching notation in patterns that are used for file name substitution, except that a **/** (slash), leading **.** (dot), or a dot immediately following a slash do not need to match explicitly.

**if** *List* **then** *List* [**elif** *List* **then** *List*] . . . [**else** *List*] **fi** Runs the commands specified in the *List* parameter following the **if** command. If the command returns a zero exit value, the shell runs the *List* parameter following the first **then** command. Otherwise, it runs the *List* parameter following the **elif** command (if it exists). If this exit value is zero, the shell runs the *List* parameter following the next **then** command. If the command returns a non-zero exit value, the shell runs the *List* parameter following the **else** command (if it exists). If no **else** *List* or **then** *List* is performed, the **if** command returns a zero exit value.

**while** *List* **do** *List* **done** Runs the commands specified in the *List* parameter following the **while** command. If the exit value of the last command in the **while** *List* is zero, the shell runs the *List* parameter following the **do** command. It continues looping through the lists until the exit value of the last command in the **while** *List* is non-zero. If no commands in the **do** *List* are performed, the **while** command returns a zero exit value.

**until** *List* **do** *List* **done** Runs the commands specified in the *List* parameter following the **until** command. If the exit value of the last command in the **until** *List* is non-zero, runs the *List* following the **do** command. Continues looping through the lists until the exit value of the last command in the **until** *List* is zero. If no commands in the **do** *List* are performed, the **until** command returns a zero exit value.



( <i>List</i> )	Runs the commands in the <i>List</i> parameter in a subshell.
{ <i>List</i> ; }	Runs the commands in the <i>List</i> parameter in the current shell process and does not start a subshell.
<i>Name</i> () { <i>List</i> }	Defines a function that is referenced by the <i>Name</i> parameter. The body of the function is the list of commands between the braces specified by the <i>List</i> parameter.

## Bourne Shell Built-In Commands

Special commands are built in to the Bourne shell and run in the shell process. Unless otherwise indicated, output is written to file descriptor 1 (standard output) and the exit status is 0 (zero) if the command does not contain any syntax errors. Input and output redirection is permitted.

Refer to the “List of Bourne Shell Built-in Commands” on page 199 for an alphabetical listing of these commands.

The following special commands are treated somewhat differently from other special built-in commands:

:	exec	shift
.	exit	times
break	export	trap
continue	readonly	wait
eval	return	

The Bourne shell processes these commands as follows:

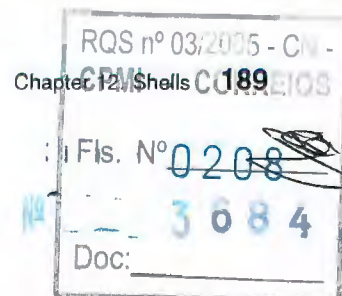
- Keyword parameter assignment lists preceding the command remain in effect when the command completes.
- I/O redirections are processed after parameter assignments.
- Errors in a shell script cause the script to stop processing.

## Special Command Descriptions

The Bourne shell provides the following special built-in commands:

### Built-In Commands

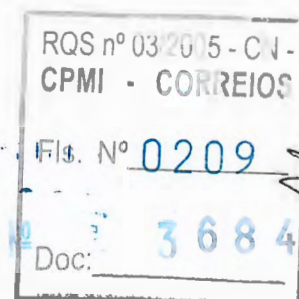
:	Returns a zero exit value.
. <i>File</i>	Reads and runs commands from the <i>File</i> parameter, and returns. Does not start a subshell. The shell uses the search path specified by the <b>PATH</b> variable to find the directory containing the specified file.
break [ <i>n</i> ]	Exits from the enclosing <b>for</b> , <b>while</b> , or <b>until</b> command loops, if any. If you specify the <i>n</i> variable, the <b>break</b> command breaks the number of levels specified by the <i>n</i> variable.
continue [ <i>n</i> ]	Resumes the next iteration of the enclosing <b>for</b> , <b>while</b> , or <b>until</b> command loops. If you specify the <i>n</i> variable, the command resumes at the <i>n</i> th enclosing loop.
cd <i>Directory</i> ]	Changes the current directory to <i>Directory</i> . If you do not specify <i>Directory</i> , the value of the <b>HOME</b> shell variable is used. The <b>CDPATH</b> shell variable defines the search path for <i>Directory</i> . <b>CDPATH</b> is a colon-separated list of alternative directory names. A null path name specifies the current directory (which is the default path). This null path name appears immediately after the equal sign in the assignment or between the colon delimiters anywhere else in the path list. If <i>Directory</i> begins with a / (slash), the shell does not use the search path. Otherwise, the shell searches each directory in the <b>CDPATH</b> shell variable.
<b>Note:</b> The restricted shell cannot run the <b>cd</b> shell command.	
echo <i>String</i> . . . ]	Writes character strings to standard output. Refer to the <b>echo</b> command for usage and parameter information. The <b>-n</b> flag is not supported.
eval [ <i>Argument</i> . . . ]	Reads arguments as input to the shell and runs the resulting command or commands.





## Built-In Commands

<b>exec</b> [ <i>Argument</i> . . . ]	Runs the command specified by the <i>Argument</i> parameter in place of this shell without creating a new process. Input and output arguments can appear and if no other arguments appear, cause the shell input or output to be modified. This is not recommended for your login shell.
<b>exit</b> [ <i>n</i> ]	Causes a shell to exit with the exit value specified by the <i>n</i> parameter. If you omit this parameter, the exit value is that of the last command executed (the Ctrl-D key sequence also causes a shell to exit). The value of the <i>n</i> parameter can be from 0 to 255, inclusive.
<b>export</b> [ <i>Name</i> . . . ]	Marks the specified names for automatic export to the environments of subsequently executed commands. If you do not specify the <i>Name</i> parameter, the <b>export</b> command displays a list of all names that are exported in this shell. You cannot export function names.
<b>hash</b> [ -r ] [ <i>Command</i> . . . ]	Finds and remembers the location in the search path of each <i>Command</i> specified. The -r flag causes the shell to forget all locations. If you do not specify the flag or any commands, the shell displays information about the remembered commands in the following format:  Hits   Cost   Command Hits indicates the number of times a command has been run by the shell process. Cost is a measure of the work required to locate a command in the search path. Command shows the path names of each specified command. Certain situations require that the stored location of a command be recalculated; for example, the location of a relative path name when the current directory changes. Commands for which that might be done are indicated by an * (asterisk) next to the Hits information. Cost is incremented when the recalculation is done.
<b>pwd</b>	Displays the current directory. Refer to the <b>pwd</b> command for a discussion of command options.
<b>read</b> [ <i>Name</i> . . . ]	Reads one line from standard input. Assigns the first word in the line to the first <i>Name</i> parameter, the second word to the second <i>Name</i> parameter, and so on, with leftover words assigned to the last <i>Name</i> parameter. This command returns a value of 0 unless it encounters an end-of-file character.
<b>readonly</b> [ <i>Name</i> . . . ]	Marks the name specified by the <i>Name</i> parameter as read-only. The value of the name cannot be reset. If you do not specify any <i>Name</i> , the <b>readonly</b> command displays a list of all read-only names.
<b>return</b> [ <i>n</i> ]	Causes a function to exit with a return value of <i>n</i> . If you do not specify the <i>n</i> variable, the function returns the status of the last command performed in that function. This command is valid only when run within a shell function.



## Built-In Commands

**set** [ *Flag* [ *Argument* ] . . . ]

Sets one or more of the following flags:

- a Marks for export all variables to which an assignment is performed. If the assignment precedes a command name, the export attribute is effective only for that command execution environment, except when the assignment precedes one of the special built-in commands. In this case, the export attribute persists after the built-in command has completed. If the assignment does not precede a command name, or if the assignment is a result of the operation of the **getopts** or **read** commands, the export attribute persists until the variable is unset.
- e Exits immediately if all of the following conditions exist for a command:
  - It exits with a return value greater than 0 (zero).
  - It is not part of the compound list of a **while**, **until**, or **if** command.
  - It is not being tested using AND or OR lists.
  - It is not a pipeline preceded by the ! (exclamation point) reserved word.
- f Disables file-name substitution.
- h Locates and remembers the commands called within functions as the functions are defined. (Normally these commands are located when the function is performed; see the **hash** command.)
- k Places all keyword parameters in the environment for a command, not just those preceding the command name.
- n Reads commands but does not run them. To check for shell script syntax errors, use the **-n** flag.
- t Exits after reading and executing one command.
- u Treats an unset variable as an error and immediately exits when performing variable substitution. An interactive shell does not exit.
- v Displays shell input lines as they are read.
- x Displays commands and their arguments before they are run.
- Does not change any of the flags. This is useful in setting the **\$1** positional parameter to a string beginning with a hyphen (-).

Using a plus sign (+) rather than a hyphen (-) unsets flags. You can also specify these flags on the shell command line. The **\$-** special variable contains the current set of flags.

Any *Argument* to the **set** command becomes a positional parameter and is assigned, in order, to **\$1**, **\$2**, and so on. If you do not specify a *flag* or *Argument*, the **set** command displays all the names and values of the current shell variables.

**shift** [*n*]

Shifts command line arguments to the left; that is, reassigns the value of the positional parameters by discarding the current value of **\$1** and assigning the value of **\$2** to **\$1**, of **\$3** to **\$2**, and so on. If there are more than 9 command line arguments, the 10th is assigned to **\$9** and any that remain are still unassigned (until after another **shift**). If there are 9 or fewer arguments, the **shift** command unsets the highest-numbered positional parameter that has a value.

**test** *Expression* ! [*Expression* ]  
**times**

The **\$0** positional parameter is never shifted. The **shift** *n* command is a shorthand notation specifying *n* number of consecutive shifts. The default value of the *n* parameter is 1. Evaluates conditional expressions. Refer to the **test** command for a discussion of command flags and parameters. The **-h** flag is not supported by the built-in test command in **bsh**. Displays the accumulated user and system times for processes run from the shell.

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## Built-In Commands

**trap** [ *Command* ] [ *n* ] . . .

Runs the command specified by the *Command* parameter when the shell receives the signal or signals specified by the *n* parameter. The **trap** commands are run in order of signal number. Any attempt to set a trap on a signal that was ignored on entry to the current shell is ineffective.

**Note:** The shell scans the *Command* parameter once when the trap is set and again when the trap is taken.

If you do not specify a command, then all traps specified by the *n* parameter are reset to their current values. If you specify a null string, this signal is ignored by the shell and by the commands it invokes. If the *n* parameter is zero (0), the specified command is run when you exit from the shell. If you do not specify either a command or a signal, the **trap** command displays a list of commands associated with each signal number.

**type** [ *Name* . . . ]

For each *Name* specified, indicates how the shell would interpret it as a command name.

**ulimit** [-HS] [ -c | -d | -f | -m | -s | -t ] [ *limit* ]

Displays or adjusts allocated shell resources. The shell resource settings can be displayed either individually or as a group. The default mode is to display resources set to the soft setting, or the lower bound, as a group.

The setting of shell resources depends on the effective user ID of the current shell. The hard level of a resource can be set only if the effective user ID of the current shell is root. You will get an error if you are not root user and you are attempting to set the hard level of a resource. By default, the root user sets both the hard and soft limits of a particular resource. The root user should therefore be careful in using the **-S**, **-H**, or default flag usage of **limit** settings. Unless you are a root user, you can set only the soft limit of a resource. After a limit has been decreased by a non-root user, it cannot be increased, even back to the original system limit.

To set a resource limit, select the appropriate flag and the limit value of the new resource, which should be an integer. You can set only one resource limit at a time. If more than one resource flag is specified, you receive undefined results. By default, **ulimit** with only a new value on the command line sets the file size of the shell. Use of the **-f** flag is optional.

You can specify the following **ulimit** command flags:

- c** Sets or displays core segment for shell.
- d** Sets or displays data segment for shell.
- f** Sets or displays file size for shell.
- H** Sets or displays hard resource limit (root user only)
- m** Sets or displays memory for shell.
- s** Sets or displays stack segment for shell.
- S** Sets or displays soft resource limit.
- t** Sets or displays CPU time maximum for shell.

**umask** [ *nnn* ]

Determines file permissions. This value, along with the permissions of the creating process, determines a file's permissions when the file is created. The default is 022. When no value is entered, **umask** displays the current value.

**unset** [ *Name* . . . ]

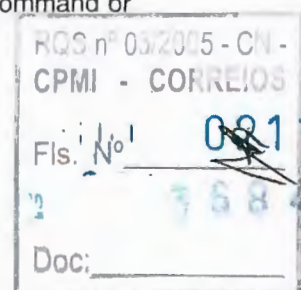
Removes the corresponding variable or function for each name specified by the *Name* parameter. The **PATH**, **PS1**, **PS2**, **MAILCHECK**, and **IFS** shell variables cannot be unset.

**wait** [ *n* ]

Waits for the child process whose process number is specified by the *n* parameter to exit and then returns the exit status of that process. If you do not specify the *n* parameter, the shell waits for all currently active child processes and the return value is 0.

## Command Substitution in the Bourne Shell

Command substitution allows you to capture the output of any command as an argument to another command. When you place a command line within backquotes (`), the shell first runs the command or



commands, and then replaces the entire expression, including the backquotes, with the output. This feature is often used to give values to shell variables. For example, the statement:

```
today=`date`
```

assigns the string representing the current date to the `today` variable. The following assignment saves, in the `files` variable, the number of files in the current directory:

```
files=`ls | wc -l`
```

You can perform command substitution on any command that writes to standard output.

To nest command substitutions, precede each of the nested backquotes with a backslash (\), as in:

```
logmsg=`echo Your login directory is `pwd``
```

You can also give values to shell variables indirectly by using the **read** special command. This command takes a line from standard input (usually your keyboard) and assigns consecutive words on that line to any variables named. For example:

```
read first init last
```

takes an input line of the form:

```
J. Q. Public
```

and has the same effect as if you had typed:

```
first=J. init=Q. last=Public
```

The **read** special command assigns any excess words to the last variable.

---

## Variable and File-Name Substitution in the Bourne Shell

The Bourne shell permits you to do variable and file-name substitutions.

The following sections discuss creating and substituting variables in the Bourne shell:

- "Variable Substitution in the Bourne Shell"
- "User-Defined Variables"
- "Conditional Substitution" on page 196
- "Positional Parameters" on page 197
- "File-Name Substitution in the Bourne Shell" on page 198
- "Character Classes" on page 198

## Variable Substitution in the Bourne Shell

The Bourne shell has several mechanisms for creating variables (assigning a string value to a name). Certain variables, positional parameters and keyword parameters are normally set only on a command line. Other variables are simply names to which you or the shell can assign string values.

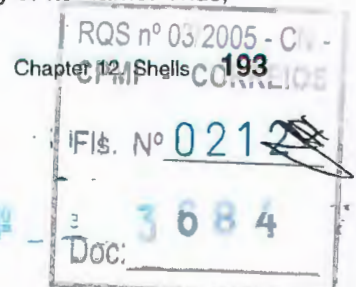
## User-Defined Variables

The shell recognizes alphanumeric variables to which string values can be assigned. To assign a string value to a name, type:

```
Name=String
```

Press Enter.

A name is a sequence of letters, digits, and underscores that begins with an underscore or a letter. To use the value that you have assigned to a variable, add a dollar sign (\$) to the beginning of its name. Thus,





the *\$Name* variable yields the value specified by the *String* variable. Note that no spaces are on either side of the equal sign (=) in an assignment statement. (Positional parameters cannot appear in an assignment statement. They can be set only as described in "Positional Parameters" on page 197.) You can put more than one assignment on a command line, but remember that the shell performs the assignments from right to left.

If you enclose the *String* variable with double or single quotation marks (" or '), the shell does not treat blanks, tabs, semicolons, and newline characters within the string as word delimiters, but imbeds them literally in the string.

If you enclose the *String* variable with double quotation marks ("), the shell still recognizes variable names in the string and performs variable substitution; that is, it replaces references to positional parameters and other variable names that are prefaced by dollar sign (\$) with their corresponding values, if any. The shell also performs command substitution within strings that are enclosed in double quotation marks.

If you enclose the *String* variable with single quotation marks ('), the shell does not substitute variables or commands within the string. The following sequence illustrates this difference:

```
You:      num=875
          number1="Add $num"
          number2='Add $num'
          echo $number1
System:    Add 875
You:      echo $number2
System:    Add $num
```

The shell does not reinterpret blanks in assignments after variable substitution. Thus, the following assignments result in \$first and \$second having the same value:

```
first='a string with embedded blanks'
second=$first
```

When you reference a variable, you can enclose the variable name (or the digit designating a positional parameter) in { } to delimit the variable name from any string following. In particular, if the character immediately following the name is a letter, digit, or underscore, and the variable is not a positional parameter, then the braces are required:

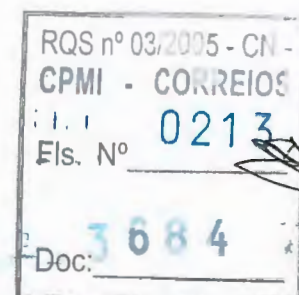
```
You:      a='This is a'
          echo "${a}n example"
System:    This is an example
You:      echo "$a test"
System:    This is a test
```

Refer to "Conditional Substitution" on page 196 for a different use of braces in variable substitutions.

## Variables Used by the Shell

The shell uses the following variables. Although the shell sets some of them, you can set or reset all of them:

<b>CDPATH</b>	Specifies the search path for the <b>cd</b> (change directory) command.
<b>HOME</b>	Indicates the name of your <i>login directory</i> , the directory that becomes the current directory upon completion of a login. The <b>login</b> program initializes this variable. The <b>cd</b> command uses the value of the <b>\$HOME</b> variable as its default value. Using this variable rather than an explicit path name in a shell procedure allows the procedure to be run from a different directory without alterations.
<b>IFS</b>	The characters that are IFS (internal field separators), the characters that the shell uses during blank interpretation; see "Blank Interpretation" on page 196. The shell initially sets the <b>IFS</b> variable to include the blank, tab, and newline characters.





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<b>LANG</b>	Determines the locale to use for the locale categories when both the <b>LC_ALL</b> variable and the corresponding environment variable (beginning with <b>LC_</b> ) do not specify a locale. For more information about locales, see "Locale Overview" in <i>AIX 5L Version 5.2 National Language Support Guide and Reference</i> .
<b>LC_ALL</b>	Determines the locale to be used to override any values for locale categories specified by the settings of the <b>LANG</b> environment variable or any environment variables beginning with <b>LC_</b> .
<b>LC_COLLATE</b>	Defines the collating sequence to use when sorting names and when character ranges occur in patterns.
<b>LC_CTYPE</b>	Determines the locale for the interpretation of sequences of bytes of text data as characters (that is, single- versus multibyte characters in arguments and input files), which characters are defined as letters ( <b>alpha</b> character class), and the behavior of character classes within pattern matching.
<b>LC_MESSAGES</b>	Determines the language in which messages should be written.
<b>LIBPATH</b>	Specifies the search path for shared libraries.
<b>LOGNAME</b>	Specifies your login name, marked <b>readonly</b> in the <b>/etc/profile</b> file.
<b>MAIL</b>	Indicates the path name of the file used by the mail system to detect the arrival of new mail. If this variable is set, the shell periodically checks the modification time of this file and displays the value of <b>\$MAILMSG</b> if the time changes and the length of the file is greater than 0. Set the <b>MAIL</b> variable in the <b>.profile</b> file. The value normally assigned to it by users of the <b>mail</b> command is <b>/usr/spool/mail/\$LOGNAME</b> .
<b>MAILCHECK</b>	The number of seconds that the shell lets elapse before checking again for the arrival of mail in the files specified by the <b>MAILPATH</b> or <b>MAIL</b> variables. The default value is 600 seconds (10 minutes). If you set the <b>MAILCHECK</b> variable to 0, the shell checks before each prompt.
<b>MAILMSG</b>	The mail notification message. If you explicitly set the <b>MAILMSG</b> variable to a null string ( <b>MAILMSG=""</b> ), no message is displayed.
<b>MAILPATH</b>	A list of file names separated by colons. If this variable is set, the shell informs you of the arrival of mail in any of the files specified in the list. You can follow each file name by a % and a message to be displayed when mail arrives. Otherwise, the shell uses the value of the <b>MAILMSG</b> variable or, by default, the message <b>[YOU HAVE NEW MAIL]</b> .
	<b>Note:</b> When the <b>MAILPATH</b> variable is set, these files are checked instead of the file set by the <b>MAIL</b> variable. To check the files set by the <b>MAILPATH</b> variable and the file set by the <b>MAIL</b> variable, specify the <b>MAIL</b> file in your list of <b>MAILPATH</b> files.
<b>PATH</b>	<p>The search path for commands, which is an ordered list of directory path names separated by colons. The shell searches these directories in the specified order when it looks for commands. A null string anywhere in the list represents the current directory.</p> <p>The <b>PATH</b> variable is normally initialized in the <b>/etc/environment</b> file, usually to <b>/usr/bin:/etc:/usr/sbin:/usr/ucb:/usr/bin/X11:/sbin</b>. You can reset this variable to suit your own needs. The <b>PATH</b> variable provided in your <b>.profile</b> file also includes <b>\$HOME/bin</b> and your current directory.</p> <p>If you have a project-specific directory of commands, for example, <b>/project/bin</b>, that you want searched before the standard system directories, set your <b>PATH</b> variable as follows:</p> <pre>PATH=/project/bin:\$PATH</pre> <p>The best place to set your <b>PATH</b> variable to a value other than the default value is in your <b>\$HOME/.profile</b> file. You cannot reset the <b>PATH</b> variable if you are executing commands under the restricted shell.</p>
<b>PS1</b>	The string to be used as the primary system prompt. An interactive shell displays this prompt string when it expects input. The default value of the <b>PS1</b> variable is \$ followed by a blank space, for nonroot users.
<b>PS2</b>	The value of the secondary prompt string. If the shell expects more input when it encounters a new-line character in its input, it prompts with the value of the <b>PS2</b> variable. The default value of the <b>PS2</b> variable is > , followed by a blank space.
<b>SHACCT</b>	The name of a file that you own. If this variable is set, the shell writes an accounting record in the file for each shell script executed. You can use accounting programs such as <b>acctcom</b> and <b>acctcms</b> to analyze the data collected.

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## SHELL

The path name of the shell, which is kept in the environment. This variable should be set and exported by the **\$HOME/.profile** file of each restricted login.

## TIMEOUT

The number of minutes a shell remains inactive before it exits. If this variable is set to a value greater than zero (0), the shell exits if a command is not entered within the prescribed number of seconds after issuing the **PS1** prompt. (Note that the shell can be compiled with a maximum boundary that cannot be exceeded for this value.) A value of zero indicates no time limit.

## Predefined Special Variables

Several variables have special meanings. The following variables are set only by the shell.

**\$@** Expands the positional parameters, beginning with **\$1**. Each parameter is separated by a space.

If you place " " around **\$@**, the shell considers each positional parameter a separate string. If no positional parameters exist, the Bourne shell expands the statement to an unquoted null string.

**\$\*** Expands the positional parameters, beginning with **\$1**. The shell separates each parameter with the first character of the **IFS** variable value.

If you place " " around **\$\***, the shell includes the positional parameter values, in double quotation marks. Each value is separated by the first character of the **IFS** variable.

**\$#** Specifies the number of positional parameters passed to the shell, not counting the name of the shell procedure itself. The **\$#** variable thus yields the number of the highest-numbered positional parameter that is set. One of the primary uses of this variable is to check for the presence of the required number of arguments. Only positional parameters **\$0** through **\$9** are accessible through the shell. See "Positional Parameters" on page 197 for more information.

**\$?** Specifies the exit value of the last command executed. Its value is a decimal string. Most commands return a value of 0 to indicate successful completion. The shell itself returns the current value of the **\$?** variable as its exit value.

**\$\$** Identifies the process number of the current process. Because process numbers are unique among all existing processes, this string is often used to generate unique names for temporary files.

The following example illustrates the recommended practice of creating temporary files in a directory used only for that purpose:

```
temp=/tmp/$$
ls >$temp
.
.
rm $temp
```

**!** Specifies the process number of the last process run in the background using the **&** terminator.

**-** A string consisting of the names of the execution flags currently set in the shell.

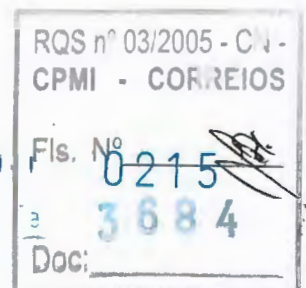
## Blank Interpretation

After the shell performs variable and command substitution, it scans the results for internal field separators (those defined in the **IFS** shell variable). The shell splits the line into distinct words at each place it finds one or more of these characters separating each distinct word with a single space. It then retains explicit null arguments (" " or "") and discards implicit null arguments (those resulting from parameters that have no values).

## Conditional Substitution

Normally, the shell replaces the expression **\$Variable** with the string value assigned to the *Variable* variable, if there is one. However, there is a special notation that allows *conditional substitution*, depending on whether the variable is set or not null, or both. By definition, a variable is set if it has ever been assigned a value. The value of a variable can be the null string, which you can assign to a variable in any one of the following ways:

A=



bcd=""

Efg=""

set "" ""

Assigns the null string to the A, bcd, and Efg.

Sets the first and second positional parameters to the null string and unsets all other positional parameters.

The following is a list of the available expressions you can use to perform conditional substitution:

<code>\${Variable-String}</code>	If the variable is set, substitute the <i>Variable</i> value in place of this expression. Otherwise, replace this expression with the <i>String</i> value.
<code>\${Variable:-String}</code>	If the variable is set and not null, substitute the <i>Variable</i> value in place of this expression. Otherwise, replace this expression with the <i>String</i> value.
<code>\${Variable=String}</code>	If the variable is set, substitute the <i>Variable</i> value in place of this expression. Otherwise, set the <i>Variable</i> value to the <i>String</i> value and then substitute the <i>Variable</i> value in place of this expression. You cannot assign values to positional parameters in this fashion.
<code>\${Variable:=String}</code>	If the variable is set and not null, substitute the <i>Variable</i> value in place of this expression. Otherwise, set the <i>Variable</i> value to the <i>String</i> value and then substitute the <i>Variable</i> value in place of this expression. You cannot assign values to positional parameters in this fashion.
<code>\${Variable?String}</code>	If the variable is set, substitute the <i>Variable</i> value in place of this expression. Otherwise, display a message of the following form: Variable: String and exit from the current shell (unless the shell is the login shell). If you do not specify a value for the <i>String</i> variable, the shell displays the following message: Variable: parameter null or not set
<code>\${Variable:?String}</code>	If the variable is set and not null, substitute the <i>Variable</i> value in place of this expression. Otherwise, display a message of the following form: Variable: String and exit from the current shell (unless the shell is the login shell). If you do not specify the <i>String</i> value, the shell displays the following message: Variable: parameter null or not set
<code>\${Variable+String}</code>	If the variable is set, substitute the <i>String</i> value in place of this expression. Otherwise, substitute the null string.
<code>\${Variable:+String}</code>	If the variable is set and not null, substitute the <i>String</i> value in place of this expression. Otherwise, substitute the null string.

In conditional substitution, the shell does not evaluate the *String* variable until the shell uses this variable as a substituted string. Thus, in the following example, the shell executes the **pwd** command only if *d* is not set or is null:

```
echo ${d:-`pwd`}
```

## Positional Parameters

When you run a shell procedure, the shell implicitly creates positional parameters that reference each word on the command line by its position on the command line. The word in position 0 (the procedure name) is called **\$0**, the next word (the first parameter) is called **\$1**, and so on, up to **\$9**. To refer to command line parameters numbered higher than 9, use the built-in **shift** command.

You can reset the values of the positional parameters explicitly by using the built-in **set** command.

**Note:** When an argument for a position is not specified, its positional parameter is set to null. Positional parameters are global and can be passed to nested shell procedures.

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## File-Name Substitution in the Bourne Shell

Command parameters are often file names. You can automatically produce a list of file names as parameters on a command line. To do this, specify a character that the shell recognizes as a pattern-matching character. When a command includes such a character, the shell replaces it with the file names in a directory.

**Note:** The Bourne shell does not support file-name expansion based on equivalence classification of characters.

Most characters in such a pattern match themselves, but you can also use some special pattern-matching characters in your pattern. These special characters are as follows:

*	Matches any string, including the null string
?	Matches any one character
[ . . . ]	Matches any one of the characters enclosed in square brackets
[ ! . . . ]	Matches any character within square brackets <i>other than</i> one of the characters that follow the exclamation mark

Within square brackets, a pair of characters separated by a - specifies the set of all characters lexicographically within the inclusive range of that pair, according to the binary ordering of character values.

Pattern matching has some restrictions. If the first character of a file name is a dot (.), it can be matched only by a pattern that also begins with a dot. For example, \* matches the file names **myfile** and **yourfile** but not the file names **.myfile** and **.yourfile**. To match these files, use a pattern such as the following:

```
.*file
```

If a pattern does not match any file names, then the pattern itself is returned as the result of the attempted match.

File and directory names should not contain the characters \*, ?, [, or ] because they can cause infinite recursion (that is, infinite loops) during pattern-matching attempts.

## Character Classes

You can also use character classes to match file names, as follows:

```
[[:charclass:]]
```

This format instructs the system to match any single character belonging to the specified class. The defined classes correspond to **ctype** subroutines, as follows:

Character Class	Definition
alnum	Alphanumeric characters
alpha	Uppercase and lowercase letters
blank	Space or horizontal tab
cntrl	Control characters
digit	Digits
graph	Graphic characters
lower	Lowercase letters
print	Printable characters
punct	Punctuation characters
space	Space, horizontal tab, carriage return, newline, vertical tab or form-feed character
upper	Uppercase characters
xdigit	Hexadecimal digits

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## Input and Output Redirection in the Bourne Shell

In general, most commands do not know whether their input or output is associated with the keyboard, the display screen, or a file. Thus, a command can be used conveniently either at the keyboard or in a pipeline.

The following redirection options can appear anywhere in a simple command. They can also precede or follow a command, but are not passed to the command.

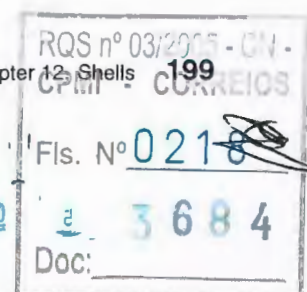
<File	Uses the specified file as standard input.
>File	Uses the specified file as standard output. Creates the file if it does not exist; otherwise, truncates it to zero length.
>>File	Uses the specified file as standard output. Creates the file if it does not exist; otherwise, adds the output to the end of the file.
<<[-]eofstr	Reads as standard input all lines from the <i>eofstr</i> variable up to a line containing only <i>eofstr</i> or up to an end-of-file character. If any character in the <i>eofstr</i> variable is quoted, the shell does not expand or interpret any characters in the input lines. Otherwise, it performs variable and command substitution and ignores a quoted newline character ( <b>newline</b> ). Use a \ to quote characters within the <i>eofstr</i> variable or within the input lines.
	If you add a - to the << redirection option, then all leading tabs are stripped from the <i>eofstr</i> variable and from the input lines.
<&Digit	Associates standard input with the file descriptor specified by the <i>Digit</i> variable.
>&Digit	Associates standard output with the file descriptor specified by the <i>Digit</i> variable.
<&-	Closes standard input.
>&-	Closes standard output.

**Note:** The restricted shell does not allow output redirection.

For more information about redirection, see Chapter 5, "Input and Output Redirection" on page 45.

## List of Bourne Shell Built-in Commands

:	Returns a zero exit value
.	Reads and executes commands from a file parameter and then returns.
break	Exists from the enclosing <b>for</b> , <b>while</b> , or <b>until</b> command loops, if any.
cd	Changes the current directory to the specified directory.
continue	Resumes the next iteration of the enclosing <b>for</b> , <b>while</b> , or <b>until</b> command loops.
echo	Writes character strings to standard output.
eval	Reads the arguments as input to the shell and executes the resulting command or commands.
exec	Executes the command specified by the <i>Argument</i> parameter, instead of this shell, without creating a new process.
exit	Exits the shell whose exit status is specified by the <i>n</i> parameter.
export	Marks names for automatic export to the environment of subsequently executed commands.
hash	Finds and remembers the location in the search path of specified commands.
pwd	Displays the current directory.
read	Reads one line from standard input.
readonly	Marks name specified by <i>Name</i> parameter as read-only.
return	Causes a function to exit with a specified return value.
set	Controls the display of various parameters to standard output.
shift	Shifts command-line arguments to the left.
test	Evaluates conditional expressions.
times	Displays the accumulated user and system times for processes run from the shell.
trap	Runs a specified command when the shell receives a specified signal or signals.
type	Interprets how the shell would interpret a specified name as a command name.





<b>ulimit</b>	Displays or adjusts allocated shell resources.
<b>umask</b>	Determines file permissions.
<b>unset</b>	Removes the variable or function corresponding to a specified name.
<b>wait</b>	Waits for the specified child process to end and reports its termination status.

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## C Shell

The C shell is an interactive command interpreter and a command programming language. It uses syntax that is similar to the C programming language. The **cs**h command starts the C shell.

When you log in, the **cs**h command first searches the systemwide setup file **/etc/csh.cshrc**. If the setup file is there, the C shell executes the commands stored in that file. Next, the C shell executes the systemwide setup file **/etc/csh.login** if it is available. Then, it searches your home directory for the **.cshrc** and **.login** files. If they exist, they contain any customized user information pertinent to running the C shell. All variables set in the **/etc/csh.cshrc** and **/etc/csh.login** files might be overridden by your **.cshrc** and **.login** files in your **\$HOME** directory. Only the root user can modify the **/etc/csh.cshrc** and **/etc/csh.login** files.

The **/etc/csh.login** and **\$HOME/.login** files are executed only once at login time. These files are generally used to hold environment variable definitions, commands that you want executed once at login, or commands that set up terminal characteristics.

The **/etc/csh.cshrc** and **\$HOME/.cshrc** files are executed at login time, and every time the **cs**h command or a C shell script is invoked. They are generally used to define C shell characteristics like aliases and C shell variables (for example, history, noclobber, or ignoreeof). It is recommended that you only use the C Shell built-in commands (see "C Shell Built-In Commands" on page 202) in the **/etc/csh.cshrc** and **\$HOME/.cshrc** files because using other commands increases the startup time for shell scripts.

This section discusses the following:

- "C Shell Limitations" on page 201
- "Signal Handling" on page 201
- "C Shell Commands" on page 201
  - "C Shell Built-In Commands" on page 202
  - "C Shell Expressions and Operators" on page 207
  - "Command Substitution in the C Shell" on page 208
  - "Nonbuilt-in C Shell Command Execution" on page 209
- "History Substitution in the C Shell" on page 209
  - "History Lists" on page 209
  - "Event Specification" on page 210
  - "Quoting with Single and Double Quotes" on page 211
- "Alias Substitution in the C Shell" on page 212
- "Variable and File-Name Substitution in the C Shell" on page 213
  - "Variable Substitution in the C Shell" on page 213
  - "File-Name Substitution in the C Shell" on page 214
  - "File-Name Expansion" on page 214
  - "File-Name Abbreviation" on page 215
  - "Character Classes" on page 216
- "Environment Variables in the C Shell" on page 216
- "Input and Output Redirection in the C Shell" on page 218

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- “Job Control in the C Shell” on page 219
- “C Shell” on page 221

## C Shell Limitations

The following are limitations of the C shell:

- Words can be no longer than 1024 bytes.
- Argument lists are limited to ARG\_MAX bytes. Values for the ARG\_MAX variable are found in the `/usr/include/sys/limits.h` file.
- The number of arguments to a command that involves file-name expansion is limited to 1/6th the number of bytes allowed in an argument list.
- Command substitutions can substitute no more bytes than are allowed in an argument list.
- To detect looping, the shell restricts the number of alias substitutions on a single line to 20.
- The **cs**h command does not support file-name expansion based on equivalence classification of characters.
- File descriptors (other than standard in, standard out, and standard error) opened before **cs**h executes any application are not available to that application.

## Signal Handling

The C shell normally ignores quit signals. Jobs running detached are not affected by signals generated from the keyboard (**INTERRUPT**, **QUIT**, and **HANGUP**). Other signals have the values the shell inherits from its parent. You can control the shell's handling of **INTERRUPT** and **TERMINATE** signals in shell procedures with **onintr**. Login shells catch or ignore **TERMINATE** signals depending on how they are set up. Shells other than login shells pass **TERMINATE** signals on to the child processes. In no cases are **INTERRUPT** signals allowed when a login shell is reading the `.logout` file.

## C Shell Commands

A simple command is a sequence of words separated by blanks or tabs.

A *word* is a sequence of characters or numerals, or both, that does not contain blanks without quotation marks. In addition, the following characters and doubled characters also form single words when used as command separators or terminators:

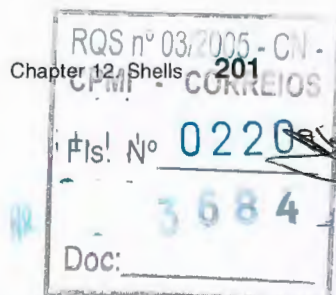
```
&      |      ;      > >
&&     |      <<     < <
<      |      (      )
```

These special characters can be parts of other words. Preceding them with a `\`, however, prevents the shell from interpreting them as special characters. Strings enclosed in `' '` or `" "` (matched pairs of quotation characters) or backquotes can also form parts of words. Blanks, tab characters, and special characters do not form separate words when they are enclosed in these marks. In addition, you can enclose a newline character within these marks by preceding it with a `\`.

The first word in the simple command sequence (numbered 0) usually specifies the name of a command. Any remaining words, with a few exceptions, are passed to that command. If the command specifies an executable file that is a compiled program, the shell immediately runs that program. If the file is marked executable but is not a compiled program, the shell assumes that it is a shell script. In this case, the shell starts another instance of itself (a subshell) to read the file and execute the commands included in it.

This section discusses the following:

- “C Shell Built-In Commands” on page 202





- "C Shell Expressions and Operators" on page 207
- "Command Substitution in the C Shell" on page 208
- "Nonbuilt-in C Shell Command Execution" on page 209

## C Shell Built-In Commands

Built-in commands are run within the shell. If a built-in command occurs as any component of a pipeline, except the last, the command runs in a subshell.

**Note:** If you enter a command from the C shell prompt, the system searches for a built-in command first. If a built-in command does not exist, the system searches the directories specified by the **path** shell variable for a system-level command. Some C shell built-in commands and operating system commands have the same name. However, these commands do not necessarily work the same way. For more information on how the command works, check the appropriate command description.

If you run a shell script from the shell and the first line of the shell script begins with `#!/ShellPathname`, the C shell runs the shell specified in the comment to process the script. Otherwise, it runs the default shell (the shell linked to `/usr/bin/sh`). If run by the default shell, C shell built-in commands might not be recognized. To run C shell commands, make the first line of the script `#!/usr/bin/csh`.

Refer to the "List of C Shell Built-in Commands" on page 219 for an alphabetic listing of the built-in commands.

## C Shell Command Descriptions

The C shell provides the following built-in commands:

<b>alias</b> [ <i>Name</i> [ <i>WordList</i> ]]	Displays all aliases if you do not specify any parameters. Otherwise, the command displays the alias for the specified <i>Name</i> . If <i>WordList</i> is specified, this command assigns the value of <i>WordList</i> to the alias <i>Name</i> . The specified alias <i>Name</i> cannot be <b>alias</b> or <b>unalias</b> .
<b>bg</b> [% <i>Job</i> ...]	Puts the current job or job specified by <i>Job</i> into the background, continuing the job if it was stopped.
<b>break</b>	Resumes running after the <b>end</b> of the nearest enclosing <b>foreach</b> or <b>while</b> command.
<b>breaksw</b>	Breaks from a <b>switch</b> command; resumes after the <b>endsw</b> command.
<b>case</b> <i>Label</i> :	Defines a <i>Label</i> in a <b>switch</b> command.
<b>cd</b> [ <i>Name</i> ]	Equivalent to the <b>chdir</b> command (see following description).
<b>chdir</b> [ <i>Name</i> ]	Changes the current directory to that specified by the <i>Name</i> variable. If you do not specify <i>Name</i> , the command changes to your home directory. If the value of the <i>Name</i> variable is not a subdirectory of the current directory and does not begin with <code>/</code> , <code>./</code> , or <code>../</code> , the shell checks each component of the <b>cdpath</b> shell variable to see if it has a subdirectory matching the <i>Name</i> variable. If the <i>Name</i> variable is a shell variable with a value that begins with <code>/</code> , the shell tries this to see if it is a directory. The <b>chdir</b> command is equivalent to the <b>cd</b> command.
<b>continue</b>	Continues execution at the <b>end</b> of the nearest enclosing <b>while</b> or <b>foreach</b> command.
<b>default:</b>	Labels the <b>default</b> case in a <b>switch</b> statement. The <b>default</b> should come after all other <b>case</b> labels.
<b>dirs</b>	Displays the directory stack.
<b>echo</b>	Writes character strings to the standard output of the shell.
<b>else</b>	Runs the commands that follow the second <b>else</b> in an <b>if</b> ( <i>Expression</i> ) <b>then</b> ... <b>else if</b> ( <i>Expression2</i> ) <b>then</b> ... <b>else</b> ... <b>endif</b> command sequence.

<b>end</b>	Successively sets the <i>Name</i> variable to each member specified by the <i>List</i> variable and runs the sequence of <i>Commands</i> between the <b>foreach</b> and the matching <b>end</b> statements. The <b>foreach</b> and <b>end</b> statements must appear alone on separate lines.
<b>endif</b>	Uses the <b>continue</b> statement to continue the loop and the <b>break</b> statement to end the loop prematurely. When the <b>foreach</b> command is read from the terminal, the C shell prompts with a ? to allow <i>Commands</i> to be entered. <i>Commands</i> within loops, prompted for by ?, are not placed in the history list. If the <i>Expression</i> variable is true, runs the <i>Commands</i> that follow the first <b>then</b> statement. If the <b>else if</b> <i>Expression2</i> is true, runs the <i>Commands</i> that follow the second <b>then</b> statement. If the <b>else if</b> <i>Expression2</i> is false, runs the <i>Commands</i> that follow the <b>else</b> . Any number of <b>else if</b> pairs are possible. Only one <b>endif</b> statement is needed. The <b>else</b> segment is optional. The words <b>else</b> and <b>endif</b> can be used only at the beginning of input lines. The <b>if</b> segment must appear alone on its input line or after an <b>else</b> command.
<b>endsw</b>	Successively matches each <b>case</b> label against the value of the <i>string</i> variable. The <i>string</i> is command and file name expanded first. Use the pattern-matching characters *, ?, and [ . . . ] in the <b>case</b> labels, which are variable-expanded. If none of the labels match before a <b>default</b> label is found, the execution begins after the <b>default</b> label. The <b>case</b> label and the <b>default</b> label must appear at the beginning of the line. The <b>breaksw</b> command causes execution to continue after the <b>endsw</b> command. Otherwise, control might fall through the <b>case</b> and <b>default</b> labels, as in the C programming language. If no label matches and there is no <b>default</b> , execution continues after the <b>endsw</b> command.
<b>eval</b> <i>Parameter</i> . . .	Reads the value of the <i>Parameter</i> variable as input to the shell and runs the resulting command or commands in the context of the current shell. Use this command to run commands generated as the result of command or variable substitution, since parsing occurs before these substitutions.
<b>exec</b> <i>Command</i>	Runs the specified <i>Command</i> in place of the current shell.
<b>exit</b> [( <i>Expression</i> )]	Exits the shell with either the value of the <b>status</b> shell variable (if no <i>Expression</i> is specified) or with the value of the specified <i>Expression</i> .
<b>fg</b> [% <i>Job</i> ...]	Brings the current job or job specified by <i>Job</i> into the foreground, continuing the job if it was stopped.
<b>foreach</b> <i>Name</i> ( <i>List</i> ) <i>Command</i> . . .	Successively sets a <i>Name</i> variable for each member specified by the <i>List</i> variable and a sequence of commands, until reaching an <b>end</b> command.
<b>glob</b> <i>List</i>	Displays <i>List</i> using history, variable, and file name expansion. Puts a null character between words and does not include a carriage return at the end.
<b>goto</b> <i>Word</i>	Continues to run after the line specified by the <i>Word</i> variable. The specified <i>Word</i> is file name and command expanded to yield a string of the form specified by the <i>Label:</i> variable. The shell rewinds its input as much as possible and searches for a line of the form <i>Label:</i> , possibly preceded by blanks or tabs.
<b>hashstat</b>	Displays statistics indicating how successful the hash table has been at locating commands.
<b>history</b> [-r   -h] [ <i>n</i> ]	Displays the history event list. The oldest events are displayed first. If you specify a number <i>n</i> , only the specified number of the most recent events are displayed. The <b>-r</b> flag reverses the order in which the events are displayed so the most recent is displayed first. The <b>-h</b> flag displays the history list without leading numbers. Use this flag to produce files suitable for use with the <b>-h</b> flag of the <b>source</b> command.



**if** (*Expression*) *Command*

Runs the specified *Command* (including its arguments) if the specified *Expression* is true. Variable substitution on the *Command* variable happens early, at the same time as the rest of the **if** statement. The specified *Command* must be a simple command (rather than a pipeline, command list, or parenthesized command list).

**Note:** Input and output redirection occurs even if the *Expression* variable is false and the *Command* is not executed.

**jobs** [-l]

Lists the active jobs. With the -l (lowercase l) flag, the **jobs** command lists process IDs in addition to the job number and name.

**kill** -l | [[-*Signal*] % *Job*...|*PID*...]

Sends either the **TERM** (terminate) signal or the signal specified by *Signal* to the specified *Job* or *PID* (process). Specify signals either by number or by name (as given in the */usr/include/sys/signal.h* file, stripped of the **SIG** prefix). The -l (lowercase l) flag lists the signal names.

**limit** [-h] [*Resource* [*Max-Use*]]

Limits the usage of the specified resource by the current process and each process it creates. Process resource limits are defined in the */etc/security/limits* file. Controllable resources are the central processing unit (CPU) time, file size, data size, core dump size, and memory use. Maximum allowable values for these resources are set with the **mkuser** command when the user is added to the system. They are changed with the **chuser** command.

Limits are categorized as either soft or hard. Users may increase their soft limits up to the ceiling imposed by the hard limits. You must have root user authority to increase a soft limit above the hard limit, or to change hard limits. The -h flag displays hard limits instead of the soft limits.

If a *Max-Use* parameter is not specified, the **limit** command displays the current limit of the specified resource. If the *Resource* parameter is not specified, the **limit** command displays the current limits of all resources. For more information about the resources controlled by the **limit** subcommand, see the **getrlimit**, **setrlimit**, or **vlimit** subroutine in the *AIX 5L Version 5.2 Technical Reference: Base Operating System and Extensions Volume 1*.

The *Max-Use* parameter for CPU time is specified in the hh:mm:ss format. The *Max-Use* parameter for other resources is specified as a floating-point number or an integer optionally followed by a scale factor. The scale factor is: k or kilobytes (1024 bytes), m or megabytes, or b or blocks (the units used by the **ulimit** subroutine as explained in the *AIX 5L Version 5.2 Technical Reference: Base Operating System and Extensions Volume 2*). If you do not specify a scale factor, k is assumed for all resources. For both resource names and scale factors, unambiguous prefixes of the names suffice.

**Note:** This command limits the physical memory (memory use) available for a process only if there is contention for system memory by other active processes.

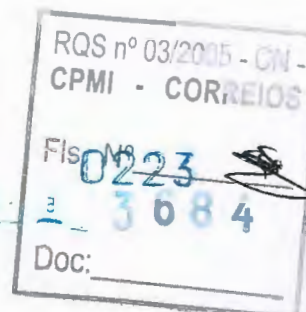
**login**

Ends a login shell and replaces it with an instance of the */usr/bin/login* command. This is one way to log out (included for compatibility with the **ksh** and **bsh** commands).

**logout**

**nice** [+*n*] [*Command*]

Ends a login shell. This command must be used if the **ignoreeof** option is set. If no values are specified, sets the priority of commands run in this shell to 24. If the +*n* flag is specified, sets the priority plus the specified number. If the +*n* flag and *Command* are specified, runs *Command* at priority 24 plus the specified number. If you have root user authority, you can run the **nice** statement with a negative number. The *Command* always runs in a subshell, and the restrictions placed on commands in simple **if** statements apply.





**nohup** [*Command*]

Causes **hangups** to be ignored for the remainder of the script when no *Command* is specified. If *Command* is specified, causes the specified *Command* to be run with **hangups** ignored. To run a pipeline or list of commands, put the pipeline or list in a shell script, give the script execute permission, and use the shell script as the value of the *Command* variable. All processes run in the background with **&** are effectively protected from being sent a **hangup** signal when you log out. However, these processes are still subject to explicitly sent **hangups** unless the **nohup** statement is used.

**notify** [%*Job*...]

Causes the shell to notify you asynchronously when the status of the current job or specified *Job* changes. Normally, the shell provides notification just before it presents the shell prompt. This feature is automatic if the **notify** shell variable is set.

**onintr** [- | *Label*]

Controls the action of the shell on interrupts. If no arguments are specified, restores the default action of the shell on interrupts, which ends shell scripts or returns to the command input level. If a **-** flag is specified, causes all interrupts to be ignored. If *Label* is specified, causes the shell to run a **goto** *Label* statement when the shell receives an interrupt or when a child process ends due to an interruption. In any case, if the shell is running detached and interrupts are being ignored, all forms of the **onintr** statement have no meaning. Interrupts continue to be ignored by the shell and all invoked commands.

**popd** [+*n*]

Pops the directory stack and changes to the new top directory. If you specify a +*n* variable, the command discards the *n*th entry in the stack. The elements of the directory stack are numbered from the top, starting at 0.

**pushd** [+*n*] *Name*

With no arguments, exchanges the top two elements of the directory stack. With the *Name* variable, the command changes to the new directory and pushes the old current directory (as given in the **cwd** shell variable) onto the directory stack. If you specify a +*n* variable, the command rotates the *n*th component of the directory stack around to be the top element and changes to it. The members of the directory stack are numbered from the top, starting at 0.

**rehash**

Causes recomputation of the internal hash table of the contents of the directories in the **path** shell variable. This action is needed if new commands are added to directories in the **path** shell variable while you are logged in. The **rehash** command is necessary only if commands are added to one of the user's own directories or if someone changes the contents of one of the system directories.

**repeat** *Count Command*

Runs the specified *Command*, subject to the same restrictions as commands in simple **if** statements, the number of times specified by *Count*.

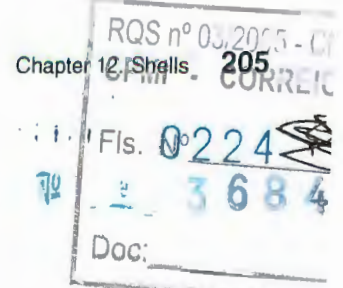
**Note:** I/O redirections occur exactly once, even if the *Count* variable equals 0.

**set** [[*Name*[*n*]] [= *Word*]] | [*Name* = (*List*)]

Shows the value of all shell variables when used with no arguments. Variables that have more than a single word as their value are displayed as a parenthesized word list. If only *Name* is specified, the C shell sets the *Name* variable to the null string. Otherwise, sets *Name* to the value of the *Word* variable, or sets the *Name* variable to the list of words specified by the *List* variable. When *n* is specified, the *n*th component of the *Name* variable is set to the value of the *Word* variable; the *n*th component must already exist. In all cases, the value is command and file name expanded. These arguments may be repeated to set multiple values in a single **set** command. However, variable expansion happens for all arguments before any setting occurs.

**setenv** *Name Value*

Sets the value of the environment variable specified by the *Name* variable to *Value*, a single string. The most commonly used environment variables, **USER**, **TERM**, **HOME**, and **PATH**, are automatically imported to and exported from the C shell variables **user**, **term**, **home**, and **path**. There is no need to use the **setenv** statement for these.





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**shift** [*Variable*]

Shifts the members of the **argv** shell variable or the specified *Variable* to the left. An error occurs if the **argv** shell variable or specified *Variable* is not set or has less than one word as its value.

**source**[-h] *Name*

Reads commands specified by the *Name* variable. You can nest the **source** commands. However, if they are nested too deeply, the shell might run out of file descriptors. An error in a **source** command at any level ends all nested **source** commands. Normally, input during **source** commands is not placed on the history list. The **-h** flag causes the commands to be placed in the history list without executing them.

**stop** [%*Job* ...]

Stops the current job or specified *Job* running in the background.

**suspend**

Stops the shell as if a **STOP** signal had been received.

**switch** (*string*)

Starts a **switch** (*String*) case *String* : ... **breaksw** default: ... **breaksw** **endsw** command sequence. This command sequence successively matches each case label against the value of the *String* variable. If none of the labels match before a default label is found, the execution begins after the default label.

**time** [*Command*]

The **time** command controls automatic timing of commands. If you do not specify the *Command* variable, the **time** command displays a summary of time used by this shell and its children. If you specify a command with the *Command* variable, it is timed. The shell then displays a time summary, as described under the **time** shell variable. If necessary, an extra shell is created to display the time statistic when the command completes.

The following example uses **time** with the **sleep** command:

```
time sleep
```

The output from this command looks similar to the following:

```
0.0u 0.0s 0:00 100% 44+4k 0+0io 0pf+0w
```

The output fields are as follows:

Field	Description
-------	-------------

<b>First</b>	Number of seconds of CPU time devoted to the user process
--------------	---

<b>Second</b>	Number of seconds of CPU time consumed by the kernel on behalf of the user process
---------------	--

<b>Third</b>	Elapsed (wall clock) time for the command
--------------	---

<b>Fourth</b>	Total user CPU Time plus system time, as a percentage of elapsed time
---------------	---

<b>Fifth</b>	Average amount of shared memory used, plus average amount of unshared data space used, in kilobytes
--------------	---

<b>Sixth</b>	Number of block input and output operations
--------------	---

<b>Seventh</b>	Page faults plus number of swaps
----------------	----------------------------------

**umask** [*Value*]

Determines file permissions. This *Value*, along with the permissions of the creating process, determines a file's permissions when the file is created. The default is 022. The current setting will be displayed if no *Value* is specified.

**unalias** \**Pattern*

Discards all aliases with names that match the *Pattern* variable. All aliases are removed by the **unalias** \* command. The absence of aliases does not cause an error.

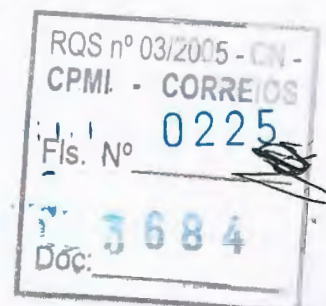
**unhash**

Disables the use of the internal hash table to locate running programs.

**unlimit** [-h][*Resource*]

Removes the limitation on the *Resource* variable. If no *Resource* variable is specified, all resource limitations are removed. See the description of the **limit** command for the list of *Resource* names.

The **-h** flag removes corresponding hard limits. Only a user with root user authority can change hard limits.



**unset** \*!Pattern

Removes all variables with names that match the *Pattern* variable. Use **unset** \* to remove all variables. If no variables are set, it does not cause an error.

**unsetenv** Pattern

Removes all variables from the environment whose name matches the specified *Pattern*. (See the **setenv** built-in command.)

**wait**

Waits for all background jobs. If the shell is interactive, an INTERRUPT (usually the Ctrl-C key sequence) disrupts the wait. The shell then displays the names and job numbers of all jobs known to be outstanding.

**while** (*Expression*) *Command* . . .  
**end**

Evaluates the *Commands* between the **while** and the matching **end** statements while the expression specified by the *Expression* variable evaluates nonzero. You can use the **break** statement to end and the **continue** statement to continue the loop prematurely. The **while** and **end** statements must appear alone on their input lines. If the input is from a terminal, prompts occur after the while (*Expression*) similar to the **foreach** statement.

@ [*Name*[*n*] = *Expression*]

Displays the values of all the shell variables when used with no arguments. Otherwise, sets the name specified by the *Name* variable to the value of the *Expression* variable. If the expression contains <, >, &, or | characters, this part of the expression must be placed within parentheses. When *n* is specified, the *n*th component of the *Name* variable is set to the *Expression* variable. Both the *Name* variable and its *n*th component must already exist.

C language operators, such as \*= and +=, are available. The space separating the *Name* variable from the assignment operator is optional. Spaces are, however, required in separating components of the *Expression* variable, which would otherwise be read as a single word. Special suffix operators, double plus sign (++) and double hyphen (--), increase and decrease, respectively, the value of the *Name* variable.

## C Shell Expressions and Operators

The @ built-in command and the **exit**, **if**, and **while** statements accept expressions that include operators similar to those of C language, with the same precedence. The following operators are available:

Operator	What it Means
()	change precedence
~	complement
!	negation
*/ %	multiply, divide, modulo
+ -	add, subtract
<< >>	left shift, right shift
<= >= < >	relational operators
== != =~ !~	string comparison/pattern matching
&	bitwise AND
^	bitwise exclusive OR
	bitwise inclusive OR
&&	logical AND
	logical OR

In the previous list, precedence of the operators decreases down the list (left to right, top to bottom).

**Note:** The operators + and - are right-associative. For example, evaluation of a + b - c is performed as follows:

a + (b - c)

and not as follows:

(a + b) - c

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The ==, !=, =~, and !~ operators compare their arguments as strings; all others operate on numbers. The =~ and !~ operators are similar to == and !=, except that the rightmost side is a *pattern* against which the leftmost operand is matched. This reduces the need for use of the **switch** statement in shell procedures.

The logical operators or (||) and and (&&) are also available. They can be used to check for a range of numbers, as in the following example:

```
if ($#argv > 2 && $#argv < 7) then
```

In the preceding example, the number of arguments must be greater than 2 and less than 7.

Strings beginning with zero (0) are considered octal numbers. Null or missing arguments are considered 0. All expressions result in strings representing decimal numbers. Note that two components of an expression can appear in the same word. Except when next to components of expressions that are syntactically significant to the parser (& | < > ( ) ), expression components should be surrounded by spaces.

Also available in expressions as primitive operands are command executions enclosed in ( ) and file inquiries of the form (-**operator** *Filename*), where **operator** is one of the following:

r	Read access
w	Write access
x	Execute access
e	Existence
o	Ownership
z	Zero size
f	Plain file
d	Directory

The specified *Filename* is command and file-name expanded and then tested to see if it has the specified relationship to the real user. If *Filename* does not exist or is inaccessible, all inquiries return false(0). If the command runs successfully, the inquiry returns a value of true(1). Otherwise, if the command fails, the inquiry returns a value of false(0). If more detailed status information is required, run the command outside an expression and then examine the **status** shell variable.

## Command Substitution in the C Shell

In *command substitution*, the shell executes a specified command and replaces that command with its output. To perform command substitution in the C shell, enclose the command or command string in backquotes ( ` ` ). The shell normally breaks the output from the command into separate words at blanks, tabs, and newline characters. It then replaces the original command with this output.

In the following example, the backquotes ( ` ` ) around the **date** command indicate that the output of the command will be substituted:

```
echo The current date and time is: `date`
```

The output from this command might look like:

```
The current date and time is: Wed Apr 8 13:52:14 CDT 1992
```

The C shell performs command substitution selectively on the arguments of built-in shell commands. This means that it does not expand those parts of expressions that are not evaluated. For commands that are not built-in, the shell substitutes the command name separately from the argument list. The substitution occurs in a child of the main shell, only after the shell performs input or output redirection.

If a command string is surrounded by " ", the shell treats only newline characters as word separators, thus preserving blanks and tabs within the word. In all cases, the single final newline character does not force a new word.

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## Nonbuilt-in C Shell Command Execution

When the C shell determines that a command is not a built-in shell command, it attempts to run the command with the **execv** subroutine. Each word in the **path** shell variable names a directory from which the shell attempts to run the command. If given neither the **-c** nor **-t** flag, the shell hashes the names in these directories into an internal table. The shell tries to call the **exec** subroutine on a directory only if there is a possibility that the command resides there. If you turn off this mechanism with the **unhash** command or give the shell the **-c** or **-t** flag, the shell concatenates with the given command name to form a path name of a file. The shell also does this in any case for each directory component of the **path** variable that does not begin with a **/**. The shell then attempts to run the command.

Parenthesized commands always run in a subshell. For example:

```
(cd ; pwd) ; pwd
```

displays the home directory without changing the current directory location. However, the command:

```
cd ; pwd
```

changes the current directory location to the home directory. Parenthesized commands are most often used to prevent the **chdir** command from affecting the current shell.

If the file has execute permission, but is not an executable binary to the system, then the shell assumes it is a file containing shell commands and runs a new shell to read it.

If there is an alias for the shell, then the words of the alias are prefixed to the argument list to form the shell command. The first word of the alias should be the full path name of the shell.

---

## History Substitution in the C Shell

History substitution lets you modify individual words from previous commands to create new commands. History substitution makes it easy to repeat commands, repeat the arguments of a previous command in the current command, or fix spelling mistakes in the previous command with little typing.

History substitutions begin with the **!** character and can appear anywhere on the command line, provided they do not nest (in other words, a history substitution cannot contain another history substitution). You can precede the **!** with a **\** to cancel the exclamation point's special meaning. In addition, if you place the **!** before a blank, tab, newline character, **=**, or **(**, history substitution does not occur.

History substitutions also occur when you begin an input line with a **^**. The shell echoes any input line containing history substitutions at the workstation before it executes that line.

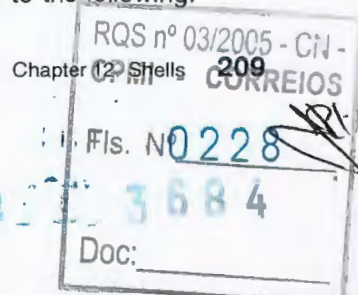
This section discusses the following:

- "History Lists"
- "Event Specification" on page 210
- "Quoting with Single and Double Quotes" on page 211

### History Lists

The history list saves commands that the shell reads from the command line that consist of one or more words. History substitution reintroduces sequences of words from these saved commands into the input stream.

The **history** shell variable controls the size of the history list. You must set the **history** shell variable either in the **.cshrc** file or on the command line with the built-in **set** command. The previous command is always retained regardless of the value of the **history** variable. Commands in the history list are numbered sequentially, beginning with 1. The built-in **history** command produces output similar to the following:





9 write michael  
10 ed write.c  
11 cat oldwrite.c  
12 diff \*write.c

The shell displays the command strings with their event numbers. The event number appears to the left of the command and represent when the command was entered in relation to the other commands in the history. It is not usually necessary to use event numbers to refer to events, but you can have the current event number displayed as part of your system prompt by placing an ! in the prompt string assigned to the **PROMPT** environment variable.

A full history reference contains an event specification, a word designator, and one or more modifiers in the following general format:

Event[.]Word:Modifier[:Modifier] . . .

**Note:** Only one word can be modified. A string that contains blanks is not allowed.

In the previous sample of **history** command output, the current event number is 13. Using this example, the following refer to previous events:

!10            Event number 10.  
!-2           Event number 11 (the current event minus 2).  
!d            Command word beginning with d (event number 12).  
!?mic?        Command word containing the string mic (event number 9).

These forms, without further modification, simply reintroduce the words of the specified events, each separated by a single blank. As a special case, !! refers to the previous command; the command !! alone on an input line reruns the previous command.

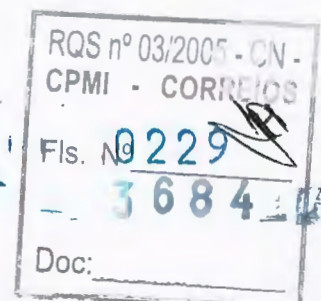
## Event Specification

To select words from an event, follow the event specification with a : and one of the following word designators (the words of an input line are numbered sequentially starting from 0):

0	First word (the command name)
n	<i>n</i> th argument
^	First argument
\$	Last argument
%	Word matched by an immediately preceding <i>?string?</i> search
x-y	Range of words from the <i>x</i> th word to the <i>y</i> th word
-y	Range of words from the first word (0) to the <i>y</i> th word
*	First through the last argument, or nothing if there is only one word (the command name) in the event
x*	<i>x</i> th argument through the last argument
x-	Same as <i>x*</i> but omitting the last argument

If the word designator begins with a ^, \$, \*, -, or %, you can omit the colon that separates the event specification from the word designator. You can also place a sequence of the following modifiers after the optional word designator, each preceded by a colon:

h	Removes a trailing path name extension, leaving the head.
r	Removes a trailing .xxx component, leaving the root name.
e	Removes all but the .xxx trailing extension.
s/ <i>OldWord</i> / <i>NewWord</i> /	Substitutes the value of the <i>NewWord</i> variable for the value of the <i>OldWord</i> variable.



The left side of a substitution is not a pattern in the sense of a string recognized by an editor; rather, it is a word, a single unit without blanks. Normally, a / delimits the original word (*OldWord*) and its replacement (*NewWord*). However, you can use any character as the delimiter. In the following example, using the % as a delimiter allows a / to be included in the words:

```
s%/home/myfile%/home/yourfile%
```

The shell replaces an & with the *OldWord* text in the *NewWord* variable. In the following example, /home/myfile becomes /temp/home/myfile.

```
s%/home/myfile%/temp&%
```

The shell replaces a null word in a substitution with either the last substitution or with the last string used in the contextual scan `!?String?`. You can omit the trailing delimiter (/) if a newline character follows immediately. Use the following modifiers to delimit the history list:

t	Removes all leading path name components, leaving the tail
&	Repeats the previous substitution
g	Applies the change globally; that is, all occurrences for each line
p	Displays the new command, but does not run it
q	Quotes the substituted words, thus preventing further substitutions
x	Acts like the q modifier, but breaks into words at blanks, tabs, and new-line characters

When using the preceding modifiers, the change applies only to the first modifiable word unless the g modifier precedes the selected modifier.

If you give a history reference without an event specification (for example, !\$), the shell uses the previous command as the event. If a previous history reference occurs on the same line, the shell repeats the previous reference. Thus, the following sequence gives the first and last arguments of the command that matches `?foo?`.

```
!?foo?^ !$
```

A special abbreviation of a history reference occurs when the first nonblank character of an input line is a ^. This is equivalent to `!:s^`, thus providing a convenient shorthand for substitutions on the text of the previous line. The command `^ lb^ lib` corrects the spelling of lib in the command.

If necessary, you can enclose a history substitution in { } to insulate it from the characters that follow. For example, if you want to use a reference to the command:

```
ls -ld ~paul
```

to perform the command:

```
ls -ld ~paula
```

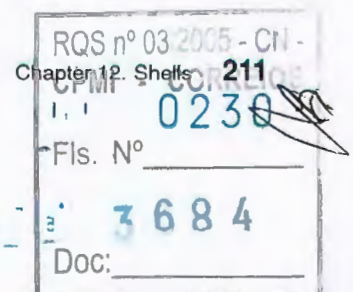
use the following construction:

```
!{1}a
```

In this example, `!{1}a` looks for a command starting with l and appends a to the end.

## Quoting with Single and Double Quotes

To prevent further interpretation of all or some of the substitutions, enclose strings in single and double quotation marks. Enclosing strings in ' ' prevents further interpretation, while enclosing strings in " " allows further expansion. In both cases, the text that results becomes all or part of a single word.





## Alias Substitution in the C Shell

An *alias* is a name assigned to a command or command string. The C shell allows you to assign aliases and use them as you would commands. The shell maintains a list of the aliases that you define.

After the shell scans the command line, it divides the commands into distinct words and checks the first word of each command, left to right, to see if there is an alias. If an alias is found, the shell uses the history mechanism to replace the text of the alias with the text of the command referenced by the alias. The resulting words replace the command and argument list. If no reference is made to the history list, the argument list is left unchanged.

For information about the C shell history mechanism, see "History Substitution in the C Shell" on page 209.

The **alias** and **unalias** built-in commands establish, display, and modify the alias list. Use the alias command in the following format:

```
alias [Name [WordList]]
```

The optional *Name* variable specifies the alias for the specified name. If you specify a word list with the *WordList* variable, the command assigns it as the alias of the *Name* variable. If you run the **alias** command without either optional variable, it displays all C shell aliases.

If the alias for the **ls** command is **ls -l**, the following command:

```
ls /usr
```

is replaced by the command:

```
ls -l /usr
```

The argument list is undisturbed because there is no reference to the history list in the command with an alias. Similarly, if the alias for the **lookup** command is as follows:

```
grep \!^ /etc/passwd
```

then the shell replaces **lookup bill** with the following:

```
grep bill /etc/passwd
```

In this example, **!^** refers to the history list, and the shell replaces it with the first argument in the input line, in this case **bill**.

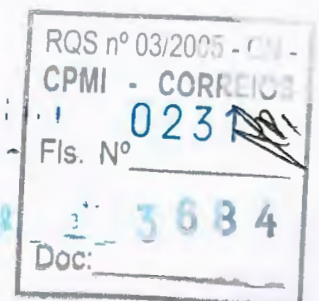
You can use special pattern-matching characters in an alias. The following command:

```
alias lprint 'pr &bslash2.!* >
```

```
> print'
```

creates a command that formats its arguments to the line printer. The **!** character is protected from the shell in the alias by use of single quotation marks so that the alias is not expanded until the **pr** command runs.

If the shell locates an alias, it performs the word transformation of the input text and begins the alias process again on the reformed input line. If the first word of the next text is the same as the old, looping is prevented by flagging the alias to terminate the alias process. Other subsequent loops are detected and result in an error.





## Variable and File-Name Substitution in the C Shell

The C Shell permits you to do variable and file-name substitutions.

This section discusses the following:

- "Variable Substitution in the C Shell"
- "File-Name Substitution in the C Shell" on page 214
- "File-Name Expansion" on page 214
- "File-Name Abbreviation" on page 215
- "Character Classes" on page 216
- "C Shell" on page 221

### Variable Substitution in the C Shell

The C shell maintains a set of variables, each of which has as its value a list of zero or more words. Some of these variables are set by the shell or referred to by it. For instance, the **argv** variable is an image of the shell variable list, and words that comprise the value of this variable are referred to in special ways.

To change and display the values of variables, use the **set** and **unset** commands. Of the variables referred to by the shell, a number are toggles (variables that turn something on and off). The shell does not examine toggles for a value, only for whether they are set or unset. For instance, the **verbose** shell variable is a toggle that causes command input to be echoed. The setting of this variable results from issuing the **-v** flag on the command line.

Other operations treat variables numerically. The **@** command performs numeric calculations and the result is assigned to a variable. Variable values are, however, always represented as (zero or more) strings. For numeric operations, the null string is considered to be zero, and the second and subsequent words of multiword values are ignored.

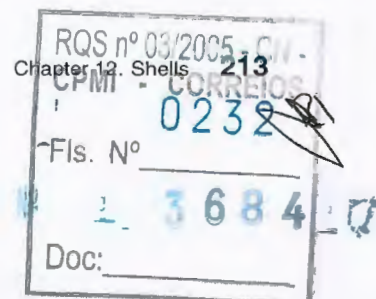
When you issue a command, the shell parses the input line and performs alias substitution. Next, before running the command, it performs variable substitution. The **\$** character keys the substitution. It is, however, passed unchanged if followed by a blank, tab, or newline character. Preceding the **\$** character with a **\** prevents this expansion, except in two cases:

- The command is enclosed in **" "**. In this case, the shell always performs the substitution.
- The command is enclosed in **' '**. In this case, the shell never performs the substitution. Strings enclosed in **' '** are interpreted for command substitution. (See "Command Substitution in the C Shell" on page 208.)

The shell recognizes input and output redirection before variable expansion, and expands each separately. Otherwise, the command name and complete argument list expands together. It is therefore possible for the first (command) word to generate more than one word, the first of which becomes the command name and the rest of which become parameters.

Unless enclosed in **" "** or given the **:q** modifier, the results of variable substitution might eventually be subject to command and file-name substitution. When enclosed by double quotation marks, a variable with a value that consists of multiple words expands to a single word or a portion of a single word, with the words of the variable's value separated by blanks. When you apply the **:q** modifier to a substitution, the variable expands to multiple words. Each word is separated by a blank and enclosed in double quotation marks to prevent later command or file-name substitution.

The following notations allow you to introduce variable values into the shell input. Except as noted, it is an error to reference a variable that is not set with the **set** command.





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You can apply the modifiers **:gh**, **:gt**, **:gr**, **:h**, **:r**, **:q**, and **:x** to the following substitutions. If **{ }** appear in the command form, then the modifiers must be placed within the braces. Only one **:** modifier is permitted on each variable expansion.

<b>\$Name</b>	
<b>\${Name}</b>	Replaced by the words assigned to the <i>Name</i> variable, each separated by a blank. Braces insulate the <i>Name</i> variable from any following characters that would otherwise be part of it. Shell variable names start with a letter and consist of up to 20 letters and digits, including the underline ( <b>_</b> ) character. If the <i>Name</i> variable does not specify a shell variable but is set in the environment, then its value is returned. The modifiers preceded by colons, as well as the other forms described here, are not available in this case.
<b>\$Name[number]</b>	
<b>\${Name[number]}</b>	Selects only some of the words from the value of the <i>Name</i> variable. The number is subjected to variable substitution and might consist of a single number, or two numbers separated by a <b>-</b> . The first word of a variable's string value is numbered 1. If the first number of a range is omitted, it defaults to 1. If the last number of a range is omitted, it defaults to <b>\$#Name</b> . The <b>*</b> symbol selects all words. It is not an error for a range to be empty if the second argument is omitted or is in a range.
<b>\$#Name</b>	
<b>\${#Name}</b>	Gives the number of words in the <i>Name</i> variable. This can be used in a <b>[number]</b> as shown above. For example, <b>\$Name[\$#Name]</b> .
<b>\$0</b>	Substitutes the name of the file from which command input is being read. An error occurs if the name is not known.
<b>\$number</b>	
<b>\${number}</b>	Equivalent to <b>\$argv[number]</b> .
<b>\$*</b>	Equivalent to <b>\$argv[*]</b> .

The following substitutions may not be changed with **:** modifiers:

<b> \$?name</b>	
<b> \${?name}</b>	Substitutes the string 1 if the <i>name</i> variable is set, zero (0) if this variable is not set.
<b> \$?0</b>	Substitutes 1 if the current input file name is known, zero (0) if the file name is not known.
<b> \$\$</b>	Substitutes the (decimal) process number of the parent shell.
<b> \$&lt;</b>	Substitutes a line from standard input, without further interpretation. Use this substitution to read from the keyboard in a shell procedure.

## File-Name Substitution in the C Shell

The C shell provides several shortcuts to save time and keystrokes. If a word contains any of the characters **\***, **?**, **[ ]**, or **{ }**, or begins with a tilde (**~**), that word is a candidate for file-name substitution. The C shell regards the word as a pattern and replaces the word with an alphabetized list of file names matching the pattern.

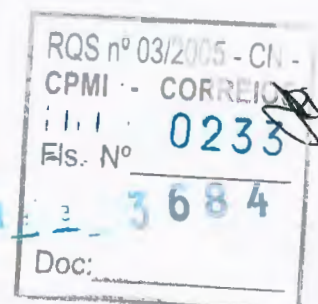
The current collating sequence is used, as specified by the **LC\_COLLATE** or **LANG** environment variables. In a list of words specifying file-name substitution, an error results if no patterns match an existing file name. However, it is not required that every pattern match. Only the character-matching symbols **\***, **?**, and **[ ]** indicate pattern-matching or file-name expansion. The tilde (**~**) and **{ }** characters indicate file-name abbreviation.

## File-Name Expansion

The **\*** character matches any string of characters, including the null string. For example, in a directory containing the files:

```
a aa aax alice b bb c cc
```

the command **echo a\*** prints all files names beginning with the character **a**:



a aa aax alice

**Note:** When file names are matched, the characters dot (.) and / must be matched explicitly.

The ? character matches any single character. The following command:

```
ls a?x
```

lists every file name beginning with the letter a, followed by a single character, and ending with the letter x:

```
aax
```

To match a single character or a range of characters, enclose the character or characters inside of []. The following command:

```
ls [abc]
```

lists all file names exactly matching one of the enclosed characters:

```
a b c
```

Within brackets, a lexical range of characters is indicated by [a-z]. The characters matching this pattern are defined by the current collating sequence.

## File-Name Abbreviation

The tilde (~) and { characters indicate file-name abbreviation. A ~ at the beginning of a file name is used to represent home directories. Standing alone, the ~ character expands to your home directory as reflected in the value of the **home** shell variable. For example, the following command:

```
ls ~
```

lists all files and directories located in your **\$HOME** directory.

When the command is followed by a name consisting of letters, digits, and - characters, the shell searches for a user with that name and substitutes that user's **\$HOME** directory.

**Note:** If the ~ character is followed by a character other than a letter or /, or appears anywhere except at the beginning of a word, it does not expand.

To match characters in file names without typing the entire file name, use { } around the file names. The pattern a{b,c,d}e is another way of writing abe ace ade. The shell preserves the left-to-right order and separately stores the results of matches at a low level to preserve this order. This construct might be nested. Thus, the following:

```
~source/s1/{oldls,ls}.c
```

expands to:

```
/usr/source/s1/oldls.c /usr/source/s1/ls.c
```

if the home directory for **source** is **/usr/source**. Similarly, the following:

```
../{memo,*box}
```

might expand to:

```
../memo ../box ../mbox
```

**Note:** memo is not sorted with the results of matching \*box. As a special case, the {, }, and { } characters are passed undisturbed.

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## Character Classes

You can also use character classes to match file names within a range indication. The following format instructs the system to match any single character belonging to the specified class:

`[[:charclass:]]`

The following classes correspond to **ctype** subroutines:

Character Class	Definition
<b>alnum</b>	Alphanumeric characters
<b>alpha</b>	Uppercase and lowercase letters
<b>cntrl</b>	Control characters
<b>digit</b>	Digits
<b>graph</b>	Graphic characters
<b>lower</b>	Lowercase letters
<b>print</b>	Printable characters
<b>punct</b>	Punctuation character
<b>space</b>	Space, horizontal tab, carriage return, newline, vertical tab, or form-feed character
<b>upper</b>	Uppercase characters
<b>xdigit</b>	Hexadecimal digits

Suppose that you are in a directory containing the following files:

a aa aax Alice b bb c cc

Type the following command at a C shell prompt:

```
ls [[:lower:]]
```

Press Enter.

The C shell lists all file names that begin with lowercase characters:

a aa aax b bb c cc

For more information about character class expressions, refer to the **ed** command.

---

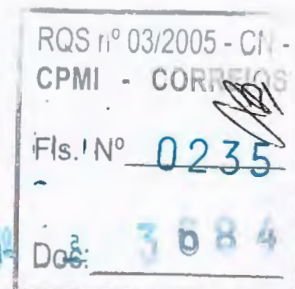
## Environment Variables in the C Shell

Certain variables have special meaning to the C shell. Of these, **argv**, **cwd**, **home**, **path**, **prompt**, **shell**, and **status** are always set by the shell. Except for the **cwd** and **status** variables, this action occurs only at initialization. These variables maintain their settings unless you explicitly reset them.

The **cs**h command copies the **USER**, **TERM**, **HOME**, and **PATH** environment variables into the **cs**h variables, **user**, **term**, **home**, and **path**, respectively. The values are copied back into the environment whenever the normal shell variables are reset. The **path** variable cannot be set in other than in the **.cshrc** file, because **cs**h subprocesses import the **path** definition from the environment and reexport it if changed.

The following variables have special meanings:

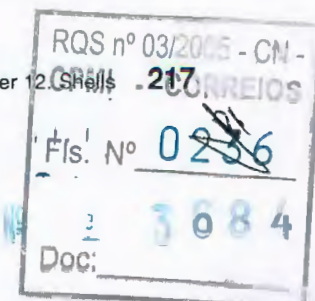
<b>argv</b>	Contains the arguments passed to shell scripts. Positional parameters are substituted from this variable.
<b>cdpath</b>	Specifies a list of alternate directories to be searched by the <b>chdir</b> or <b>cd</b> command to find subdirectories.
<b>cwd</b>	Specifies the full path name of the current directory.





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<b>echo</b>	Set when the <b>-x</b> command line flag is used; when set, causes each command and its arguments to echo just before being run. For commands that are not built-in, all expansions occur before echoing. Built-in commands are echoed before command and file-name substitution because these substitutions are then done selectively.
<b>histchars</b>	Specifies a string value to change the characters used in history substitution. Use the first character of its value as the history substitution character, this replaces the default character, <b>!</b> . The second character of its value replaces the <b>^</b> character in quick substitutions.
	<b>Note:</b> Setting the <b>histchars</b> value to a character used in command or file names might cause unintentional history substitution.
<b>history</b>	Contains a numeric value to control the size of the history list. Any command that is referenced within the number of events permitted is not discarded. Very large values of the <b>history</b> variable might cause the shell to run out of memory. Regardless of whether this variable is set, the C shell always saves the last command that ran on the history list.
<b>home</b>	Indicates your home directory, initialized from the environment. The file-name expansion of the tilde ( <b>~</b> ) character refers to this variable.
<b>ignoreeof</b>	Specifies that the shell ignore an end-of-file character from input devices that are workstations. This prevents shells from accidentally being killed when the shell reads an end-of-file character (Ctrl-D).
<b>mail</b>	Specifies the files where the shell checks for mail. This is done after each command completion which results in a prompt if a specified time interval has elapsed. The shell displays the message Mail in file. if the file exists with an access time less than its change time. If the first word of the value of the <b>mail</b> variable is numeric, it specifies a different mail-checking time interval (in seconds); the default is 600 (10 minutes). If you specify multiple mail files, the shell displays the message New mail in file, when there is mail in the specified file.
<b>noclobber</b>	Places restrictions on output redirection to ensure that files are not accidentally destroyed and that redirections append to existing files.
<b>noglob</b>	Inhibits file-name expansion. This is most useful in shell scripts that do not deal with file names, or when a list of file names has been obtained and further expansions are not desirable.
<b>nomatch</b>	Specifies that no error results if a file name expansion does not match any existing files; rather, the primitive pattern returns. It is still an error for the primitive pattern to be malformed.
<b>notify</b>	Specifies that the shell send asynchronous notification of changes in job status. The default presents status changes just before displaying the shell prompt.
<b>path</b>	Specifies directories in which commands are sought for execution. A null word specifies the current directory. If there is no <b>path</b> variable set, then only full path names can run. The default search path (from the <b>/etc/environment</b> file used during login) is as follows: <code>/usr/bin /etc /usr/sbin /usr/ucb /usr/bin/X11 /sbin</code> A shell given neither the <b>-c</b> nor the <b>-t</b> flag normally hashes the contents of the directories in the <b>path</b> variable after reading the <b>.cshrc</b> and also each time the <b>path</b> variable is reset. If new commands are added to these directories while the shell is active, you must give the <b>rehash</b> command. Otherwise, the commands might not be found.
<b>prompt</b>	Specifies the string displayed before each command is read from an interactive workstation input. If an <b>!</b> appears in the string, it is replaced by the current event number. If the <b>!</b> character is in a quoted string enclosed by single or double quotation marks, the <b>!</b> character must be preceded by a <b>\</b> . The default prompt for users without root authority is <b>%</b> . The default prompt for the user with root authority is <b>#</b> .
<b>savehist</b>	Specifies a numeric value to control the number of entries of the history list that are saved in the <b>~/.history</b> file when you log out. Any command referenced in this number of events is saved. During startup, the shell reads <b>~/.history</b> into the history list, enabling history to be saved across logins. Very large values of the <b>savehist</b> variable slow down the shell startup.
<b>shell</b>	Specifies the file in which the C shell resides. This is used in forking shells to interpret files that have execute bits set, but which are not executable by the system. This is initialized to the home of the C shell.
<b>status</b>	Specifies the status returned by the last command. If the command ends abnormally, 0200 is added to the status. Built-in commands that are unsuccessful return an exit status of 1. Successful built-in commands set status to a value of 0.
<b>time</b>	Controls automatic timing of commands. If this variable is set, any command that takes more than the specified number of CPU seconds will display a line of resources used, at the end of execution. For more information about the default outputs, see the built-in <b>time</b> command.





**verbose**

Set by the **-v** command line flag, this variable causes the words of each command to display after history substitution.



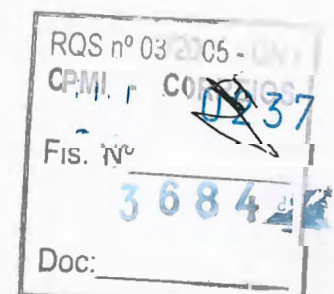
## Input and Output Redirection in the C Shell

Before the C shell executes a command, it scans the command line for redirection characters. These special notations direct the shell to redirect input and output.

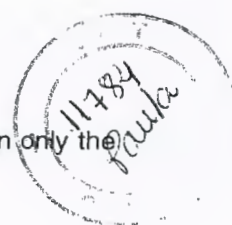
You can redirect the standard input and output of a command with the following syntax statements:

<b>&lt; File</b>	Opens the specified <i>File</i> (which is first variable, command, and file name expanded) as the standard input.
<b>&lt;&lt; Word</b>	Reads the shell input up to the line that matches the value of the <i>Word</i> variable. The <i>Word</i> variable is not subjected to variable, file name, or command substitution. Each input line is compared to the <i>Word</i> variable before any substitutions are done on the line. Unless a quoting character (\, ", ' or `) appears in the <i>Word</i> variable, the shell performs variable and command substitution on the intervening lines, allowing the \ character to quote the \$, \, and ` characters. Commands that are substituted have all blanks, tabs, and newline characters preserved, except for the final newline character, which is dropped. The resultant text is placed in an anonymous temporary file, which is given to the command as standard input.
<b>&gt; File</b>	
<b>&gt;! File</b>	
<b>&gt;&amp; File</b>	
<b>&gt;&amp;! File</b>	Uses the specified <i>File</i> as standard output. If <i>File</i> does not exist, it is created. If <i>File</i> exists, it is truncated, and its previous contents are lost. If the <b>noclobber</b> shell variable is set, <i>File</i> must not exist or be a character special file, or an error results. This helps prevent accidental destruction of files. In this case, use the forms including an ! to suppress this check. <i>File</i> is expanded in the same way as < input file names. The form >& redirects both standard output and standard error to the specified <i>File</i> . The following example shows how to separately redirect standard output to <b>/dev/tty</b> and standard error to <b>/dev/null</b> . The parentheses are required to allow standard output and standard error to be separate. <pre>% (find / -name vi -print &gt; /dev/tty) &gt;&amp; /dev/null</pre>
<b>:&gt; &gt;File</b>	
<b>:&gt; &gt;! File</b>	
<b>:&gt; &gt;&amp; File</b>	
<b>:&gt; &gt;&amp;! File</b>	Uses the specified <i>File</i> as standard output like >, but <i>appends</i> output to the end of <i>File</i> . If the <b>noclobber</b> shell variable is set, an error results if <i>File</i> does not exist, unless one of the forms including an ! is given. Otherwise, it is similar to >.

A command receives the environment in which the shell was invoked, as changed by the input/output parameters and the presence of the command as a pipeline. Thus, unlike some previous shells, commands that run from a shell script do not have access to the text of the commands by default. Rather, they receive the original standard input of the shell. Use the << mechanism to present inline data, which allows shell command files to function as components of pipelines and also lets the shell block read its input. Note that the default standard input for a command run detached is not changed to the empty **/dev/null** file. Rather, the standard input remains the original standard input of the shell.



To redirect the standard error through a pipe with the standard output, use the form `l&` rather than `only the l`.



## Control Flow

The shell contains commands that can be used to regulate the flow of control in command files (shell scripts) and (in limited but useful ways) from shell command-line input. These commands all operate by forcing the shell to repeat, or skip, in its input.

The **foreach**, **switch**, and **while** statements, and the **if-then-else** form of the **if** statement, require that the major keywords appear in a single simple command on an input line.

If the shell input is not searchable, the shell buffers input whenever a loop is being read and searches the internal buffer to do the rereading implied by the loop. To the extent that this is allowed, backward **gotos** succeed on inputs that you cannot search.

---

## Job Control in the C Shell

The shell associates a job number with each process. The shell keeps a table of current jobs and assigns them small integer numbers. When you start a job in the background with an **&**, the shell prints a line that looks like the following:

```
[1] 1234
```

This line indicates that the job number is 1 and that the job is composed of a single process with a process ID of 1234. Use the built-in **jobs** command to see the table of current jobs.

A job running in the background competes for input if it tries to read from the workstation. Background jobs can also produce output for the workstation that gets interleaved with the output of other jobs.

You can refer to jobs in the shell in several ways. Use the **%** character to introduce a job name. This name can be either the job number or the command name that started the job, if this name is unique. For example, if a **make** process is running as job 1, you can refer to it as **%1**. You can also refer to it as **%make**, if there is only one suspended job with a name that begins with the string **make**. You can also use the following:

```
String
```

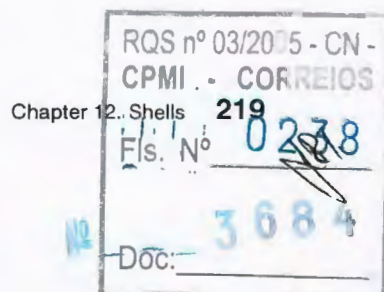
to specify a job whose name contains the **String** variable, if there is only one such job.

The shell detects immediately whenever a process changes its state. If a job becomes blocked so that further progress is impossible, the shell sends a message to the workstation. This message displays only after you press the Enter key. If, however, the **notify** shell variable is set, the shell immediately issues a message that indicates changes in the status of background jobs. Use the built-in **notify** command to mark a single process so that its status changes are promptly reported. By default, the **notify** command marks the current process.

---

## List of C Shell Built-in Commands

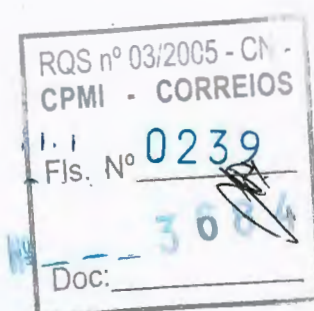
@	Displays the value of specified shell variables.
alias	Displays specified aliases or all aliases.
bg	Puts the current or specified jobs into the background.
break	Resumes running after the end of the nearest enclosing <b>foreach</b> or <b>while</b> command.
breaksw	Breaks from a <b>switch</b> command.
case	Defines a label in a <b>switch</b> command.
cd	Changes the current directory to the specified directory.
chdir	Changes the current directory to the specified directory.





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<b>continue</b>	Continues execution of the nearest enclosing <b>foreach</b> or <b>while</b> command.
<b>default</b>	Labels the default case in a <b>switch</b> statement.
<b>dirs</b>	Displays the directory stack.
<b>echo</b>	Writes character strings to the standard output of the shell.
<b>else</b>	Runs the commands that follow the second <b>else</b> in an <b>if (Expression) then ...else if (Expression2) then ... else ... endif</b> command sequence.
<b>end</b>	Signifies the end of a sequence of commands preceded by the <b>foreach</b> command.
<b>endif</b>	Runs the commands that follow the second <b>then</b> statement in an <b>if (Expression) then ... else if (Expression2) then ... else ... endif</b> command sequence.
<b>endsw</b>	Marks the end of a <b>switch (String) case String : ... breaksw default: ... breaksw endsw</b> command sequence. This command sequence successively matches each case label against the value of the <i>String</i> variable. Execution continues after the <b>endsw</b> command if a <b>breaksw</b> command is executed or if no label matches and there is no default.
<b>eval</b>	Reads variable values as input to the shell and executes the resulting command or commands in the context of the current shell.
<b>exec</b>	Runs the specified command in place of the current shell.
<b>exit</b>	Exits the shell with either the value of the status shell variable or the value of the specified expression.
<b>fg</b>	Brings the current or specified jobs into the foreground, continuing them if they are stopped.
<b>foreach</b>	Successively sets a <i>Name</i> variable for each member specified by the <i>List</i> variable and a sequence of commands, until reaching an <b>end</b> command.
<b>glob</b>	Displays list using history, variable, and file-name expansion.
<b>goto</b>	Continues to run after a specified line.
<b>hashstat</b>	Displays statistics indicating how successful the hash table has been at locating commands.
<b>history</b>	Displays the history event list.
<b>if</b>	Runs a specified command if a specified expression is true.
<b>jobs</b>	Lists the active jobs.
<b>kill</b>	Sends either the <b>TERM</b> (terminate) signal or the signal specified by the <i>Signal</i> variable to the specified job or process.
<b>limit</b>	Limits usage of a specified resource by the current process and each process it creates.
<b>login</b>	Ends a login shell and replaces it with an instance of the <b>/usr/sbin/login</b> command.
<b>logout</b>	Ends a login shell.
<b>nice</b>	Sets the priority of commands run in the shell.
<b>nohup</b>	Causes hangups to be ignored for the remainder of a procedure.
<b>notify</b>	Causes the shell to notify you asynchronously when the status of the current or a specified job changes.
<b>onintr</b>	Controls the action of the shell on interrupts.
<b>popd</b>	Pops the directory stack and returns to the new top directory.
<b>pushd</b>	Exchanges elements of the directory stack.
<b>rehash</b>	Causes recomputation of the internal hash table containing the contents of the directories in the path shell variable.
<b>repeat</b>	Runs the specified command, subject to the same restrictions as the <b>if</b> command, the number of times specified.
<b>set</b>	Shows the value of all shell variables.
<b>setenv</b>	Modifies the value of the specified environment variable.
<b>shift</b>	Shifts the specified variable to the left.
<b>source</b>	Reads command specified by the <i>Name</i> variable.
<b>stop</b>	Stops the current or specified jobs running in the background.
<b>suspend</b>	Stops the shell as if a <b>STOP</b> signal has been received.
<b>switch</b>	Starts a <b>switch (String) case String : ... breaksw default: ... breaksw endsw</b> command sequence. This command sequence successively matches each case label against the value of the <i>String</i> variable. If none of the labels match before a default label is found, the execution begins after the default label.
<b>time</b>	Displays a summary of the time used by the shell and its child processes.
<b>umask</b>	Determines file permissions.
<b>unalias</b>	Discards all aliases with names that match the <i>Pattern</i> variable.
<b>unhash</b>	Disables the use of the internal hash table to locate running programs.



<b>unlimit</b>	Removes resource limitations.
<b>unset</b>	Removes all variables having names that match the <i>Pattern</i> variable.
<b>unsetenv</b>	Removes all variables from the environment whose names match the specified <i>Pattern</i> variable.
<b>wait</b>	Waits for all background jobs.
<b>while</b>	Evaluates the commands between the <b>while</b> and the matching <b>end</b> command sequence while an expression specified by the <i>Expression</i> variable evaluates nonzero.

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## Related Information

### Korn Shell

The **ksh** and **stty** commands.

The **alias**, **cd**, **export**, **fc**, **getopts**, **read**, **set**, and **typeset** Korn shell commands.

The **/etc/passwd** file.

### Bourne Shell

The **bsh** or **Rsh** command, **login** command.

The Bourne shell **read** special command.

The **setuid** subroutine, **setgid** subroutine.

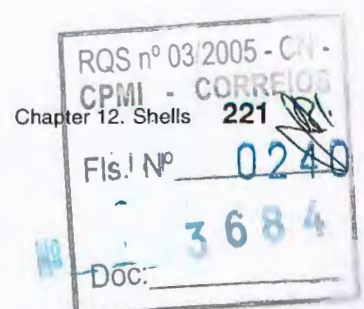
The **null** special file.

The **environment** file, **profile** file format.

### C Shell

The **cs** command, **ed** command.

The **alias**, **unalias**, **jobs**, **notify** and **set** C Shell built-in commands.







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## Chapter 13. AIX Documentation

This section discusses the online documentation available for AIX.

### IBM eServer pSeries Information Center

IBM eServer pSeries Information Center provides a portal to AIX documentation as well as access to tools and resources. From the Information Center, the entire AIX software documentation library for releases 4.3, 5.1, and 5.2 are available. Each book released in 5.1 and 5.2 are available in PDF format, and abstracts for books released in 5.2 are provided. Other tools and resources include:

- An error message database showing users what the error messages mean and, in many cases, how they can recover from them. This database also provides information for LED codes, and error identifiers.
- A resources page that links users to other IBM and non-IBM Web sites proven useful to system administrators, application developers, and users.
- Several how-to's that provide users with step-by-step instructions for completing system administrator and user tasks.
- Several FAQs (frequently asked questions) that provide users with quick answers to common questions.
- Links to related frequently used documentation from IBM, including white papers, Redbooks, and technical reports on topics such as RS/6000 SP and HACMP for AIX.
- A link to the documentation search tool is provided for each release, along with links to the release notes and readme files.
- A link to the entire pSeries and RS/6000 hardware documentation library.

### Using the IBM eServer pSeries Information Center

To bring up the Information Center on an AIX system, do the following:

- On the AIX command line, type:  
`infocenter`  
  
Press Enter.  
  
OR
- From the CDE Help panel, select the Information Center icon.  
OR
- Go to the following Web address:  
`http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base`

### Documentation Library Service

The Documentation Library Service allows you to read, search, and print online HTML documents and provides a library application that appears in your web browser. The application includes links to read installed documents and a search form that you can use to search for text. When you search, a results page displays the results of the search with links to the documents containing the search target words.

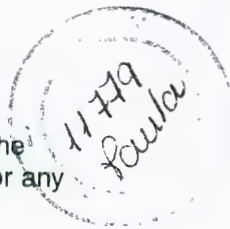
Starting with AIX 5.1, you can also download printable versions of books.

Two types of forms are provided: a global search form that shows all the volumes installed on a search server, and a specific search form that only searches a specific set of volumes, such as the manuals for an application.

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The documentation library service allows you to search documents that have been registered with the search service. The system administrator registers the documents. You cannot search the Internet or any unregistered documents on your search server.



If you write HTML documents at your site, your system administrator can add these documents to the documentation library so that you can read, search, and print the documents.

## Using the Documentation Library Service

You can use the Documentation Library Service to do the following tasks:

- To read the documentation installed in your system's default library, do one of the following:
  - Type `docsearch` at the command line.
  - Open the CDE Desktop Help subpanel. Click on the documentation search service icon, which looks like binoculars.

**Note:** If you have a copy of the AIX 4.3 (or later version) CD, you can read it on a PC. Insert the CD into the CD-ROM drive on your PC. If the documentation CD is AIX 4.3.3 or later, use a Web browser to open the CD file called `readme.htm` that is located in the top directory of the CD. If you have an AIX 4.3.0 through AIX 4.3.2 version of the Base Documentation CD, open the `usr/share/man/info/en_US/a_doc_lib/aixgen/topnav/topnav.htm` file.

- To open a library stored on a remote documentation server, in your browser's location bar, type the following Web address:

`http://server_name[:port_number]/cgi-bin/ds_form`

The global search form opens, where you can search the documents stored on the server with the name that you specified in `server_name`. You can also view all of the books by category.

**Note:** You need type the `port_number` only if the port is not the standard 80.

For example, if you want to search the registered documents on a search server named `hinson` and it uses port 80, type:

`http://hinson/cgi-bin/ds_form`

After the search form for a server displays in your browser, you can create a bookmark that takes you back to the server. Your system administrator can also create a Web page that contains links to all of the different documentation servers in an organization.

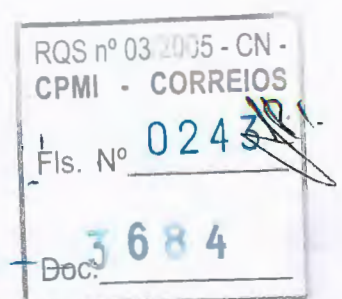
The documentation is also available for reading and searching at the following Web address: `http://www.ibm.com/servers/aix/library`. Note that while this site contains the AIX base operating system documentation, it may not contain other documentation installed on your local documentation server.

- Specific search forms are usually launched from search links inside HTML documents. They typically appear on the pages of applications manuals or help files. For example, each page in the library has a search link. Clicking on one of these search links launches a specific search form that allows you to search only the library volumes.

After the library application opens, you can click the **Help** link in the upper-right corner for instructions about how to use the library.

## Changing the Documentation Library Service Language

By default, when you open the CDE Desktop icons for the documentation search service or the base library, the documents display in the same language as your CDE Desktop.



However, you might need to see the documentation in a language that is different from your desktop language. For example, your desktop runs in your native language but the manuals may only be available in English. You can change your documentation language so that documents display in a different language from that used in your desktop.

**Notes:**

1. The procedure described below does not affect the language used if you are opening a document or search form from an HTML link inside another document. These steps affect only the language used for the documentation search service or the base library desktop icons.
2. Make sure there is documentation already installed for the language you want to use.

You can change your documentation language by running the following command:

```
/usr/bin/chdoclang locale
```

Where *locale* is the locale name that is the new language for viewing and searching documentation. Locale names can be found in "Locale Naming Conventions" in *AIX 5L Version 5.2 National Language Support Guide and Reference*.

You must log out and then log back in to see the language change take effect.

If you are using the CDE Desktop, you must also edit your Desktop file **\$HOME/.dtprofile** so that your documentation language setting in your **\$HOME/.profile** file will be read during CDE login. To do this, complete the following steps:

1. Open your **.dtprofile** file in the dtpad editor by typing the following command:  

```
dtpad $HOME/.dtprofile
```
2. Find the line that contains the following text:  

```
DTSOURCEPROFILE=true
```
3. If there are any comment (#) characters at the start of that line, delete only the # characters, not the entire line. If there are no comment characters, close the editor.
4. Save your changed **.dtprofile** file.
5. Log out and log back in.

For example, if you want to change your documentation language to Spanish (locale name **es\_ES**), type the following command:

```
/usr/bin/chdoclang es_ES
```

Log out and log back in to your desktop.

After you change your documentation language, you can delete the language setting so that documentation will again display in the same language as your desktop. To delete your language setting, type the following command:

```
/usr/bin/chdoclang -d
```

Log out and log back in to your desktop.

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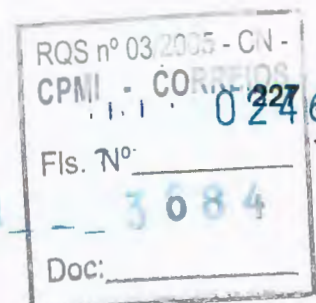
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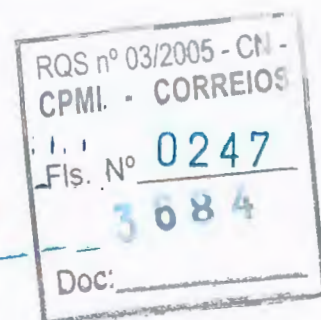
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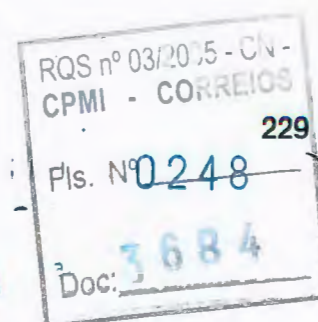
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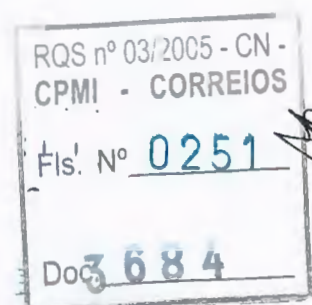
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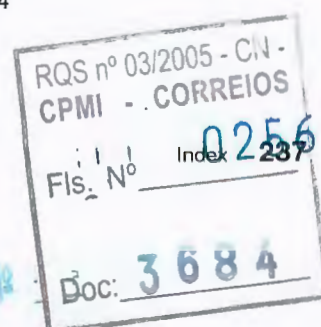
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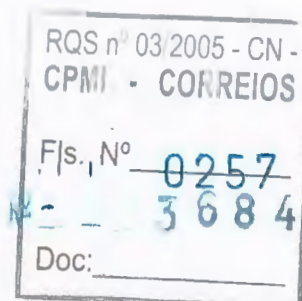
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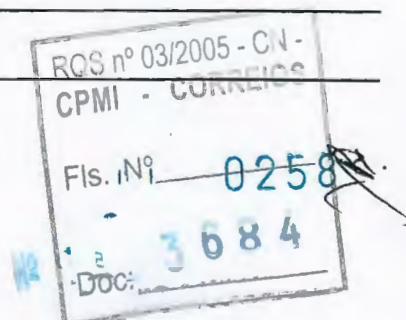
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## ANEXO 3

# CATÁLOGOS, MANUAIS E OUTROS DOCUMENTOS TÉCNICOS

### VOLUME 6

#### CONTEÚDO:

AdvantEDGE for Microsoft SQL SERVER – USER GUIDE – Release 1 and Later

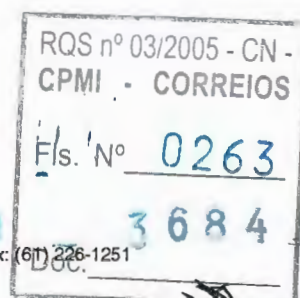
AdvantEDGE for Microsoft EXCHANGE – USER GUIDE – Release 1.1 and Later

AdvantEDGE for Microsoft IIS – USER GUIDE – Release 1.0 Patchlevel 2 or Later

eHealth Service Response User Guide

eHealth AIM for Apache User Guide

eHealth AIM for Oracle User Guide



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# **ADVANTEDGE**

## **FOR MICROSOFT SQL SERVER**

### ***User Guide***

Release 1 and Later

09-16070-002

May 2001

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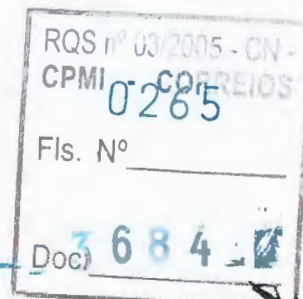
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## Patent Information

U. S. Patent 5,615,323  
Patents Pending

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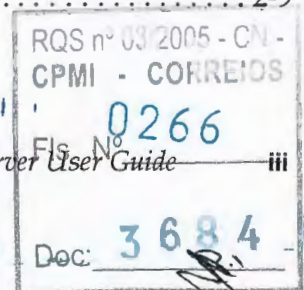
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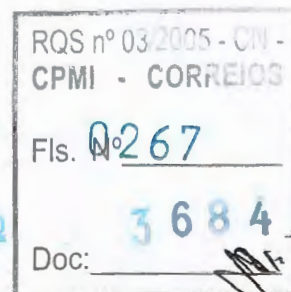
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## About This Guide




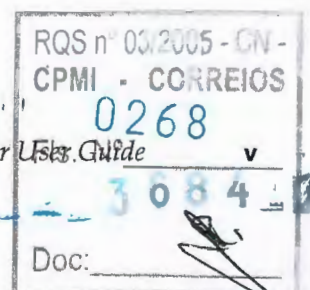
The *AdvantEDGE for Microsoft SQL Server User Guide* provides instructions for installing and using AdvantEDGE for Microsoft SQL Server. This guide is intended for the person responsible for installing and configuring AdvantEDGE for Microsoft SQL Server. This guide supports AdvantEDGE for Microsoft SQL Server Release 1.0 and later and the SystemEDGE agent Release 4.0, Patchlevel 3 and later.

To use AdvantEDGE for Microsoft SQL Server, you should have a basic understanding of the Microsoft SQL Server application, the Concord SystemEDGE agent, Simple Network Management Protocol (SNMP), the Host Resources management information base (MIB), and your host's operating systems environment. For more information, refer to Microsoft documentation and the *SystemEDGE Agent User Guide*.

## How This Guide Is Organized

This guide is organized as follows:

- 
- Chapter 1, "Introduction," provides an overview of AdvantEDGE for Microsoft SQL Server and its capabilities for monitoring Microsoft SQL Server.
  - Chapter 2, "Installing AdvantEDGE for Microsoft SQL Server," explains how to install and configure the Concord AdvantEDGE for Microsoft SQL Server software on a host system.
  - Chapter 3, "Using the AdvantEDGE for Microsoft SQL Server MIB," describes the information that is available through the Concord AdvantEDGE for Microsoft SQL Server MIB.
  - Chapter 4, "Using AdvantEDGE for Microsoft SQL Server," explains how to configure and use Concord's AdvantEDGE for Microsoft SQL Server in your host environment.





## ABOUT THIS GUIDE

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## Conventions in This Guide

The following paragraph shows a sample command. Throughout this guide, commands are formatted this way to distinguish them from other information. Due to space limitations in this guide, some commands wrap from one line to the next. Disregard these line breaks and **enter each command on one line**. Otherwise, your command syntax will be incorrect.

```
watch process procAlive 'sqlservr' 5000 0x0
30 'Microsoft SQL Server' ''
```

You must enter the command on one line, as shown here:

```
watch process procAlive 'sqlservr' 5000 0x0 30 'Microsoft SQL Server' ''
```

## Contact Information

If you need any assistance with the SystemEDGE agent or the AdvantEDGE for Microsoft SQL Server Point module, contact Customer Support, using one of the following methods:

Phone:	(888) 832-4340 (for calls from the USA and Canada) (508) 303-4300 (for calls from other countries)
Fax:	(508) 303-4343
Email:	<a href="mailto:support@concord.com">support@concord.com</a>
Web site:	<a href="http://www.concord.com">http://www.concord.com</a>



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# Introduction

This chapter provides an overview of the purpose and features of AdvantEDGE for Microsoft SQL Server.

## Introducing AdvantEDGE for Microsoft SQL Server

AdvantEDGE for Microsoft SQL Server is a plug-in for the SystemEDGE agent that brings the intelligent self-management capabilities of the SystemEDGE agent to the application level. You can configure this plug-in to monitor the Microsoft SQL Server processes and features that are relevant to your organization. You can also configure it to alert you to any potential issues with the application or the system on which it is running before those issues become problems.

AdvantEDGE for Microsoft SQL Server makes important information about Microsoft SQL Server available to network management software through the SystemEDGE agent and Simple Network Management Protocol (SNMP). It can provide information at the system, application, and database levels.

AdvantEDGE for Microsoft SQL Server enables you to monitor the health and availability of Microsoft SQL Server running on the Windows NT or Windows 2000 operating system. It must be installed on every SQL Server system that needs to be monitored. For more information, refer to Chapter 2, "Installing AdvantEDGE for Microsoft SQL Server."

### NOTE

This document is not intended as a manual on how to install, administer, or use Microsoft SQL Server. For assistance, refer to Microsoft documentation.

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## Purpose of AdvantEDGE for Microsoft SQL Server

At its best, an instance of Microsoft SQL Server can process queries from thousands of concurrent users who connect over a network. It can support data warehouses or data marts that process complex queries required to discover trends and analyze critical factors in enterprise activity.

Despite advances in the design of database management systems in the last ten years, issues remain that frequently impact the health and availability of Microsoft SQL Server.

These issues include the following:

- Performance tuning, which involves trade-offs between resources for queries and resources for indexing columns
- Table locking, which can prevent users from being able to update records
- Tuning the maximum size of transaction logs to ensure that records can be updated

The purpose of AdvantEDGE for Microsoft SQL Server is to provide you with the tools and information necessary for monitoring the health and availability of Microsoft SQL Server.

## Functionality of AdvantEDGE for Microsoft SQL Server

AdvantEDGE for Microsoft SQL Server accomplishes its purpose depending on the way it is deployed. It can operate with any SNMP-compliant management software such as Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others.

## Using AdvantEDGE for Microsoft SQL Server

As a plug-in for the SystemEDGE agent, AdvantEDGE for Microsoft SQL Server works to closely manage the Microsoft SQL Server application. Right out-of-the-box, it provides real-time fault detection and is capable of correcting problems without human intervention.



## Using AdvantEDGE for Microsoft SQL Server with eHealth

When teamed with the eHealth product suite, AdvantEDGE for Microsoft SQL Server and the SystemEDGE agent provide the historical data for long-term trending analysis and capacity planning.

With eHealth – Application Assessment, you can run At-a-Glance, Trend, Top N, and MyHealth reports for the following types of variables:

- Amount of central processing unit (CPU), memory, and disk space the Microsoft SQL Server application is using
- Size of the Microsoft SQL Server configuration and database logs
- Transaction log size and percentage of transaction log space used
- Frequency of hits within Microsoft SQL Server caches

For more information about the variables that you can monitor and the reports that you can run when you integrate AdvantEDGE for Microsoft SQL Server with eHealth, refer to the eHealth Web Help.

## Using AdvantEDGE for Microsoft SQL Server with Live Health

In a deployment with Live Health, AdvantEDGE for Microsoft SQL Server and the SystemEDGE agent provide the data for real-time detection of faults, potential outages, and delays associated with Microsoft SQL Server database activity. Unlike other real-time monitoring solutions and network management systems, Live Health applies intelligent algorithms to the data, resulting in precise assessments of application health and database performance. For more information about how Live Health can detect brownouts and service delays across applications, systems, and networks, refer to the Live Health Web Help.





# Installing AdvantEDGE for Microsoft SQL Server

This chapter explains how to install, configure, and license the AdvantEDGE for Microsoft SQL Server Point module.

## NOTE

For the most current information about installing AdvantEDGE for Microsoft SQL Server, refer to the release notes (relnotes.txt) on the installation CD-ROM.

## Installation Requirements

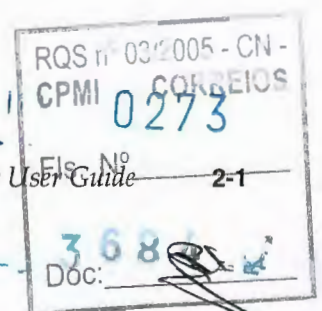
Before you install AdvantEDGE for Microsoft SQL Server, you must first install, license, and configure the SystemEDGE agent Release 4.0, Patchlevel 3 or later. For more information, refer to the *SystemEDGE Agent User Guide*. Also, your system must be running Microsoft SQL Server 7.0 or Microsoft SQL Server 2000 on Windows NT 4.0 or later. For more information, refer to the Microsoft documentation.

## Installing the Software

AdvantEDGE for Microsoft SQL Server is distributed as a self-extracting executable named sqlmod.exe.

To install it:

1. Locate the SQL Server system that you need to monitor.
2. Log on to the system as the administrator.
3. Click **Start**.
4. Select **Programs → Command Prompt**.



## 2 INSTALLING ADVANTEDGE FOR MICROSOFT SQL SERVER

*Installing the Software*

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5. Insert the CD-ROM containing the Concord software distributions into the CD-ROM drive.

Windows NT automatically mounts the drive using the CD-ROM drive's corresponding drive letter.

### NOTE

The particular drive letter is specific to your system and depends on the number and types of disks attached to your system.

6. Determine the directory that you want to use as the installation directory for AdvantEDGE for Microsoft SQL Server. If the SystemEDGE agent is installed at C:\sysedge, you should use C:\sysedge\plugins.
7. Run the self-extracting executable by entering the following at the command prompt:

```
D:\sqlmod\ntx86\sqlmod.exe -dir C:\sysedge\plugins
```

where *D* is the CD-ROM drive for your system, and C:\sysedge\plugins is the installation directory.

### NOTE

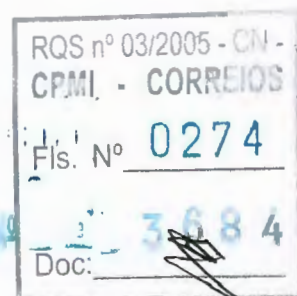
The -dir option is important because it instructs the self-extracting executable to recreate the intended subdirectory hierarchy used throughout this manual.

The executable then places the distribution in an sqlmod subdirectory within the specified target directory (for example, C:\sysedge\plugins\sqlmod).

### NOTE

You cannot execute sqlmod.exe directly from the CD-ROM.

AdvantEDGE for Microsoft SQL Server is now installed.







## INSTALLING ADVANTEDGE FOR MICROSOFT SQL SERVER

*Configuring AdvantEDGE for Microsoft SQL Server*

.....

### AdvantEDGE for Microsoft SQL Server Files

Table 2-1 describes the files created by the installation process.

**Table 2-1: Files Installed by AdvantEDGE for Microsoft SQL Server**

Filename	Description
sqlmod.asn1	AdvantEDGE for Microsoft SQL Server MIB specification
sqlmod.cf	AdvantEDGE for Microsoft SQL Server configuration file
sqlmod.dll	AdvantEDGE for Microsoft SQL Server dynamic link library (DLL) for Windows NT and Windows 2000
sqlmod.pdf	AdvantEDGE for Microsoft SQL Server User Guide
examples	AdvantEDGE for Microsoft SQL Server monitoring examples
relnotes.txt	Release notes for AdvantEDGE for Microsoft SQL Server

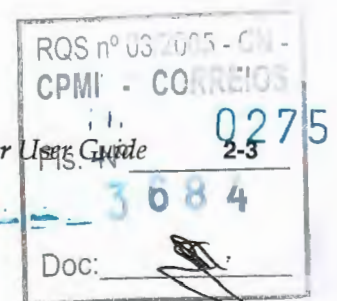
### Configuring AdvantEDGE for Microsoft SQL Server

After you install AdvantEDGE for Microsoft SQL Server, you must configure the Point module by editing the following files:

- sysedge.cf
- sqlmod.cf

### Editing the sysedge.cf File

The SystemEDGE agent uses the configuration file sysedge.cf and the *sysedge\_plugin* keyword to specify which AdvantEDGE modules to load at system start time. By default, the SystemEDGE agent does not load any plug-ins at initialization time, but you can edit the sysedge.cf file to configure the agent to load any AdvantEDGE Point modules that you have installed. The sysedge.cf file is located in your system directory (for example, C:\winnt\system32). For more information about the sysedge.cf file, refer to the *SystemEDGE Agent User Guide*.



## 2 INSTALLING ADVANTEDGE FOR MICROSOFT SQL SERVER

*Configuring AdvantEDGE for Microsoft SQL Server*

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To configure the SystemEDGE agent to start AdvantEDGE for Microsoft SQL Server at system start time, open the sysedge.cf file for editing; then add the following lines:

```
# SQL Server
sysedge_plugin C:\sysedge\plugins\sqlmod\sqlmod.dll
```

where C:\sysedge\plugins\sqlmod is the directory in which you installed the AdvantEDGE for Microsoft SQL Server files. This command line provides the complete pathname to sqlmod.dll, the AdvantEDGE for Microsoft SQL Server dynamic link library.

### Editing the sqlmod.cf File

The sqlmod.cf file describes the AdvantEDGE for Microsoft SQL Server Point module configuration. Make sure that this file is located in the same directory as sqlmod.dll (for example, C:\sysedge\plugins\sqlmod). If you are running more than one instance of Microsoft SQL Server on your system, edit the configuration file to associate the Open Database Connectivity (ODBC) connections with the instances that you want to monitor.

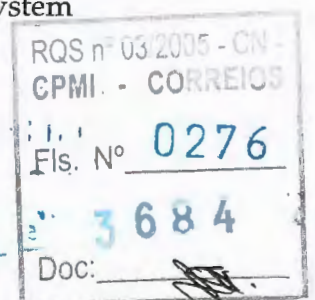
The following is a sample sqlmod.cf file.

```
sqlmod 1 "{SQL Server}" SLOWPOKE MSSQLODBC sa password
sqlmod 2 "{SQL Server}" SLOWPOKE\INSTANCE1 ODBCInstance1 sa password
sqlmod 3 "{SQL Server}" SLOWPOKE\INSTANCE2 ODBCInstance2 sa password
```

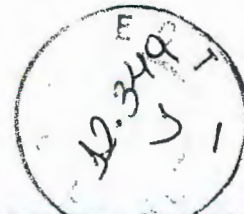
- Position 1: sqlmod.
- Position 2: The index number uniquely assigned to the instance.
- Position 3: The name of the driver to connect with Microsoft SQL Server; it will usually be "{SQL Server}". The driver name must be enclosed in brackets.
- Position 4: The name of the Microsoft SQL Server to which to connect.
- Position 5: The name of the ODBC connection.
- Position 6: A user name; for example, "sa" would be an appropriate choice for a user with a system administrator role.
- Position 7: An appropriate password.

#### NOTE

The user that you specify in this file does **not** need to be a system administrator and does **not** need db\_owner level access.







## INSTALLING ADVANTEDGE FOR MICROSOFT SQL SERVER

*Configuring AdvantEDGE for Microsoft SQL Server*

.....

### Editing Guidelines

When editing the sqlmod.cf file, follow these guidelines:

- Enclose an entry in quotation marks if it contains a space character.
- After you modify the sqlmod.cf file, save it and restart the SystemEDGE agent.
- After restarting the SystemEDGE agent, license the module as described in "Licensing AdvantEDGE for Microsoft SQL Server" on page 2-6.
- The user that you specify in sqlmod.cf does not need to have a server role, but **must** have at least db\_datareader access to the master database. You can set up and verify this access from the Enterprise Manager under Security -> Logins.

### Creating an ODBC Connection to Microsoft SQL Server

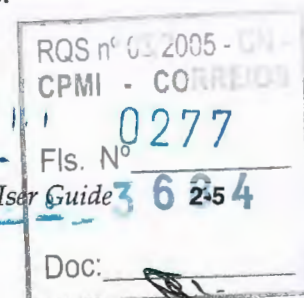
The system administrator should set up an ODBC connection to use Microsoft SQL Server authentication with a login ID and password. This connection stays open after it is established.

#### NOTE

It is important that the username assigned for the ODBC connection have the proper Microsoft SQL Server access permissions. Failure to do so may cause SQL Server operation to lock up when attempting the connection.

To create a new ODBC connection using Microsoft SQL Server authentication:

1. Log on to the system as the administrator.
2. Click **Start**.
3. Select **Settings** → **Control Panel**. The Control Panel window appears.
4. Double-click the **ODBC Data Sources** icon. (In Windows 2000, this is in the Administrative Tools folder of the Control Panel window.) The ODBC Data Sources Administrator window appears.
5. Select the **User DSN** tab (if it is not already selected.)
6. Select **Add**.
7. Select **SQL Server** from the list of ODBC drivers and click **Finish**. The Create a New Data Source to SQL Server wizard appears.
8. Specify a connection name in the **Name** field.



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9. Optionally, specify a description of the data source in the **Description** field.
10. Specify the server for the ODBC connection in the **Server** field.
11. Select **Next**.
12. Select **With SQL Server authentication using a login ID and password entered by the user**.
13. Select **Next**.
14. Select **Next** to accept the default values. The ODBC Microsoft SQL Server Setup window appears.
15. Select **Test Data Source**.

## Licensing AdvantEDGE for Microsoft SQL Server

Like the SystemEDGE agent, AdvantEDGE for Microsoft SQL Server utilizes a host-based license method. Copies of AdvantEDGE for Microsoft SQL Server can run only on systems that possess a valid license key. This license is separate from the one used for the SystemEDGE agent.

The first time that you attempt to start the SystemEDGE agent after installing AdvantEDGE for Microsoft SQL Server, the agent displays a message stating that it did not find a valid license for AdvantEDGE for Microsoft SQL Server. It then provides you with a *public key* that you can use to generate a permanent license key for your host machine.

A license key is made up of four space-separated, 8-character sequences, totaling 32 characters. The sysedge.lic file contains the AdvantEDGE for Microsoft SQL Server license, as well as the SystemEDGE agent license and other AdvantEDGE Point module licenses. For an example of a license file, refer to "Sample License File" on page 2-9.

### NOTE

If you are using an evaluation copy of AdvantEDGE for Microsoft SQL Server, you must request a temporary license that will enable AdvantEDGE for Microsoft SQL Server to operate during the evaluation period.

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## Obtaining a License

To obtain a license, choose one of the following methods:

- Run the Concord `licenseutil.pl` script.
- Run the `licenseme.exe` license utility.
- Use the AdvantEDGE View licensing procedure; refer to the AdvantEDGE View Web Help.
- Send an e-mail request to [license@empire.com](mailto:license@empire.com).
- Complete the online license form through the Internet, as described in "Generating the License" on page 2-7.

You can obtain a license at any time from the Concord licensing Web server (<http://license.concord.com>). If you use AdvantEDGE View licensing, AdvantEDGE View can automatically retrieve and set up licenses for the SystemEDGE agent and the plug-ins. For more information, refer to the *Automating the Licensing of SystemEDGE and AdvantEDGE Point Plugin Modules* white paper and the *SystemEDGE Agent User Guide*.

## Generating the License

The SystemEDGE setup program generates the licensing information for your system.

To generate a license:

1. Run the SystemEDGE agent setup command by entering the following at the command prompt:

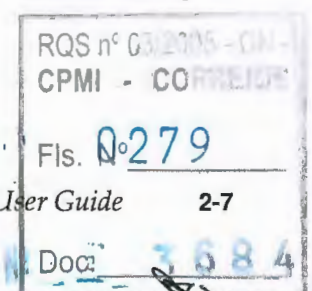
```
sysedge\setup -l
```

The setup program displays a message similar to the following:

```
SystemEDGE Version 4.0 Patchlevel 3
Copyright 2001 by Concord Communications, Inc.
Please contact Concord Communications, Inc. to obtain a license
http://www.concord.com/support, Email: license@concord.com
Provide: sysedge neptune NTx86 5.0 346561363366b19c 4.0 Patchlevel 3
```

2. Complete the Web-based license form for AdvantEDGE for Microsoft SQL Server available from Concord's licensing Web server at the following URL:

<http://license.concord.com>



## 2 INSTALLING ADVANTEDGE FOR MICROSOFT SQL SERVER

*Licensing AdvantEDGE for Microsoft SQL Server*

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### NOTE

You must supply a user name and password to access the license form.

Supply the following information on the form:

- Customer ID
- Name
- E-mail address
- Software version number (4.0 in the example above)
- Patchlevel
- System name (neptune in the example above)
- Operating system name (NTx86 in the example above)
- Version (5.0 in the example above)
- System identifier (346561363366b19c in the example above)

### NOTE

When you are licensing AdvantEDGE for Microsoft SQL Server, select **sqlmod** as the product on the licensing form.

After you submit the license request, the Concord Web server generates a license and displays it to your Web browser. It also e-mails the license to the contact person in your organization.

3. Copy the generated license key into the sysedge.lic file in the system32 subdirectory (C:\winnt\system32) and save this file.

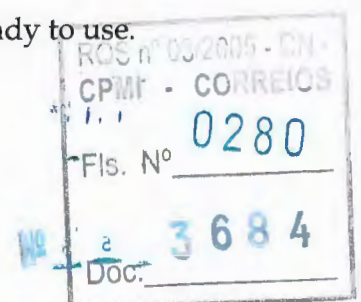
### NOTE

The license key is case-sensitive. Copy it exactly as it appears. If possible, use your system's cut-and-paste feature instead of entering it manually. If you do enter the license key manually, ensure that you do not confuse characters such as the letters l and I and the number 1, or the letter O and the number 0.

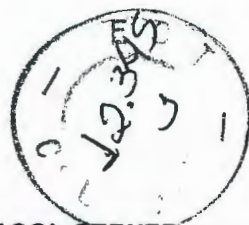
4. Stop and restart the Windows NT Master agent by entering these commands at the command prompt:

```
net stop snmp
net start snmp
```

AdvantEDGE for Microsoft SQL Server is now licensed and ready to use.







## INSTALLING ADVANTEDGE FOR MICROSOFT SQL SERVER

*Licensing AdvantEDGE for Microsoft SQL Server*

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### Sample License File

The following is a sample SystemEDGE agent license file. A pound character (#) in column 1 indicates that the entire line is a comment.

```
# license file for SystemEDGE Agent
# Empire Technologies, Inc.
# A Concord Communications Company
# http://www.empire.com
#
# file /etc/sysedge.lic or %SystemRoot%\system32\sysedge.lic
# A valid license key has four parts of 8 characters per part
# parts are separated by space(s) with one license key per
  line
# sysedge neptune NTx86 5.0 807cb1da007cb1da 4.0
e13311d3 0F2a7cb1 abC512dc fF8C923a
# sqlmod neptune NTx86 5.0 807cb1da007cb1da 1.0
a7943fde 098a87ij a4kiuf39 afafEkj4
```

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# Using the AdvantEDGE for Microsoft SQL Server MIB

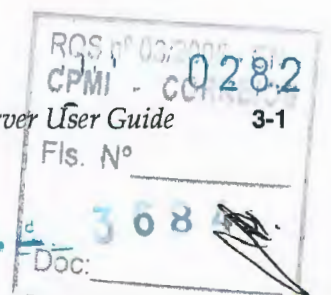
This chapter outlines the information available from the Concord Communications Management Information Base (MIB) for the Microsoft SQL Server. The MIB specification (sqlmod.asn1) defines a collection of objects for monitoring and managing Microsoft SQL Server. All MIB objects related to AdvantEDGE for Microsoft SQL Server exist at object identifier (OID) branch 1.3.6.1.4.1.546.16.8 in the Concord Systems Management MIB.

This chapter explains the organization and content of the AdvantEDGE for Microsoft SQL Server MIB. You must configure the SystemEDGE agent to monitor the MIB objects that are relevant to your configuration. For that information, refer to Chapter 4, "Using AdvantEDGE for Microsoft SQL Server."

## MIB Overview

The MIB is organized into broad sections for server configuration, footprint, and performance. The server configuration section describes MIB objects that capture data such as database names, database creation dates, database status, and database device names, as well as overall server-level activity indicators. The footprint section defines MIB objects that convey how much of the underlying system's resources are consumed by Microsoft SQL Server. The performance section contains MIB objects that capture data regarding lock requests, access methods, transaction log activity, memory management, SQL statistics, buffer management, and cache management.

SQL Server 2000 supports multiple instances of the sqlserver process. The Concord Communications MIB for Microsoft SQL Server was specifically designed to handle data from multiple instances. The information set contained in this MIB is unique.





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The following sections briefly describe the MIB objects. Refer to the AdvantEDGE for Microsoft SQL Server MIB Specification (sqlmod.asn1) for a list of MIB objects and their syntax sequences and statuses.

## Configuration Section

The Configuration section of the AdvantEDGE for Microsoft SQL Server MIB contains configuration parameters and settings that are important for monitoring the Microsoft SQL Server process and configuring databases.

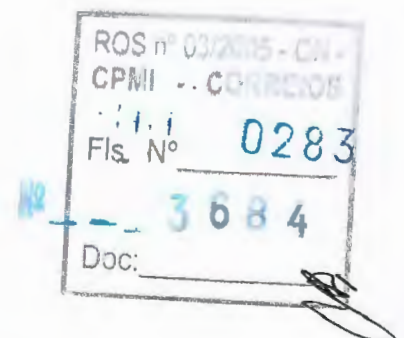


### Database Description Group

The Database Description group contains high-level information about the Microsoft SQL Server application including the status of the database. Table 3-1 describes the Database Description MIB objects.

**Table 3-1: SQL Server Database Description MIB Objects**

MIB Object	Description
sqlmodDBDescInstanceIdx	SQL Server instance InstanceIdx
sqlmodDBDescVendor	Database server vendor
sqlmodDBDescProdName	Product name for the database server
sqlmodDBDescVers	SQL Server version
sqlmodDBDescContact	Contact individual or organization
sqlmodDBDescStatus	Number indicating SQL Server status where 1=initialized, 2=ready, 3=running, 4=standby, 5=terminated, 6=waiting, 7=transitioning, 8=unknown
sqlmodDBDescUptime	SQL Server uptime in msec
sqlmodDBDescIsClustered	Number indicating SQL Server clustering status where 1=not clustered, 2=clustered, 3=not determined



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## SQL Server General Information Group

The SQL Server General Information group contains MIB objects that capture basic information about an instance of Microsoft SQL Server and the status of this process. Table 3-2 describes the SQL Server General Information MIB objects.

**Table 3-2: SQL Server General Information MIB Objects**

MIB Object	Description
sqlmodDBGenProcInstanceIdx	SQL Server instance InstanceIdx
sqlmodDBGenProcServName	Name of SQL Server instance
sqlmodDBGenProcStartTime	Date and time that the SQL Server instance started
sqlmodDBGenProcCompPageRead	Number of physical page reads completed for this instance since it started
sqlmodDBGenProcCompPageWrite	Number of physical page writes completed for this instance since it started
sqlmodDBGenProcTDSPackRead	Number of TDS packets read from network for this instance since it started
sqlmodDBGenProcTDSPackWrite	Number of TDS packets written to network for this instance since it started
sqlmodDBGenProcBlkngLocks	Total number of blocking locks for this instance
sqlmodDBGenProcUsersBlkd	Number of users blocked by other users for this instance

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## Advanced Configuration Group

The Advanced Configuration group contains MIB objects that capture data about advanced configuration parameters such as locks, query wait, and maximum number of worker threads. Table 3-3 describes the Advanced Configuration MIB objects.

**Table 3-3: Advanced Configuration MIB Objects**

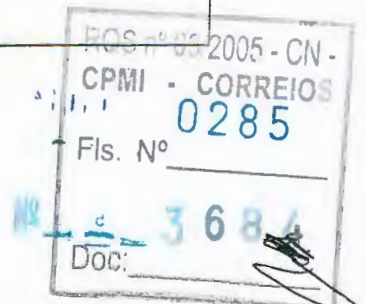
MIB Object	Description
sqlmodDBAdvCfgInstanceIdx	SQL Server instance InstanceIdx
sqlmodDBAdvCfgParams	SQL Server configuration values (For a list of values, refer to the sqlmod.asn1 file.)
sqlmodDBAdvCfgParamName	Description of parameter
sqlmodDBAdvCfgMin	Minimum value of parameter
sqlmodDBAdvCfgMax	Maximum value of parameter
sqlmodDBAdvCfgCfg	Configured value for parameter
sqlmodDBAdvCfgRun	Runtime value for parameter

## Databases Information Group

The Databases Information group includes MIB objects that report on total database size, transaction log size, and other measures of database management activity. Table 3-4 describes the Database Information MIB objects.

**Table 3-4: Database Information MIB Objects (Page 1 of 2)**

MIB Object	Description
sqlmodDBDbasesInfoInstanceIdx	SQL Server instance InstanceIdx
sqlmodDBDbasesInfoDBID	SQL Server DBID
sqlmodDBDbasesInfoName	SQL Server database name
sqlmodDBDbasesInfoState	SQL Server database state. (For a list of values, refer to the sqlmod.asn1 file.)
sqlmodDBDbasesInfoCreat	Database creation date and time
sqlmodDBDbasesInfoOwn	Database owner
sqlmodDBDbasesInfoSz	Database size in KB



**Table 3-4: Database Information MIB Objects (Page 2 of 2)**

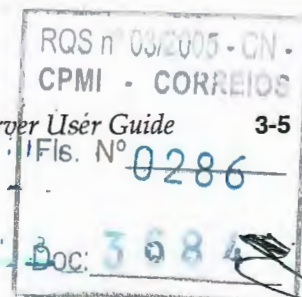
MIB Object	Description
sqlmodDBDbasesInfoUnalloc	Unallocated space in KB
sqlmodDBDbasesInfoReserv	Reserved space in KB
sqlmodDBDbasesInfoUseddata	Used data space in KB
sqlmodDBDbasesInfoUsedIdx	Used index space in KB
sqlmodDBDbasesInfoUnused	Unused space in KB
sqlmodDBDbasesInfoLasttranslog	Date and time of last transaction log dump
sqlmodDBDbasesInfoTranslogsz	Transaction log size in KB
sqlmodDBDbasesInfoTranslogsp	Percent of transaction log space used
sqlmodDBDbasesInfoLastfull	Date and time of last transaction log full backup
sqlmodDBDbasesInfoLastdifferential	Date and time of last transaction log differential backup
sqlmodDBDbasesInfoLastfilegroup	Date and time of last transaction log file/filegroup backup

## Database Options Group

The Database Options group relates the database ID and database name to a database option which has been set. Table 3-5 describes the Database Options MIB objects.

**Table 3-5: Database Options MIB Objects**

MIB Object	Description
sqlmodDBDbasesOptInstanceIdx	SQL Server instance InstanceIdx
sqlmodDBDbasesOptDBID	SQL Server database ID
sqlmodDBDbasesOptOptID	Option index
sqlmodDBDbasesOptName	Name of SQL Server database to which option applies
sqlmodDBDbasesOptOption	Name of the database option which is set





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## Database Devices Group

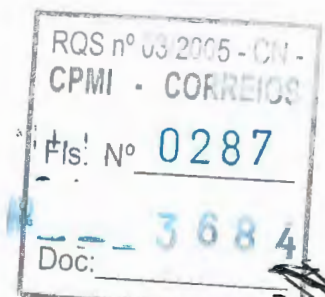
The Database Devices group includes MIB objects for device-specific information such as device description, device status, and device size. Table 3-6 describes the Database Devices MIB objects.

Table 3-6: Database Devices MIB Objects

MIB Object	Description
sqlmodDBDbasesDevInstanceId	SQL Server instance InstanceIdx
sqlmodDBDbasesDevDevice	SQL Server device index
sqlmodDBDbasesDevName	SQL Server device name
sqlmodDBDbasesDevPhysName	SQL Server device physical name
sqlmodDBDbasesDevDescrip	SQL Server device description
sqlmodDBDbasesDevStatus	SQL Server device status
sqlmodDBDbasesDevCtrlType	SQL Server device controller type
sqlmodDBDbasesDevSize	SQL Server device size

## Footprint Section

The Footprint section of the AdvantEDGE for Microsoft SQL Server MIB contains footprint statistics that are important for monitoring the SQL Server process and its impact on the system. Long-term trend analysis of footprint information is useful for anticipating and avoiding problems due to resource exhaustion. You can also monitor footprint information in real time to detect and correct temporary resource exhaustion due to viruses, security incidents, and hardware failures.



## General Footprint Group

The General Footprint group contains MIB objects that pertain to the system, not just to an instance of SQL Server. Table 3-7 describes the General Footprint MIB objects.

**Table 3-7: General Footprint MIB Objects**

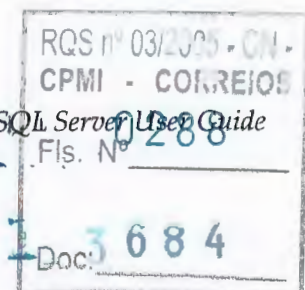
MIB Object	Description
sqlmodFootprintTotCPUTime	Total CPU time for all SQL Server instances
sqlmodFootprintTotPercentCPU	Total percent of CPU usage for all SQL Server instances
sqlmodFootprintTotMEMSize	Total memory usage for all SQL Server instances
sqlmodFootprintTotRSS	Total resident set size for all SQL Server instances
sqlmodFootprintTotPercentMEM	Total percent of memory usage for all SQL Server instances
sqlmodFootprintTotThreads	Total number of threads for all SQL Server instances
sqlmodFootprintTotFaults	Total number of page faults for all SQL Server instances

## Physical Disk Group

The Physical Disk group contains MIB objects that describe the physical disks in which database files are stored. Table 3-8 describes the Physical Disk MIB objects.

**Table 3-8: Physical Disk MIB Objects (Page 1 of 2)**

MIB Object	Description
sqlmodFootprintPhysicalDiskIdx	Number indicating the disk drive being monitored where 1 = total, 2 = drive C, 3 = drive D, 4 = drive E, 5 = drive F, etc.
sqlmodFootprintPhysicalDiskWhichdr	Name of the disk drive (for example, "C", "D") or "Total"





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**Table 3-8: Physical Disk MIB Objects (Page 2 of 2)**

MIB Object	Description
sqlmodFootprintPhysicalDiskDisktrans	Total disk transfers
sqlmodFootprintPhysicalDiskCurrdskquelen	Current disk queue length
sqlmodFootprintPhysicalDiskDskbytes	Total number of bytes moved

## SQL Server Process Footprint Group

The SQL Server Process Footprint group contains MIB objects that report the impact of the SQL Server process on the CPU and virtual memory. Table 3-9 describes the SQL Server Process Footprint MIB objects.

**Table 3-9: SQL Server Process Footprint MIB Objects**

MIB Object	Description
sqlmodFootprintProcessInstanceId	SQL Server InstanceId
sqlmodFootprintProcessMEM	Percent of real memory used by the process
sqlmodFootprintProcessSize	Combined size of the text, data, and stack segments in bytes
sqlmodFootprintProcessRSS	Size of resident set used by the process in kilobytes
sqlmodFootprintProcessTime	Accumulated CPU time used by the process in seconds
sqlmodFootprintProcessThreads	Number of threads used by the process
sqlmodFootprintProcessFaults	Number of page faults related to the process
sqlmodFootprintProcessPercentCPU	Percent of CPU usage by the process

## Performance Section

The Performance section of the AdvantEDGE for Microsoft SQL Server MIB contains MIB objects that are indicators of the availability and performance of the application. This information is necessary for capacity planning and trend analysis.

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## Locks Group

The Locks group contains the MIB objects that indicate the frequency of users being prevented from updating records in the database. Table 3-10 describes the Locks MIB objects.

**Table 3-10: Locks MIB Objects**

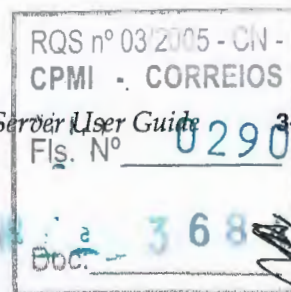
MIB Object	Description
sqlmodLocksInstanceId	SQL Server InstanceIdx
sqlmodLocksWhichlock	Number indicating lock type where 1 = extent, 2 = key, 3 = page, 4 = table, 5 = rid, 6 = database, and 7 = total
sqlmodLocksAvgwaittime	Average wait time (in msec) for lock request
sqlmodLocksLockreq	Number of lock requests
sqlmodLocksLocktimeouts	Number of lock timeouts
sqlmodLocksLockwaittime	Total lock wait time (in msec)
sqlmodLocksLockwaits	Number of lock requests that require a wait
sqlmodLocksDeadlocks	Number of deadlocked lock requests

## Access Methods Group

The Access Methods group contains MIB objects that reflect the types of searching that the SQL Server process performs during execution. Table 3-11 describes the Access Methods MIB objects.

**Table 3-11: Access Methods MIB Objects (Page 1 of 2)**

MIB Object	Description
sqlmodAccessMethodsInstanceId	SQL Server InstanceIdx
sqlmodAccessMethodsExtalloc	Number of extents allocated to database objects
sqlmodAccessMethodsFrwdrec	Number of records fetched through forwarded pointers
sqlmodAccessMethodsFullscans	Number of unrestricted full scans
sqlmodAccessMethodsIdxsearch	Number of index searches





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Table 3-11: Access Methods MIB Objects (Page 2 of 2)

MIB Object	Description
sqlmodAccessMethodsPagesplits	Number of page splits (overflowing index pages)
sqlmodAccessMethodsPagesalloc	Number of pages allocated to database objects
sqlmodAccessMethodsProbescans	Number of probe scans
sqlmodAccessMethodsRangescans	Number of range scans
sqlmodAccessMethodsSkipghostrec	Number of ghosted records skipped
sqlmodAccessMethodsTablelockescs	Number of times locks on a table were escalated
sqlmodAccessMethodsWorktblcreat	Number of worktables created

## Log Management Group

The Log Management group includes MIB objects that relate instances of the database to key indicators of transaction log activity. Table 3-12 describes the Log Management MIB objects.

Table 3-12: Log Management MIB Objects (Page 1 of 2)

MIB Object	Description
sqlmodDatabasePerfInstanceIdx	SQL Server InstanceIdx
sqlmodDatabasePerfDBIdx	SQL Server DBIdx
sqlmodDatabasePerfName	Name of SQL Server database or "Total"
sqlmodDatabasePerfActtrans	Number of active transactions
sqlmodDatabasePerfBulkcopyrows	Number of rows bulk copied
sqlmodDatabasePerfBulkcopythroughput	Size of bulk data copied (in KB)
sqlmodDatabasePerfDatafilesizes	Cumulative size of data files (in KB)
sqlmodDatabasePerfLogcachehitratio	Percent of reads satisfied from the log cache
sqlmodDatabasePerfLogfilesize	Cumulative size of the transaction log files

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**Table 3-12: Log Management MIB Objects (Page 2 of 2)**

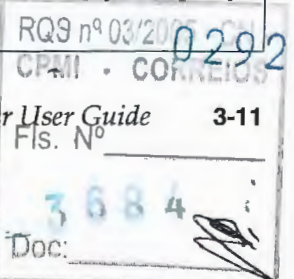
MIB Object	Description
sqlmodDatabasePerfLogflushes	Number of flushes of the transaction log
sqlmodDatabasePerfLoggrowths	Number of times that the transaction log has expanded
sqlmodDatabasePerfLogshrinks	Number of times that the transaction log has shrunk
sqlmodDatabasePerfLogtruncs	Number of times that the transaction log has been truncated
sqlmodDatabasePerfLogutilized	Percent of log space used
sqlmodDatabasePerfShrinkdata	Amount of data being moved by autoshrink operations (in bytes)
sqlmodDatabasePerfTrans	Number of transactions

## Memory Management Group

The Memory Management group contains MIB objects that characterize management of dynamic memory. Table 3-13 describes the Memory Management MIB objects.

**Table 3-13: Memory Management MIB Objects (Page 1 of 2)**

MIB Object	Description
sqlmodMemoryManagerInstanceIdx	SQL Server InstanceIdx
sqlmodMemoryManagerConnmem	Total dynamic memory used for connections
sqlmodMemoryManagerLockmem	Total dynamic memory used for locks
sqlmodMemoryManagerMaxworkspacemem	Maximum memory for executing processes
sqlmodMemoryManagerMemgrantsout	Number of processes with a workspace memory grant
sqlmodMemoryManagerMemgrantspend	Number of processes awaiting a workspace memory grant
sqlmodMemoryManagerOptmem	Total dynamic memory for query optimization





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**Table 3-13: Memory Management MIB Objects (Page 2 of 2)**

MIB Object	Description
sqlmodMemoryManagerSQLcachemem	Total dynamic memory for the SQL cache
sqlmodMemoryManagerTargservmem	Total dynamic memory that the server may consume
sqlmodMemoryManagerTotservmem	Total dynamic memory that the server is using



## SQL Statistics Group

The SQL Statistics group contains the MIB objects that characterize the autoperparameterizations (comparisons of SQL text to a template as part of query optimization) that take place in response to batch Transact-SQL (TSQL) requests. Table 3-14 describes the SQL Statistics MIB objects.

**Table 3-14: SQL Statistics MIB Objects**

MIB Object	Description
sqlmodSQLStatisticsInstanceIdx	SQL Server InstanceIdx
sqlmodSQLStatisticsAutoparamattmpt	Total failed, safe, and unsafe autoperparameterizations
sqlmodSQLStatisticsBatchreq	Number of TSQL batch requests
sqlmodSQLStatisticsFailedautoparam	Number of failed autoperparameterizations
sqlmodSQLStatisticsSafeautoparam	Number of safe autoperparameterizations
sqlmodSQLStatisticsSQLComp	Number of SQL compilations
sqlmodSQLStatisticsUnsafeautoparam	Number of unsafe autoperparameterizations

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## Buffer Management Group

The Buffer Management group contains the MIB objects that track statistics that are relevant to the efficiency of buffer management. Table 3-15 describes the Buffer Management MIB objects.

**Table 3-15: Buffer Management MIB Objects**

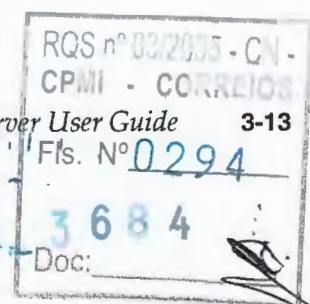
MIB Object	Description
sqlmodBufferManagerInstanceId	SQL Server InstanceIdx
sqlmodBufferManagerPagereads	Number of SQL Server ( <b>not</b> total system) page reads
sqlmodBufferManagerChkptpages	Number of checkpoint pages
sqlmodBufferManagerPagewrites	Number of SQL Server page writes (inclusive)
sqlmodBufferManagerBuffercachehitratio	Percent of data being retrieved from cache
sqlmodBufferManagerLazWriteFlush	Number of pages flushed by LazyWriter for this instance since it started
sqlmodBufferManagerPhysRead	Number of physical reads by Read Ahead Manager for this instance since it started

## General Statistics Group

The General Statistics group contains MIB objects that track the level of user login activity. Table 3-16 describes the General Statistics MIB objects.

**Table 3-16: General Statistics MIB Objects**

MIB Object	Description
sqlmodGeneralStatisticsInstanceId	SQL Server InstanceIdx
sqlmodGeneralStatisticsLogins	Number of logins
sqlmodGeneralStatisticsLogouts	Number of logouts
sqlmodGeneralStatisticsUserConns	Number of user connections





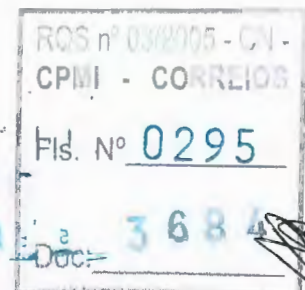
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## Cache Management Group

The Cache Management group contains MIB objects that are factors in the efficiency and effectiveness of cache management. Table 3-17 describes the Cache Management MIB objects.

**Table 3-17: Cache Management MIB Objects**

MIB Object	Description
sqlmodCacheManagerInstanceIdx	SQL Server InstanceIdx
sqlmodCacheManagerAdhocSQLCachehitratio	Percent of data found in cache for adhoc SQL queries
sqlmodCacheManagerAdhocSQLNumobj	Number of objects for adhoc SQL queries
sqlmodCacheManagerAdhocSQLNumpages	Number of pages for adhoc SQL queries
sqlmodCacheManagerProcplansCachehitratio	Percent of data found in cache for procedure plans
sqlmodCacheManagerProcplansNumobj	Number of objects for procedure plans
sqlmodCacheManagerProcplansNumpages	Number of pages for procedure plans
sqlmodCacheManagerTrigplansCachehitratio	Percent of data found in cache for trigger plans
sqlmodCacheManagerTrigplansNumobj	Number of objects for trigger plans
sqlmodCacheManagerTrigplansNumpages	Number of pages for trigger plans
SqlmodCacheManagerPrepSQLplansCachehitratio	Percent of data found in cache for prepared SQL plans
sqlmodCacheManagerPrepSQLplansNumobj	Number of objects for prepared SQL plans
sqlmodCacheManagerPrepSQLplansNumpages	Number of pages for prepared SQL plans



## Flat Information Group

The Flat Information group contains MIB objects that are totals across the set of databases for each instance of Microsoft SQL Server. Table 3-18 describes the Flat Information MIB objects.

**Table 3-18: Flat Information MIB Objects**

MIB Object	Description
sqlmodBDBbasesFlatInfoInstanceIdx	SQL Server instance
sqlmodBDBbasesFlatInfoANDedState	SQL Server database state where 64=pre-recovery, 128=recovering, 256=not recovered, 32768=emergency mode
sqlmodBDBbasesFlatInfoSzTotal	Database size in kilobytes
sqlmodBDBbasesFlatInfoUnallocTotal	Unallocated space in kilobytes
sqlmodBDBbasesFlatInfoTranslogszTotal	Transaction log size in kilobytes
sqlmodBDBbasesFlatInfoTranslogspTotal	Percent of transaction log space used
sqlmodBDBbasesFlatInfoLasttranslog	Date and time of last transaction log backup
sqlmodBDBbasesFlatInfoLastfull	Date and time of last transaction log full backup
sqlmodBDBbasesFlatInfoLastdifferential	Date and time of last transaction log differential backup
sqlmodBDBbasesFlatInfoLastfilegroup	Date and time of last transaction log file / filegroup backup



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## Flat Transaction Performance Group

The Flat Transaction Performance group contains MIB objects that are totals across the set of databases for each instance of Microsoft SQL Server.

Table 3-19 describes the Flat Transaction Performance MIB objects.

**Table 3-19: Flat Information MIB Objects**

MIB Object	Description
sqlmodDatabaseFlatPerfInstanceId	SQL Server instance
sqlmodDatabaseFlatPerfTransTotal	Number of total transactions
sqlmodDatabaseFlatPerfLogcachehitsTotal	Total number of log cache hits
sqlmodDatabaseFlatPerfLogcachemissesTotal	Total number of log cache misses

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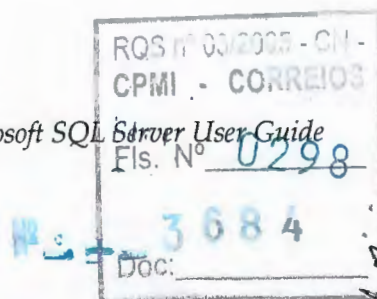
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# Using AdvantEDGE for Microsoft SQL Server

This chapter describes how to configure and use AdvantEDGE for Microsoft SQL Server. After you license this plug-in and enable it in the sysedge.cf file (refer to "Configuring AdvantEDGE for Microsoft SQL Server" on page 2-3), it will load automatically at SystemEDGE start time.

This plug-in implements additional MIB objects that provide advanced information about the health and availability of Microsoft SQL Server. AdvantEDGE for Microsoft SQL Server can operate with any SNMP-compliant management software such as Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others. If you are using AdvantEDGE for Microsoft SQL Server with eHealth, refer to the eHealth Web Help for more information about the reports that you can generate.

The purpose of this chapter is to illustrate how you can edit the SystemEDGE configuration file to utilize the new MIB objects with the process-monitoring, threshold-monitoring, and history-collection features of the SystemEDGE agent. For more examples of configuration file commands, refer to the examples file, which is available in the AdvantEDGE for Microsoft SQL Server product installation.





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## Assigning Entry Rows for the SystemEDGE Self-Monitoring Tables

All of the SystemEDGE self-monitoring tables (for example, Log Monitor table, Windows NT Event Monitor table, Process/Service Monitor table, Threshold Monitor table, and History table) require the use of unique row numbers. Each table contains an *Index* column which acts as a *key field* to distinguish rows in the table. The following sections describe the benefits of reserving a block of rows (somewhere in the range of 11 to the maximum number of rows in your table) for use by the system or application administrator.

### Setting Local Policy

System administrators may choose, as a matter of local policy, to reserve a block of rows for system administration. In compliance with this policy, all other users should use row indices that are outside of the reserved range when defining user-configured entries. This policy prevents users from using rows reserved for system administration.

### Reserving Blocks of Rows

This policy also allows system administrators to define a consistent set of conditions (row entries) to be monitored across all machines such that the same condition is defined in the same row number on each machine. For example, you can use row 3000 in each table to define entries monitoring the total number of page faults (sqlmodFootprintGeneralPageFaults) MIB object. You can then distribute this configuration to every host so that every machine running Microsoft SQL Server uses row 3000 for monitoring the total number of page faults, whether it is the Threshold Monitoring table or the History table.

To reserve a block of rows for monitoring Microsoft SQL Server:

1. Identify a block of rows that you want to reserve for use with monitoring Microsoft SQL Server.
2. Use that block of rows to define a set of row entries for each SystemEDGE self-monitoring tables. For more information, refer to the chapter on self-monitoring in the *SystemEDGE Agent User Guide*.

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3. Distribute the configuration file entries to all hosts that are running Microsoft SQL Server and AdvantEDGE for Microsoft SQL Server. For more information, refer to the *Automating the Deployment of SystemEDGE and AdvantEDGE Point Plugin Modules* white paper.

**NOTE**

Alternatively, you can use this row-number assignment policy with AdvantEDGE View for group configuration operations.

4. Require end users to avoid your block of rows when defining their own self-monitoring table entries.

## Using the SystemEDGE Self-Monitoring Features

This section provides examples of how to use SystemEDGE process-monitoring, threshold-monitoring, and history-collection features to monitor the Microsoft SQL Server application. Add these examples to the sysedge.cf file to enable monitoring of the MIB objects they specify. Modify these examples as necessary to monitor the MIB objects that are relevant for your configuration.

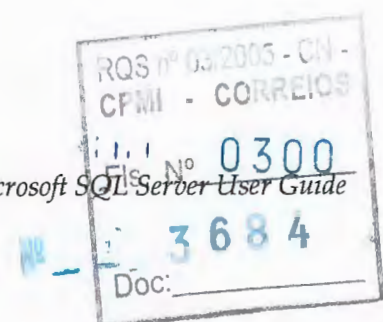
The examples in this section use row numbers in the 5000 range; use a row number for your configuration that conforms to local policies. For more information on row assignment, refer to "Assigning Entry Rows for the SystemEDGE Self-Monitoring Tables" on page 4-2. For more information on SystemEDGE process monitoring and service monitoring, refer to the *SystemEDGE Agent User Guide*.

**NOTE**

Enter the commands in this section and throughout this chapter as one line. Do not use a carriage return to match the formatting shown here.

## Using SystemEDGE Process Monitoring

This section provides an example of how to use the SystemEDGE agent to monitor the availability of a critical Microsoft SQL Server process. For more information, refer to the chapter on process monitoring in the *SystemEDGE Agent User Guide*.





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## Monitoring the Microsoft SQL Server Process

To ensure that Microsoft SQL Server is running, enter the following command:

```
watch process procAlive 'sqlservr' 5000 0x0  
30 'SQL Server' ''
```

This entry instructs the SystemEDGE agent to monitor the run-status (or liveness) of the Microsoft SQL Server process every 30 seconds and to store the data in row 5000 of the Process Monitor table.

## Using SystemEDGE Threshold Monitoring

This section provides examples of how to use SystemEDGE threshold-monitoring capabilities to monitor important Microsoft SQL Server metrics. Add the following commands to the sysedge.cf file to monitor thresholds for these MIB objects. For more information on SystemEDGE threshold-monitoring, refer to the chapter on threshold monitoring in the *SystemEDGE Agent User Guide*.

### NOTE

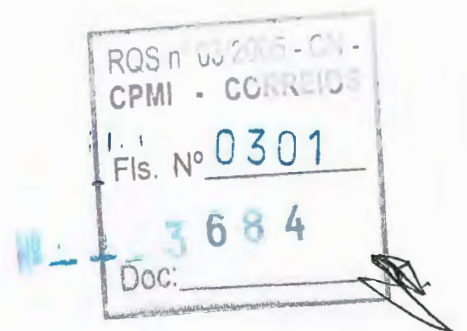
The thresholds used in these examples may not be appropriate for your system; select thresholds that are appropriate for your environment.

## Monitoring the Status of the SQL Server Process

To monitor if the SQL Server process has paused, enter the following command:

```
monitor oid sqlmodDBDescStatus 5002 0x0 60 absolute = 2 'SQL  
Server has paused'
```

This entry instructs the SystemEDGE agent to track the object, sqlmodDBDescStatus, and save the data to row 5002 of the agent's monitor table. The agent will sample the status of the SQL Server process every 60 seconds. The sample-type is 'absolute' since the object is an integer. The operator type '=' instructs the agent to send a trap whenever the status of the SQL Server process is equal to '2' which is specified in Concord's MIB for Microsoft SQL Server as indicating a paused process.



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## Monitoring the Number of Blocked Users

To monitor the number of blocked users, enter the following command:

```
monitor oid sqlmodDBGenProcUsersBlkd 5004 0x0 60 absolute >
20 'Number of Blocked Users exceeds threshold'
```

## Monitoring the Percentage of Log Space Used

To monitor the percentage of the transaction log that is used, enter the following command:

```
monitor oid sqlmodDatabasePerfLogutilitized 5005 0x0 60
absolute > 85 'Percentage of Transaction Log Utilized
exceeds threshold'
```

## Monitoring the Number of Processes Awaiting a Workspace Memory Grant

To monitor the number of processes awaiting a workspace memory grant, enter the following command:

```
monitor oid sqlmodMemoryManagerMemgrantspend 5006 0x0 60
absolute > 20 'Number of Processes Awaiting a Workspace
Memory Grant exceeds threshold'
```

## Using SystemEDGE History Collection

This section provides examples of how to use SystemEDGE history collection to track the value of important Microsoft SQL Server metrics over time. Add the following commands to the sysedge.cf file to collect history for these MIB objects. For more information on SystemEDGE history capabilities, refer to the chapter on history collection in the *SystemEDGE Agent User Guide*.

### NOTE

The number of samples and the interval between samples used in these examples may not be appropriate for your system; select values that are appropriate for your environment.

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### Collecting Number of Blocked Users History

To collect history for the number of blocked users, enter the following command:

```
emphistory 5010 60 sqlmodDBGenProcUsersBlkd 400 'Num Blocked  
Users History'
```

This entry instructs the SystemEDGE agent to track the value of the object, sqlmodDBGenProcUsersBlkd, and save the data in row 5010 of the empireHistoryCtrlTable. The agent will sample the value every 60 seconds and store the last 400 samples.

### Collecting Lock Requests Requiring a Wait History

To collect history for the number of lock requests requiring a wait, enter the following command:

```
emphistory 5011 60 sqlmodLocksLockwaits 480 'Number of Lock  
Requests Requiring a Wait History'
```

### Collecting Average Length of Disk Queue History

To collect history for the average length of the disk queue, enter the following command:

```
emphistory 5012 60 sqlmodPhysicalDiskAvgdskquelen 480  
'Average Length of Disk Queue History'
```

### Collecting Number of Database Transactions History

To collect history for the number of database transactions, enter the following command:

```
emphistory 5013 60 sqlDatabasePerfTrans 480 'Number of  
Database Transactions History'
```

### Collecting Total Amount of Dynamic Memory Used History

To collect history for the total amount of dynamic memory used, enter the following command:

```
emphistory 5014 60 sqlMemoryManagerTotservmem 480 'Total  
Amount of Dynamic Memory Used History'
```

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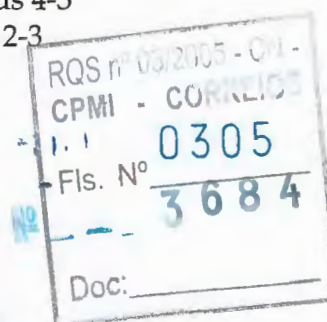
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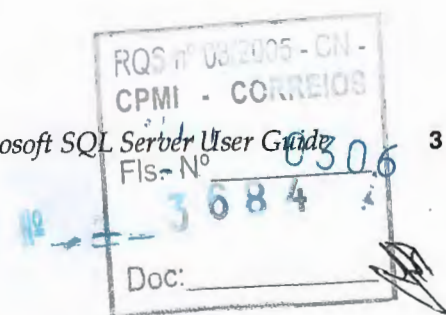
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# ADVANTEDGE™

## FOR MICROSOFT® EXCHANGE

### *User Guide*

Release 1.1 or Later

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April 2001

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### Patent Information

U. S. Patent 5,615,323  
Patents Pending

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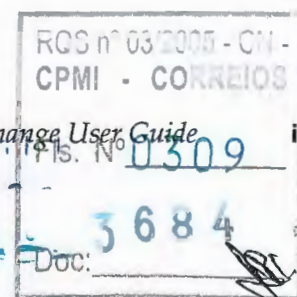
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## About This Guide

The *AdvantEDGE for Microsoft Exchange User Guide* provides instructions for installing and using AdvantEDGE for Microsoft Exchange for Windows NT x86 and Windows 2000 systems.

### NOTE

AdvantEDGE for Microsoft Exchange supports Exchange 5.5 and Exchange 2000.

This guide is intended for the person responsible for installing and configuring AdvantEDGE for Microsoft Exchange. This version supports AdvantEDGE for Microsoft Exchange Release 1.1 or later, and the SystemEDGE Agent Release 4.0, Patchlevel 3 and later.

To use AdvantEDGE for Microsoft Exchange, you should be familiar with the Microsoft Exchange application and the Concord SystemEDGE agent. Refer to Microsoft documentation and the *SystemEDGE Agent User Guide* for more information.

### NOTE

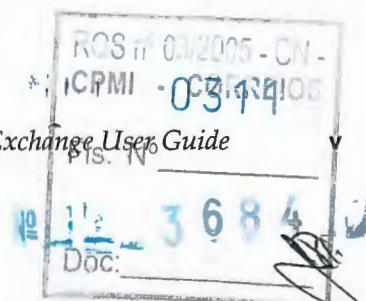
Unless otherwise specified, the content of this guide applies to both Exchange 5.5 and Exchange 2000. In areas where there are differences, this guide specifies to which version the content applies.

## How This Guide Is Organized

This guide is organized as follows:

- Chapter 1, "Introduction," provides an overview of AdvantEDGE for Microsoft Exchange and its features.
- Chapter 2, "Installing AdvantEDGE for Microsoft Exchange," explains how to install, configure, and license the AdvantEDGE for Microsoft Exchange software on a host system.

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## ABOUT THIS GUIDE

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- Chapter 3, "Using the AdvantEDGE for Microsoft Exchange MIB," describes the information that is available through the AdvantEDGE for Microsoft Exchange MIB.
- Chapter 4, "Using AdvantEDGE for Microsoft Exchange," explains how to configure and use AdvantEDGE for Microsoft Exchange in your host environment.

## Conventions Used in This Guide

This section describes conventions used in this guide.

### System Root Text Convention

This guide uses the system root text convention that is used by Microsoft to denote the Windows NT root directory:

```
%SystemRoot%\system32\
```

where %SystemRoot% is C:\winnt for Windows NT 4.0 and Windows 2000.

### Conventions for Commands

The following paragraph shows a sample command. Due to space limitations in this guide, some commands wrap from one line to the next. Disregard these line breaks, and **enter each command as one line**. Otherwise, your command syntax will be incorrect. For example, when you see a command such as the following:

```
watch process procAlive 'emsmta|EMSM TA' 5000 0x0 30  
  'Exchange MTA' ''
```

You **must** enter the command on one line, as shown here:

```
watch process procAlive 'emsmta|EMSM TA' 5000 0x0 30 'Exchange MTA' ''
```

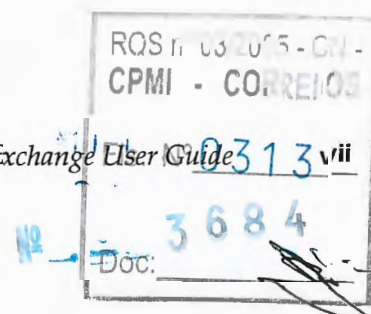
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## Contact Information

If you need any assistance with the SystemEDGE agent or the AdvantEDGE for Microsoft Exchange Point module, contact Customer Support, using one of the following methods:

Phone: (888) 832-4340 (for calls from the USA and Canada)  
(508) 303-4300 (for calls from other countries)  
Fax: (508) 303-4343  
E-mail: support@concord.com  
Web site: <http://www.concord.com>  
Licensing: <http://license.concord.com>



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# Introduction

This chapter provides an overview of the AdvantEDGE Point module for Microsoft Exchange and of the Microsoft Exchange architecture.

## NOTE

Unless otherwise stated, the term *Exchange*, as used throughout this guide and the Management Information Base (MIB) specification, refers to the Microsoft Exchange application in its entirety, which encompasses all the core services, connectors, and optional components.

## Features of AdvantEDGE for Microsoft Exchange

AdvantEDGE for Microsoft Exchange is a plug-in for the SystemEDGE agent. It enables information technology (IT) operators to monitor the performance and availability of Microsoft Exchange. Microsoft Exchange is a groupware application that enables communication and collaborative work. At its core is an e-mail routing, distribution, and storage facility. Exchange serves as the e-mail backbone for many corporations. Therefore, monitoring its health and availability is crucial to ensuring the smooth functioning of today's corporate information infrastructure.

The AdvantEDGE for Microsoft Exchange Point module makes important information about Microsoft Exchange available to management software through the SystemEDGE agent and Simple Network Management Protocol (SNMP). The SystemEDGE agent's self-monitoring capabilities enable the monitoring of important Exchange metrics, processes, and services, as well as the sending of SNMP traps when exceptions or exception conditions occur.

This release of AdvantEDGE for Microsoft Exchange supports Exchange 5.5 and Exchange 2000.

## NOTE

This document does not explain how to install, administer, or use Microsoft Exchange. For help with Microsoft Exchange, refer to your Microsoft documentation.

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## Microsoft Exchange Architecture

Microsoft Exchange is a complex piece of software containing many components. At the core of Microsoft Exchange are the following services:

- Mail transfer agent (MTA), which is responsible for routing e-mail messages to and from users.
- Directory service (DS), which maintains information about recipients, mailboxes, public and private folders, mailing lists, and other distribution lists (Exchange 5.5 only; Exchange 2000 uses Active Directory).
- Information store (IS), which serves as the repository of all messages on the Exchange server, and is composed of private and public areas.
- System attendant, which maintains the Exchange application's database and directory integrity, and on which all other Exchange services depend.
- Connectors, which transfer messages between sites, organizations, and non-native Exchange e-mail formats (for example, Internet, Lotus Notes, and Microsoft Mail). Several connectors are available from Microsoft and from third parties.
- Internet Information Services (IIS), which provides SMTP, IMAP, and POP services for Exchange 2000.

Figure 1-1 shows the relationships between the components of Microsoft Exchange 5.5. The architecture of Exchange 2000 is similar.

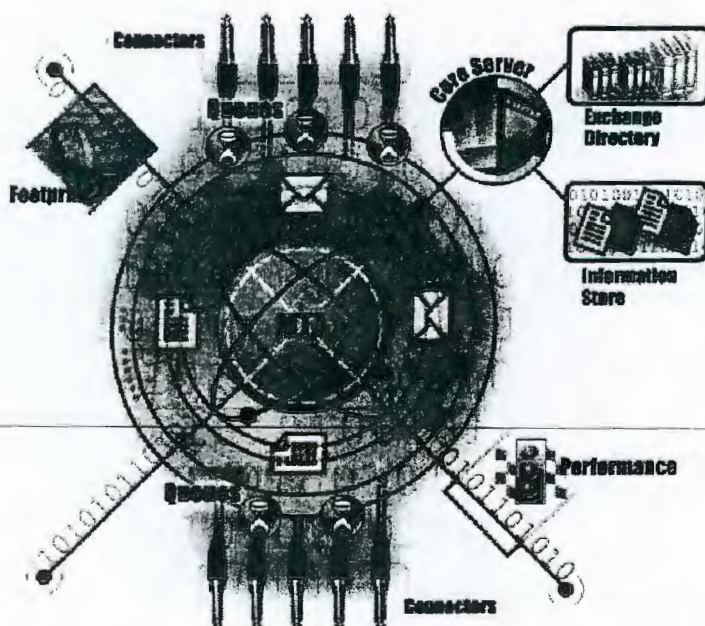


Figure 1-1: Microsoft Exchange 5.5 Architecture

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## INTRODUCTION

*Using AdvantEDGE for Microsoft Exchange*

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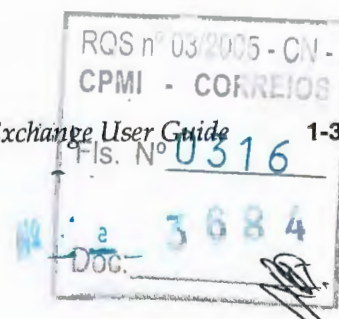
Because Microsoft Exchange is a complex application, monitoring Exchange is more complex than ensuring that a single process or Windows NT service is up and running. The many components that make up Exchange can function properly only through the availability of a variety of configuration parameters, settings, processes, Windows NT services, queues, and system resources.

## Using AdvantEDGE for Microsoft Exchange

AdvantEDGE for Microsoft Exchange can provide you with the tools and information that you need to monitor the health and availability of your Exchange server. It works with the SystemEDGE agent to closely manage the Microsoft Exchange application, providing real-time fault detection and automatically correcting problems, if necessary. You can use AdvantEDGE for Microsoft Exchange with any SNMP-compliant management software, including Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others.

You can use this plug-in with the SystemEDGE agent to perform the following tasks:

- Detect failed Exchange services (such as the Information Store or Message Transfer Agent) and restart them automatically.
- Alert an administrator when message queues become dangerously large, indicating potential security violations through SystemEDGE intelligent self-monitoring.
- Watch for Information Stores and disk partitions that are nearing capacity.
- Automatically delete temporary files when a threshold is reached to free up disk space and ensure continuous availability and performance.
- Detect types of Windows NT Events and forward them as SNMP traps to your network management system (NMS).





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## Using AdvantEDGE for Microsoft Exchange with eHealth

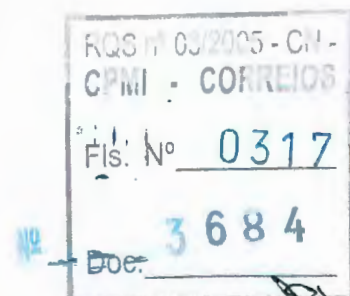
You can use AdvantEDGE for Microsoft Exchange and the SystemEDGE agent with the eHealth product suite to provide the historical data for long-term trending analysis and capacity planning. With eHealth – Application Assessment, you can run At-a-Glance, Trend, Top N, or MyHealth reports for the following types of variables:

- Amount of Central Processing Unit (CPU), total memory, and disk space that the Exchange application is using
- Size of the MTA and DS logs (Exchange 5.5 only)
- Amount of data, and number and type (public or private) of messages being processed by the MTA service
- Number of messages waiting to be processed by the MTA service
- Number of users
- SMTP traffic

For more information about the variables that you can monitor and reports you can run when you integrate AdvantEDGE for Microsoft Exchange with eHealth, refer to the eHealth Web Help.

## Using AdvantEDGE for Microsoft Exchange with Live Health

You can also use AdvantEDGE for Microsoft Exchange and the SystemEDGE agent with Live Health for real-time detection of potential problems. Live Health applies intelligent algorithms to the data, resulting in precise assessments of application health and performance. For more information about how Live Health can detect “brownouts” and service delays across applications, systems, and networks, refer to the Live Health Web Help.



# Installing AdvantEDGE for Microsoft Exchange

This chapter explains how to install, configure, and license AdvantEDGE for Microsoft Exchange.

## Installation Requirements

Before you install AdvantEDGE for Microsoft Exchange, you must first install, license, and configure the SystemEDGE agent Release 4.0, Patchlevel 3 or later. Refer to the *SystemEDGE Agent User Guide* for more information. Also, you must be running Windows NT 4.0 or Windows 2000. For more information, refer to your Microsoft documentation.

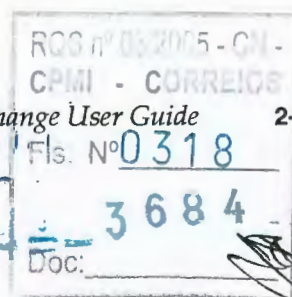
## Installing the Software

AdvantEDGE for Microsoft Exchange is distributed as a self-extracting executable named `xchgmod.exe`.

Follow these steps to install AdvantEDGE for Microsoft Exchange:

1. Log on to the Windows NT system as administrator.
2. Click **Start**.
3. Select **Programs** → **Command Prompt**.
4. Insert the CD containing the Concord software distributions into the CD-ROM drive.

Windows NT or Windows 2000 automatically mounts the drive using the CD-ROM drive's corresponding drive letter. The particular drive letter is specific to your system and depends on the number and types of disks attached to your system.





## 2 INSTALLING ADVANTEDGE FOR MICROSOFT EXCHANGE

### *AdvantEDGE for Microsoft Exchange Files*

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5. Determine which directory you want to use as the installation directory for AdvantEDGE for Microsoft Exchange. If the SystemEDGE agent is installed in C:\sysedge, the recommended installation directory is C:\sysedge\plugins.
6. Run the self-extracting executable by entering the following at the command prompt, where *D:* is the CD-ROM drive for your system, and *C:\sysedge\plugins* is the installation directory:

```
D:\xchgmod\ntx86\xchgmod.exe -dir C:\sysedge\plugins
```

**The -dir option instructs the self-extracting executable to create the intended subdirectory hierarchy that is described throughout this guide. It then places the distribution in an xchgmod subdirectory within the specified target directory (for example, C:\sysedge\plugins).**

#### NOTE

You cannot run xchgmod.exe directly from the CD-ROM.

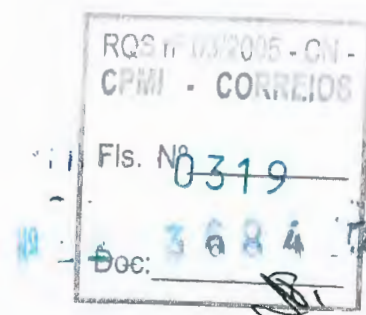
AdvantEDGE for Microsoft Exchange is now installed.

## AdvantEDGE for Microsoft Exchange Files

Table 2-1 describes the files that are installed during the AdvantEDGE for Microsoft Exchange installation.

**Table 2-1: Files Installed by AdvantEDGE for Microsoft Exchange**

File Name	Description
xchgmod.dll	AdvantEDGE for Microsoft Exchange dynamic link library (DLL) module for Windows NT and Windows 2000
xchgmod.pdf	<i>AdvantEDGE for Microsoft Exchange User Guide</i>
xchgmod.asn1	AdvantEDGE for Microsoft Exchange MIB specification
examples	AdvantEDGE for Microsoft Exchange monitoring examples
relnotes.txt	Release notes for AdvantEDGE for Microsoft Exchange



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## INSTALLING ADVANTEDGE FOR MICROSOFT EXCHANGE

Configuring AdvantEDGE for Microsoft Exchange

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### Configuring AdvantEDGE for Microsoft Exchange

The SystemEDGE agent reads the configuration file `sysedge.cf` and uses the `sysedge_plugin` keyword to specify which AdvantEDGE Point modules to load at system initialization. By default, the SystemEDGE agent does not load any plug-ins at initialization time, but you can configure the agent to load any AdvantEDGE Point modules that you have installed by editing the `sysedge.cf` file as follows.

To configure the SystemEDGE agent to start AdvantEDGE for Microsoft Exchange, provide the complete path name to `xchgmod.dll`, the AdvantEDGE for Microsoft Exchange DLL. The actual path depends on the location you selected when installing AdvantEDGE for Microsoft Exchange files. For example, enter this command if you installed the files in the `C:\sysedge\plugins\xchgmod` directory:

```
sysedge_plugin C:\sysedge\plugins\xchgmod\xchgmod.dll
```

For more information about the `sysedge.cf` file, refer to the *SystemEDGE Agent User Guide*.

### Licensing AdvantEDGE for Microsoft Exchange

Like the SystemEDGE agent, AdvantEDGE for Microsoft Exchange utilizes a *host-based* license method. Copies of AdvantEDGE for Microsoft Exchange can run only on systems that possess a valid license key. This license is separate from the one used for the SystemEDGE agent.

The first time that you attempt to start the SystemEDGE agent after installing AdvantEDGE for Microsoft Exchange, the agent displays a message that says that a valid license was not found for AdvantEDGE for Microsoft Exchange. It then provides you with a *public key* that is used to generate a permanent license key for your host machine.

A license key is made up of four space-separated, 8-character sequences, totaling 32 characters. The AdvantEDGE for Microsoft Exchange license is stored in the `sysedge.lic` file, the same file that is used for SystemEDGE agent licenses. Refer to the sample license file on page 2-6.

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## Obtaining a License

To obtain a license, you can do any of the following:

- Run the Concord-supplied `licenseutil.pl` script.
- Run the `licenseme.exe` license utility.
- Use the AdvantEDGE View licensing procedure, which is based on SNMP traps. For more information, refer to the AdvantEDGE View Web Help.
- Send an e-mail request to `license@concord.com` and place the returned license key in the appropriate license file.

### NOTE

Always include the Customer ID and user name in license requests that you send through e-mail.

- Complete the online license form through the Internet, as described in the next section, "Generating the License".

For more information about licensing, refer to the *SystemEDGE Agent User Guide* and the *Automating the Licensing of SystemEDGE and AdvantEDGE Point Plug-in Modules* white paper.

### NOTE

If you are using an evaluation copy of AdvantEDGE for Microsoft Exchange, you must request a temporary license that will enable it to operate during the evaluation period.

## Generating the License

This section describes how to generate the license using the Web-based license form. For Windows NT and Windows 2000, the setup program generates the licensing information for your system.

1. Run the SystemEDGE agent setup command to request licensing information by entering the following at the command prompt:

```
sysedge\setup -l
```

The setup program displays a message similar to the following:

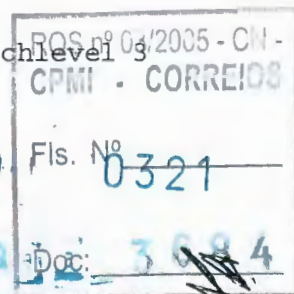
```
SystemEDGE Version 4.0 Patchlevel 3
```

```
Copyright 2001 by Concord Communications, Inc.
```

```
Please contact Concord Communications, Inc. to obtain a license
```

```
http://www.concord.com/support, Email: license@concord.com
```

```
Provide this: sysedge neptune NTx86 4.0 346561363366b19c 4.0 Patchlevel 3
```



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## INSTALLING ADVANTEDGE FOR MICROSOFT EXCHANGE

*Licensing AdvantEDGE for Microsoft Exchange*

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2. Fill out the online Web-based license form that is available from Concord's licensing Web server at the following URL:

<http://license.concord.com>

### NOTE

You must supply a user name and password to access the license form.

The license form asks you to supply the following information:

- Customer ID
- Name
- E-mail address
- Software version number (4.0 in the example above)
- Patchlevel (3 in the example above)
- System name (neptune in the example above)
- Operating system name (NTx86 in the example above)
- Version (4.0 in the example above)
- System identifier (346561363366b19c in the example above)

### NOTE

When you are licensing AdvantEDGE for Microsoft Exchange, select **xchgmod** as the product on the licensing form.

After you submit the license request, the Concord Web server generates a license and displays it to your Web browser. It also e-mails the license to the contact person in your organization.

3. Copy the generated license key into the sysedge.lic file in the system32 subdirectory (for example, C:\winnt\system32), and then save the file.

The license key is case sensitive. Copy it exactly as it appears. If possible, use your system's cut-and-paste facility instead of typing it by hand. If you are entering the license key by hand, be careful not to confuse characters such as the letters l and I and the number 1, or the letter O and the number 0.

4. Stop and restart the Windows NT Master agent by entering these commands at the command prompt:

```
net stop snmp
net start snmp
```





## 2 INSTALLING ADVANTEDGE FOR MICROSOFT EXCHANGE

*Licensing AdvantEDGE for Microsoft Exchange*

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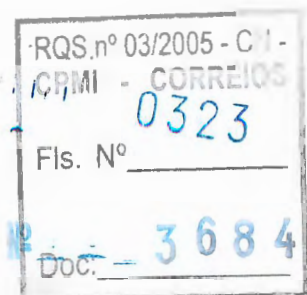
The AdvantEDGE for Microsoft Exchange Point module is now licensed and ready to use.

### Sample License File

The following is a sample SystemEDGE agent license file. A pound character (#) in column 1 indicates that the entire line is a comment.

```
# license file for SystemEDGE Agent
# Empire Technologies, Inc.
# A Concord Communications Company
# http://www.concord.com
#
# file /etc/sysedge.lic or %SystemRoot%\system32\sysedge.lic
# A valid license key has four parts of 8 characters per part
# parts are separated by space(s) with one license key per line
# sysedge jupiter NTx86 4.0 807cb1da007cb1da 4.0
e13311d3 0F2a7cb1 abC512dc fF8C923a

# xchgmod jupiter NTx86 4.0 807cb1da007cb1da 4.0
a7943fde 098a87ij a4kiuf39 afafEkj4
```



## Using the AdvantEDGE for Microsoft Exchange MIB

This chapter outlines the organization and content of the Concord Communications MIB for Microsoft Exchange. The MIB specification (xchgmod.asn1) defines a collection of objects for monitoring and managing Microsoft Exchange. You must configure the SystemEDGE agent to monitor the MIB objects that are relevant for your configuration. For more information, refer to Chapter 4, "Using AdvantEDGE for Microsoft Exchange."

Figure 3-1 shows the organization of the AdvantEDGE for Microsoft Exchange MIB.

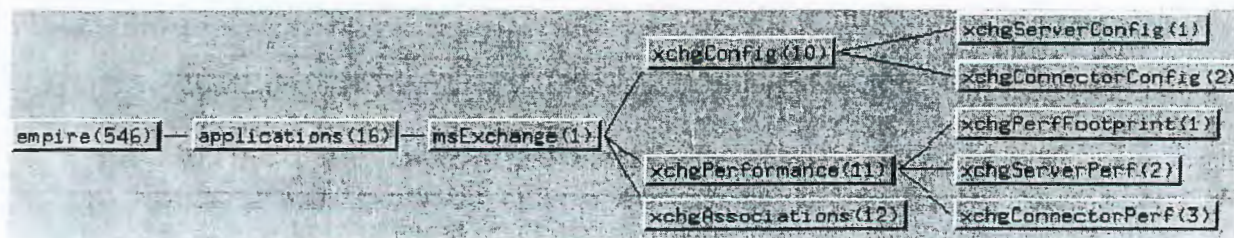
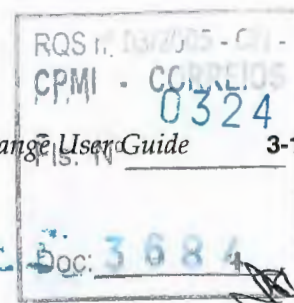


Figure 3-1: AdvantEDGE for Microsoft Exchange MIB

The MIB is organized into broad sections for configuration and performance. Within those broad sections are subsections for connector configuration and performance, and for core server configuration and performance. Within the performance section, a footprint section defines MIB objects that convey how much of the underlying system's resources are consumed by the Microsoft Exchange application.





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The following sections define important MIB objects from the Exchange MIB. This chapter defines all sections of the AdvantEDGE for Microsoft Exchange MIB, but it does **not** define all of the MIB objects. For a complete list of MIB objects, refer to the AdvantEDGE for Microsoft Exchange MIB Specification (xchgmod.asn1).

**NOTE**

Unless otherwise noted, these MIB objects are supported for both Exchange 5.5 and Exchange 2000.

## Configuration Section

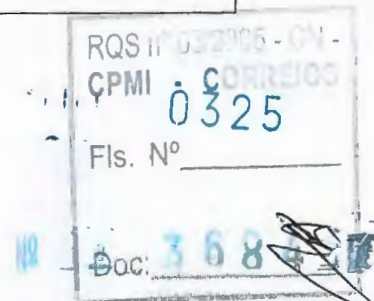
The Configuration section of the AdvantEDGE for Microsoft Exchange MIB contains configuration parameters and settings that are important for streamlining the health and performance of your Exchange server. It also includes configuration information about core servers and connectors.

## Server Configuration

The server configuration MIB group contains configuration parameters, process identifiers (IDs), and version and build numbers, as well as log and database locations. Table 3-1 defines important Server Configuration parameters.

**Table 3-1: Selected MIB Objects – Exchange Server Configuration Group**  
(Page 1 of 2)

MIB Object	Description
xchgVersion	Exchange version.
xchgBuildNumber	Exchange build number.
xchgInstallLocation	Location where Exchange is installed.
xchgStoreBuffers	Number of Exchange storage buffers configured. (Exchange 5.5 only)
xchgMinStoreThreads	Minimum number of information store (IS) threads. (Exchange 5.5 only)
xchgMaxStoreThreads	Maximum number of IS threads. (Exchange 5.5 only)
xchgPubStoreFile	Filename of the public IS.
xchgPrivStoreFile	Filename of the private IS.



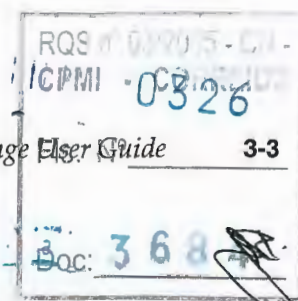
**Table 3-1: Selected MIB Objects – Exchange Server Configuration Group  
(Page 2 of 2)**

MIB Object	Description
xchgISWorkDir	IS working directory.
xchgMTARunDir	Mail Transfer Agent (MTA) run directory where temporary and working files are stored.
xchgMTADBPath	Directory containing the MTA database file(s).
xchgDSDBFile	Directory database filename. (Exchange 5.5 only)
xchgDSWorkDir	Exchange working directory where temporary and working files are stored. (Exchange 5.5 only)
xchgSApid	Process ID of the Exchange system attendant.
xchgISpid	Process ID of the Exchange information store.
xchgMTApid	Process ID of the Exchange MTA.
xchgDSpid	Process ID of the Exchange Directory.
xchgCoreIISPID	Process ID of the core IIS service, which provides SMTP, IMAP4, POP3, NNTP, and the core message routing engine. (Exchange 2000 only)

Figure 3-2 shows an example of an AdvantEDGE View core server status for Microsoft Exchange 5.5.

Component	Status	Process ID	Start-Time
Directory	Up	251	Fri Jun 09 06:22:39 2000
MTA	Up	300	Fri Jun 09 06:22:45 2000
Information Store	Up	295	Fri Jun 09 06:22:39 2000
System Attendant	Up	234	Fri Jun 09 06:22:39 2000

**Figure 3-2: Core Server Listing for Exchange 5.5**





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Figure 3-3 shows an example of an AdvantEDGE View core server status for Microsoft Exchange 2000.

Component	Status	Process ID	Start-Time
MTA	Up	1760	Sat Feb 17 17:02:47 2001
Information Store	Up	1636	Sat Feb 17 17:02:31 2001
System Attendant	Up	1176	Sat Feb 17 17:02:31 2001
Core IIS	Up	1108	Sat Feb 17 17:02:31 2001

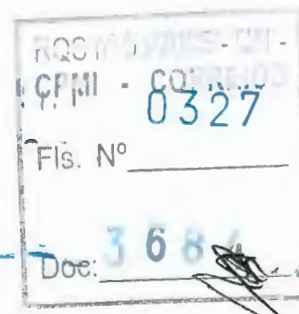
Figure 3-3: Core Server Listing for Exchange 2000

## Connector Configuration

The Connector Configuration MIB group contains the configuration parameters, process IDs, and installation status of the various Exchange connectors. Table 3-2 defines important Connector Configuration parameters.

Table 3-2: Selected MIB Objects – Exchange Connector Configuration Group  
(Page 1 of 2)

MIB Object	Description
xchgMMCInstalled	Indicates whether MS Mail connector is installed.
xchgMMCpid	Provides the process ID of the MS Mail connector.
xchgCCMCInstalled	Indicates whether Lotus cc:Mail connector is installed.
xchgCCMCpid	Provides the process ID of the cc:Mail connector.
xchgIMSInstalled	Indicates whether the Internet Mail connector is installed. On Exchange 2000, this object indicates whether the IIS/SMTP service is installed.
xchgIMSpid	Provides the process ID of the Internet Mail connector. On Exchange 2000, this object reports the PID of the IIS/SMTP service.
xchgKMSInstalled	Indicates whether Key Management Service connector is installed.
xchgKMSpid	Provides the process ID of the Key Management Service connector.



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USING THE ADVANTEDGE FOR MICROSOFT EXCHANGE MIB  
Configuration Section

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**Table 3-2: Selected MIB Objects – Exchange Connector Configuration Group**  
(Page 2 of 2)

MIB Object	Description
xchgNEWSInstalled	Indicates whether the Microsoft Exchange USENET/News connector is installed. On Exchange 2000, this object reports on whether the IIS/NNTP service is installed.
xchgNEWSpid	Provides the process ID of the USENET/News connector. On Exchange 2000, this object reports the PID of the IIS/NNTP service.
xchgIMAP4Installed	Indicates whether the Exchange 2000 IIS/IMAP 4 service is installed. (Exchange 2000 only)
xchgPOP3Installed	Indicates whether the Exchange 2000 IIS/POP3 service is installed. (Exchange 2000 only)
xchgRouteInstalled	Indicates whether the Exchange 2000 IIS/RoutingEngine service is installed. (Exchange 2000 only)
xchgSRSInstalled	Indicates whether the Exchange 2000 Site Replication Service is installed. SRS enables Exchange 2000 to emulate Exchange 5.5 directory services. (Exchange 2000 only)
xchgSRSPID	Provides the process ID of the Exchange 2000 Site Replication Service.

RCS # 032005 - GN -  
CPMI - CORREIOS  
0328  
Fis. Nº  
Doc: 3684



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Figure 3-4 shows an example of an AdvantEDGE View connector configuration status for Microsoft Exchange 5.5.

Connector	Installed	Running	ProcessID
MS Mail	Yes	No	0
MS Mail (AppleTalk)	No	No	0
cc:Mail	Yes	No	0
Internet Mail Service	Yes	Yes	432
x400	No	No	0
Site	No	No	0
RAS	No	No	0
Web	No	No	(null)
Schedule Free/Busy	Yes	No	0
Key Management Server	No	No	0
USENET News	No	No	0

Figure 3-4: Exchange 5.5 Connector Configuration Listing

RQ31 05/27/97 - C -  
CPMI - CORRE 08  
Fls. N° 0329  
Doc: 3684

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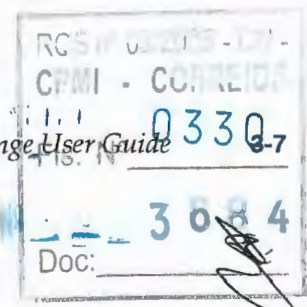
Figure 3-5 shows an example of an AdvantEDGE View connector configuration status for Microsoft Exchange 2000.

Connector	Installed	Running	ProcessID	Start-Time
MS Mail	No	No	0	
MS Mail (AppleTalk)	No	No	0	
cc:Mail	No	No	0	
Internet Mail or SMTP Service	Yes	Yes	1108	Sat Feb 17 17:02:31 2001
x400	Yes	Yes	1760	
Site	No	No	0	
RAS	No	No	0	
Schedule Free/Busy	No	No	0	
Key Management Server	No	No	0	
USENET News	Yes	Yes	1108	Sat Feb 17 17:02:31 2001
IRC Chat	No	No	0	
MS Conferencing	No	No	0	
Lotus Notes	No	No	0	
GroupWise	No	No	0	
IMAP4	Yes	Yes	1108	Sat Feb 17 17:02:31 2001
POP3	Yes	Yes	1108	Sat Feb 17 17:02:31 2001
Routing Engine	Yes	Yes	1108	Sat Feb 17 17:02:31 2001
Site Replication Service	Yes	No	0	
T.120	No	No	0	

Figure 3-5: Exchange 2000 Connector Configuration Listing

## Performance

The Performance section of the Exchange MIB contains performance data that is necessary for capacity planning and trend analysis, as well as real-time performance and availability monitoring. The Performance group is divided into several subgroups for footprint data (page 3-8), server performance (page 3-10), and connector performance (page 3-11).





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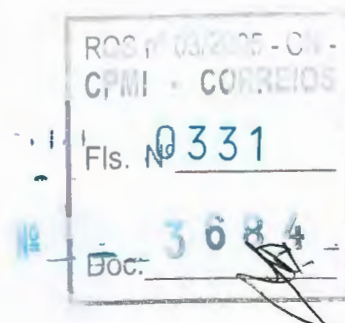
## Exchange Footprint

The Exchange Footprint group provides information about the Exchange CPU, memory, and disk resource consumption, more commonly called its *footprint*. Long-term trending analysis of footprint information is useful for anticipating and avoiding email problems due to resource exhaustion. Footprint information can also be monitored in real time to detect and correct temporary resource exhaustion due to viruses, security incidents, and hardware failures. Table 3-3 defines important Footprint metrics.

**Table 3-3: Selected MIB Objects – Exchange Footprint Group**

MIB Object	Description
xchgCPUTime	Total accumulated central processing unit (CPU) time for Exchange.
xchgPercentCPU	Percentage of CPU, over the last interval, used by Exchange.
xchgTotalRSS	Total real memory currently in use by Exchange.
xchgPercentMEM	Percentage of real memory currently in use by Exchange.
xchgDirSize	Current size of the Exchange directory. (Exchange 5.5 only)
xchgPrivStoreSize	Current size of the private IS.
xchgPubStoreSize	Current size of the public IS.
xchgTotalDiskSize	Estimate of the current total disk space used by Exchange.
xchgTotalThreads	Total number of system threads used by Exchange.

The following figures show sample footprints for a live Exchange application that is serving a medium-sized company. They represent real data collected from live Exchange servers and displayed in AdvantEDGE View reports.

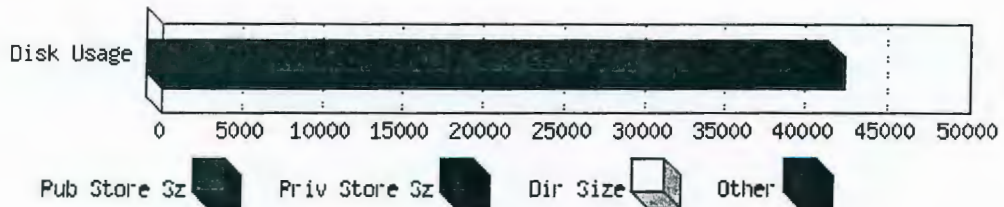


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# USING THE ADVANTEDGE FOR MICROSOFT EXCHANGE MIB Performance

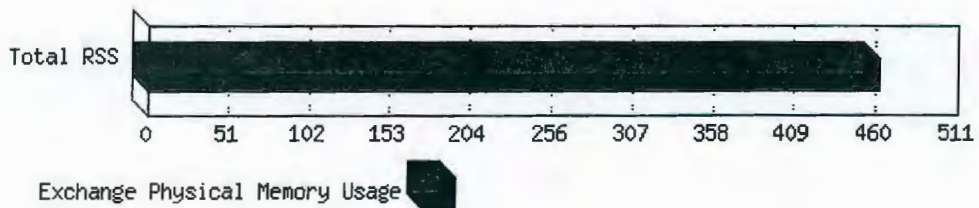
.....

Figure 3-6 shows a sample AdvantEDGE View footprint for Exchange disk usage.



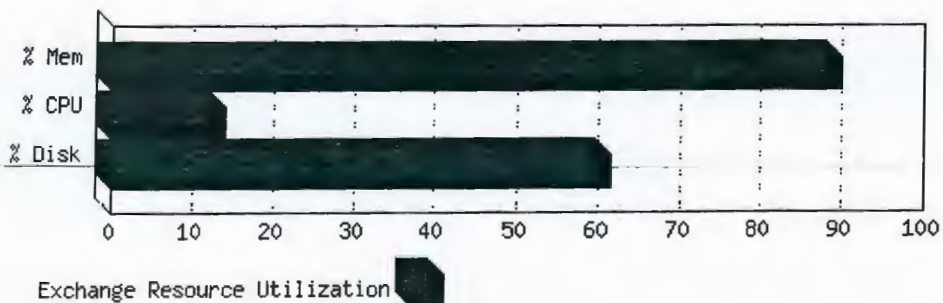
**Figure 3-6: Exchange Disk Usage Footprint**

Figure 3-7 shows a sample AdvantEDGE View footprint for Exchange memory usage (resident set size [RSS]).



**Figure 3-7: Exchange Memory Usage (RSS) Footprint**

Figure 3-8 shows a sample AdvantEDGE View footprint summary for Exchange.



**Figure 3-8: Exchange Footprint Summary**

RDS # 03395-01 -  
CPM - CORDED  
11/15/01  
Doc: 3686



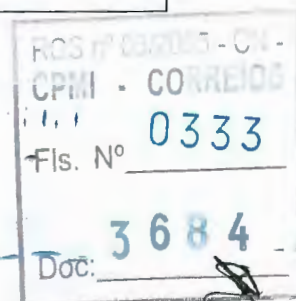
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✓

## Server Performance

The Server Performance group provides performance metrics and counters for the core Exchange server including the information store, directory, MTA, and system attendant. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-4 defines important Server Performance metrics.

**Table 3-4: Selected MIB Objects – Exchange Server Performance Group (Page 1 of 2)**

MIB Object	Description
xchgStoreUserCount	Current number of information store users/connections.
xchgMTAWorkQueueLen	Current number of messages waiting to be processed by the MTA.
xchgMTAAAssoc	Current number of MTA-to-MTA associations.
xchgMTAMessages	Total number of messages sent and received by the MTA.
xchgISPubInMessages	Total number of public messages submitted to clients.
xchgISPubOutMessages	Total number of public messages delivered to recipients.
xchgISPubSendQueLen	Current length of the public message send queue.
xchgISPrivSendQueLen	Current length of the private message send queue.
xchgISPrivInMessages	Total number of private messages submitted to clients.
xchgISPrivOutMessages	Total number of private messages delivered to recipients.
xchgDirABbrowse	Number of address book browses processed by the Microsoft Exchange directory service. (Exchange 5.5 only; Exchange 2000 uses the Active Directory service.)
xchgDirABreads	Number of address book browses reads by the Microsoft Exchange directory service. (Exchange 5.5 only; Exchange 2000 uses the Active Directory service.)



**Table 3-4: Selected MIB Objects – Exchange Server Performance Group (Page 2 of 2)**

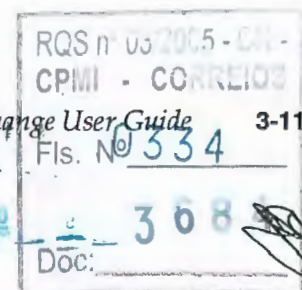
MIB Object	Description
xchgDirEXDSReads	Number of extended directory service client reads processed by this Exchange service. (Exchange 5.5 only; Exchange 2000 uses the Active Directory service.)
xchgDirReplUpdates	Number of replication updates processed by this Exchange server. (Exchange 5.5 only; Exchange 2000 uses the Active Directory service.)
xchgDirThreads	Number of directory threads currently allocated. (Exchange 5.5 only; Exchange 2000 uses the Active Directory service.)

## Connector Performance

The Connector Performance group provides performance metrics and counters for Exchange connectors including the Internet Mail connector, Lotus Notes cc:Mail, and others. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-5 defines important Connector Performance metrics.

**Table 3-5: Selected MIB Objects – Exchange Connector Performance Group**

MIB Object	Description
xchgMMCMTAMsgs	Total number of messages moved through the Microsoft Mail Connector.
xchgIMSIInQueLen	Number of Internet messages awaiting delivery in the Exchange server. (Exchange 5.5 only; Exchange 2000 uses the IIS/SMTP service.)
xchgIMSOOutQueLen	Number of messages awaiting conversion to Internet mail format. (Exchange 5.5 only; Exchange 2000 uses the IIS/SMTP service.)
xchgIMSTotQueLen	Total number of messages waiting in Internet Mail Service (IMS) queues. On Exchange 2000, this number represents the sum of the local and remote SMTP server queue lengths, plus the SMTP server local and remote retry queue lengths.

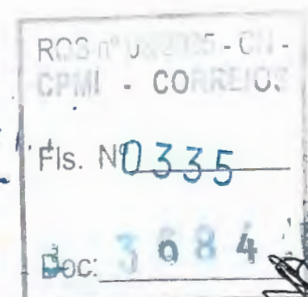




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Table 3-5: Selected MIB Objects – Exchange Connector Performance Group

MIB Object	Description
xchgIMSTotalConn	Total number of successful Internet mail connections. On Exchange 2000, this object represents the sum of the SMTP server total incoming and outgoing connections.
xchgIMSQueueOut	Number of messages waiting for delivery to the Internet. On Exchange 2000, this object represents the SMTP server local queue length.
xchgIMSTotalInMsgs	Total number of Internet messages delivered to Exchange. On Exchange 2000, this object represents the total number of messages received by the SMTP server.
xchgIMSTotalOutMsgs	Total number of outbound messages delivered to Exchange server. On Exchange 2000, this object represents the total number of messages sent by the SMTP server.
xchgCCMCQueueIn	Number of messages in the cc:Mail connector queue awaiting delivery to Exchange.
xchgCCMCQueueOut	Number of messages in Exchange awaiting delivery to cc:Mail connector.



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USING THE ADVANTEDGE FOR MICROSOFT EXCHANGE MIB  
Performance

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Figure 3-9 shows a sample AdvantEDGE View Exchange 5.5 queue.

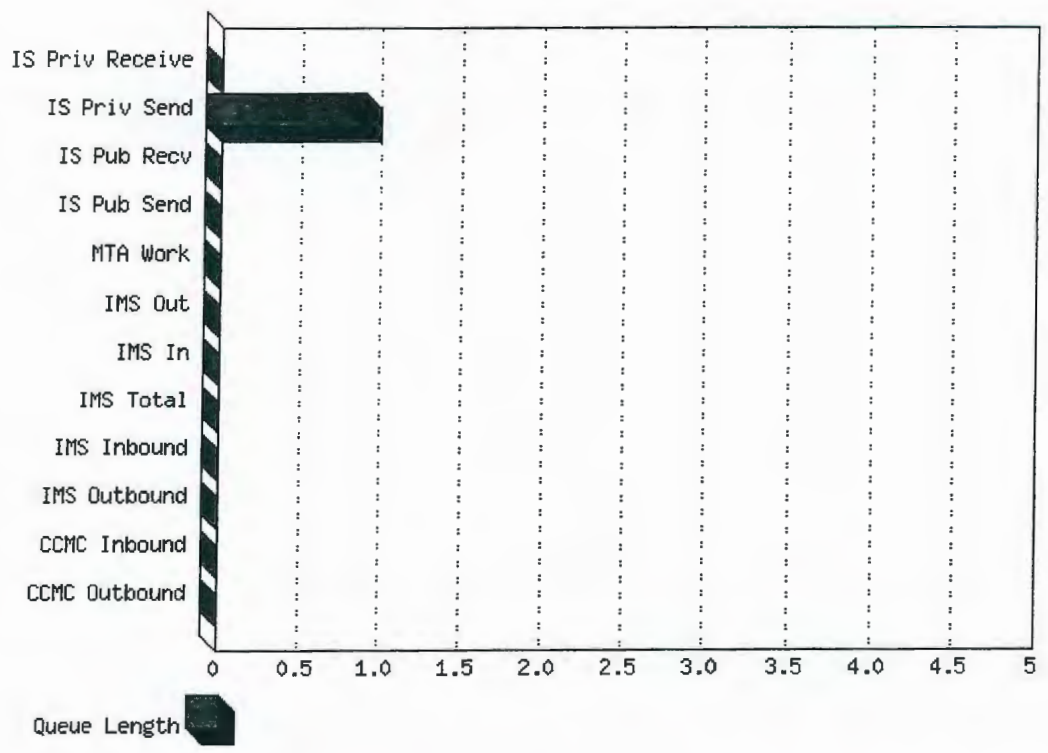


Figure 3-9: Exchange Queues for Exchange 5.5 Server

Form with stamps and handwritten numbers:

- Stamp: RDS nº 02.0015 - C.I. - CPMI - CORREIOS
- Handwritten: 0336
- Stamp: 3684
- Text: Doc: [signature]



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## Using AdvantEDGE for Microsoft Exchange

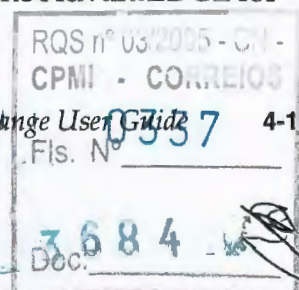
This chapter describes how to configure and use AdvantEDGE for Microsoft Exchange. This Point module is implemented as a SystemEDGE plug-in. After you enable this Point module in the sysedge.cf file and license it, it will load automatically at SystemEDGE start time. For more information, refer to "Configuring AdvantEDGE for Microsoft Exchange" and "Licensing AdvantEDGE for Microsoft Exchange" on page 2-3.

The AdvantEDGE for Microsoft Exchange plug-in implements additional MIB objects that provide advanced information about the health and availability of the Microsoft Exchange groupware application. It can operate with any SNMP-compliant management software, such as Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others. If you are using AdvantEDGE for Microsoft Exchange with eHealth, refer to the eHealth Web Help for more information about the reports that are available.

The default configuration settings of the AdvantEDGE for Microsoft Exchange plug-in enable you to use the advanced self-monitoring capabilities of SystemEDGE in conjunction with AdvantEDGE for Microsoft Exchange.

### Editing the SystemEDGE Configuration File

You can use AdvantEDGE View or another SNMP tool to edit the SystemEDGE configuration file to utilize the MIB objects found in AdvantEDGE for Microsoft Exchange with the process-monitoring, threshold-monitoring, Windows NT event-monitoring, and history-collection features of the SystemEDGE agent. All MIB objects that are related to AdvantEDGE for Microsoft Exchange exist at object identifier (OID) branch 1.3.6.1.4.1.546.16.1 in the Concord Systems Management MIB. The MIB is defined in the xchgmod.asn1 file, which is available in the AdvantEDGE for Microsoft Exchange product installation.



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## Assigning Entry Rows in the SystemEDGE Self-Monitoring Tables

All SystemEDGE self-monitoring tables (for example, log monitoring, Windows NT event monitoring, process/service monitoring, threshold monitoring, and history collection) require the use of unique row numbers. Each table contains an *Index* column which acts as a *key field* to distinguish rows in the table. This section describes the benefits of reserving a block of rows (somewhere in the range of 11 to the maximum number of rows in your table) for use by the system or application administrator.

### Setting Local Policy

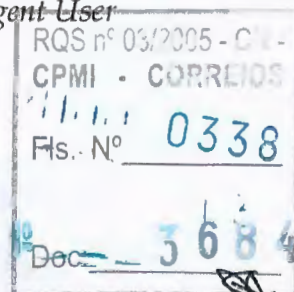
You may choose, as a matter of local policy, to reserve a block of rows for system administration. This policy allows you to define row entries within a reserved block of rows without worrying about the row already being taken by another user's entry. In compliance with the local policy, all other users should use row indices that are outside of the reserved range when they define user-configured entries.

By reserving a block of rows, you can define a consistent set of conditions (row entries) to be monitored across all machines such that the same condition is defined in the same row number on each of the machines. For example, you might use row 3000 in each table to define entries monitoring the Exchange MTA work queue length (xchgMTAWorkQueueLen). You can then distribute this configuration to every host so that every machine that is running Microsoft Exchange uses row 3000 for monitoring MTA work queue length, whether it is the threshold monitoring table or the history table. Further, every machine can also use row 3000 for monitoring the MTA service in the process/service monitoring table.

### Reserving Blocks of Rows

To reserve a block of rows for monitoring Microsoft Exchange:

1. Decide on a block of rows that you want to reserve for your use with monitoring Microsoft Exchange.
2. Use that block of rows to define a set of row entries for each of the respective SystemEDGE self-monitoring tables. For more information, refer to the chapter on self-monitoring in the *SystemEDGE Agent User Guide*.





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## USING ADVANTEDGE FOR MICROSOFT EXCHANGE

### Using the SystemEDGE Self-Monitoring Features

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3. Distribute configuration file entries out to all hosts that are running Microsoft Exchange and AdvantEDGE for Microsoft Exchange. For more information, refer to the *Automating the Deployment of SystemEDGE and AdvantEDGE Point Plug-in Modules* white paper.

#### NOTE

As an alternative, you can use this row-number assignment policy with AdvantEDGE View for group configuration operations.

4. Require end-users to avoid your block of rows when defining their own self-monitoring table entries.

## Using the SystemEDGE Self-Monitoring Features

The examples in this section show SystemEDGE configuration-file commands for monitoring Microsoft Exchange. Add these commands to the `sysedge.cf` file to enable monitoring of the MIB objects they specify. Modify these examples as necessary to monitor the MIB objects that are relevant for your configuration.

The examples in the following sections present row numbers in the 5000 range; select a row number for your configuration that conforms to local policies. For more information on row assignment, refer to "Assigning Entry Rows in the SystemEDGE Self-Monitoring Tables" on page 4-2.

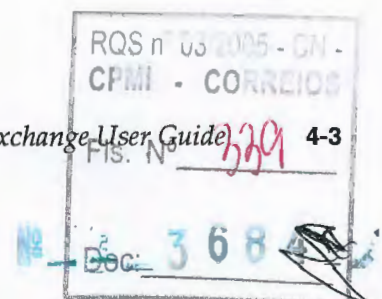
The following command, for example, instructs the SystemEDGE agent to monitor whether the Exchange MTA process is alive every 30 seconds and to store the data in row 5000 of the Process Monitoring table:

```
watch process procAlive 'emsmta|EMSMTA' 5000 0x0 30
'Exchange Dir' ''
```

For more information about the syntax for the commands in this section, refer to the *SystemEDGE Agent User Guide*.

#### NOTE

**Enter the commands throughout this chapter on one line. Do not use a carriage return to match the formatting shown here.**



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## Using SystemEDGE Process Monitoring

This section provides examples for monitoring the availability of critical Microsoft Exchange processes and services through SystemEDGE process and service monitoring. Enter the following commands in the sysedge.cf file to monitor these processes. For more information, refer to the chapter on process and service monitoring in the *SystemEDGE Agent User Guide*.

### Monitoring the Exchange 5.5 Directory Service

To make sure the Exchange 5.5 Directory Service is running, enter the following command:

```
watch process procAlive 'dsamain|DSAMAIN' 5000 0x0 30  
'Exchange Dir' ''
```

### Monitoring the Exchange MTA

To make sure the Exchange MTA is running, enter the following command:

```
watch process procAlive 'emsmta|EMSMTA' 5001 0x0 30 'Exchange  
MTA' ''
```

### Monitoring the Exchange Information Store

To make sure the Exchange Information Store is running, enter the following command:

```
watch process procAlive 'store|STORE' 5002 0x0 30 'Exchange  
Info Store' ''
```

### Monitoring the Exchange Attendant

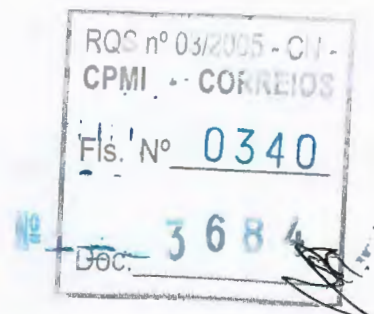
To make sure the Exchange Attendant is running, enter the following command:

```
watch process procAlive 'mad|MAD' 5003 0x0 30 'Exchange  
Attendant' ''
```

### Monitoring the Exchange Event Service

To make sure the Exchange Event Service is running, enter the following command:

```
watch process procAlive 'events|EVENTS' 5004 0x0 30 'Exchange  
Event Service' ''
```





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## USING ADVANTEDGE FOR MICROSOFT EXCHANGE

### Using the SystemEDGE Self-Monitoring Features

.....

## Monitoring the Exchange 2000 SMTP Service

To make sure the Exchange 2000 SMTP service is running, enter the following command:

```
watch process procAlive 'smtp|SMTP' 5005 0x0 30 'Exchange 2000  
SMTP Service' ''
```

## Monitoring the Core IIS Service

To make sure the Core IIS Service is running, enter the following command:

```
watch process procAlive 'iis|IIS' 5006 0x0 30 'Core IIS  
Service' ''
```

## Using SystemEDGE Threshold Monitoring

This section provides examples for monitoring important Exchange metrics through SystemEDGE threshold monitoring. Add the commands that are provided in the following sections to the sysedge.cf file to monitor thresholds for these MIB objects. For more information, refer to the chapter on threshold monitoring in the *SystemEDGE Agent User Guide*.

### NOTE

The thresholds used in these examples may not be appropriate for your Microsoft Exchange server; select thresholds that are appropriate for your environment.

## Monitoring the MTA Work Queue Length

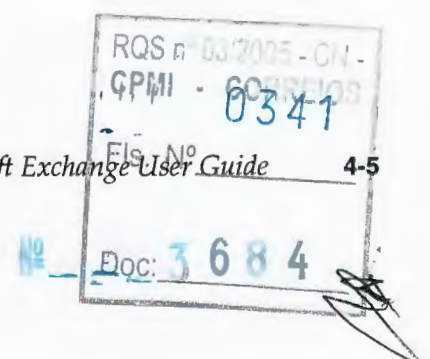
To monitor MTA work queue length, enter the following command:

```
monitor oid xchgMTAWorkQueueLen.0 5002 0x0 60 absolute > 15  
'MTA Queue Len exceeds threshold' ''
```

## Monitoring Messages Received by the MTA

To monitor the number of messages received by the MTA, enter the following command:

```
monitor oid xchgMTAInMessages.0 5003 0x0 60 delta > 35 'MTA  
In Messages exceeds threshold' ''
```



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## Monitoring Messages Sent by the MTA

To monitor the number of messages sent by the MTA, enter the following command:

```
monitor oid xchgMTAOutMessages.0 5004 0x0 60 delta > 35 'MTA  
Out Messages Exceeds threshold' ''
```

## Monitoring Information Store Users

To monitor the number of Information Store users, enter the following command:

```
monitor oid xchgStoreUserCount.0 5005 0x0 60 absolute > 750  
'Store User Cnt exceeds threshold' ''
```

## Monitoring Private Store Messages Submitted by Clients

To monitor the number of Private Store messages submitted by clients, enter the following command:

```
monitor oid xchgISPrivInMessages.0 5006 0x0 60 delta > 35  
'Priv Store In Msg crosses threshold' ''
```

## Monitoring Private Store Messages Delivered to Recipients

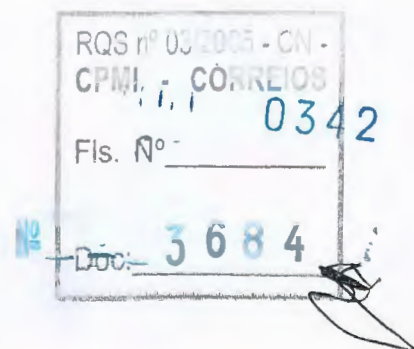
To monitor the number of Private Store messages delivered to recipients, enter the following command:

```
monitor oid xchgISPrivOutMessages.0 5007 0x0 60 delta > 35  
'Priv Store Out Msg crosses threshold' ''
```

## Monitoring SMTP Queue Length

To monitor the SMTP Queue Length, enter the following command:

```
monitor oid xchgIMSTotQueLen.0 5008 0x0 60 delta > 35 'SMTP  
Queue Length crosses threshold' ''
```





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.....

## Using SystemEDGE History Collection

This section provides examples for tracking the value of important Microsoft Exchange metrics over time through SystemEDGE history collection. Add the commands in the following sections to the sysedge.cf file to collect history for these MIB objects. For more information, refer to the chapter on history collection in the *SystemEDGE Agent User Guide*.

### NOTE

The number of samples and the interval between samples used in these examples may not be appropriate for your Microsoft Exchange server; choose values that are appropriate for your environment.

### Collecting History for MTA Work Queue Length

To collect history for MTA work queue length, enter the following command:

```
emphistory 5002 60 xchgMTAWorkQueueLen.0 480 'MTA Queue Len
History'
```

Figure 4-1 shows a sample AdvantEDGE View Exchange Work Queue Length History.

Variable is of Type Gauge. The following graph shows **absolute values**.

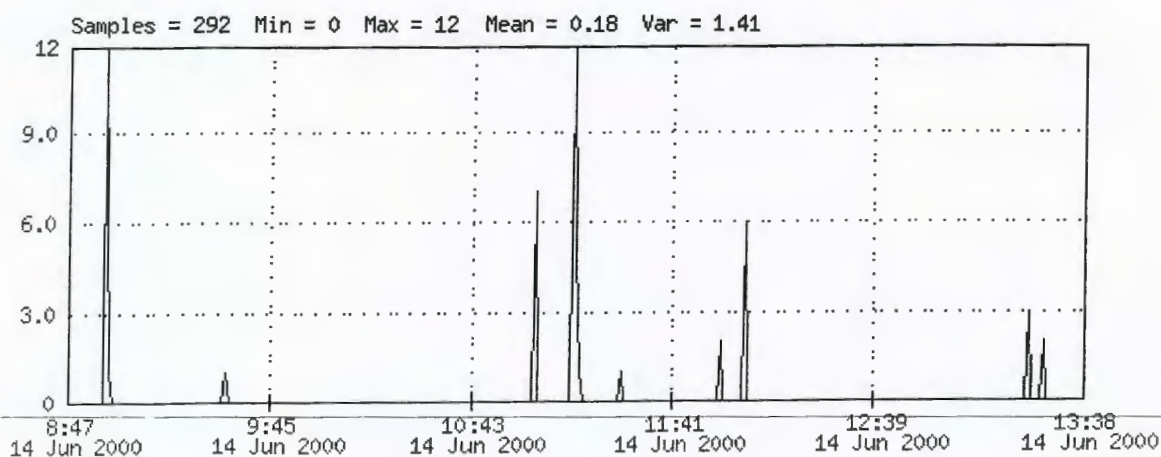
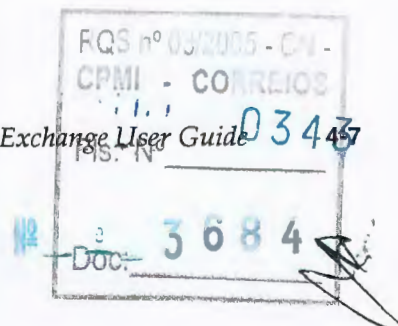


Figure 4-1: Exchange MTA Work Queue Length History



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.....

### Collecting History for MTA Message Reception

To collect history for MTA message reception, enter the following command:

```
emphistory 5003 60 xchgMTAInMessages.0 180 'MTA In Messages  
History'
```

### Collecting History for MTA Message Delivery

To collect history for MTA message delivery, enter the following command:

```
emphistory 5004 60 xchgMTAOutMessages.0 180 'MTA Out Messages  
History'
```

### Collecting History for Information Store User Count

To collect history for the Information Store user count, enter the following command:

```
emphistory 5005 60 xchgStoreUserCount.0 120 'Store User Cnt  
History'
```

Figure 4-2 shows an AdvantEDGE View sample history for user count.

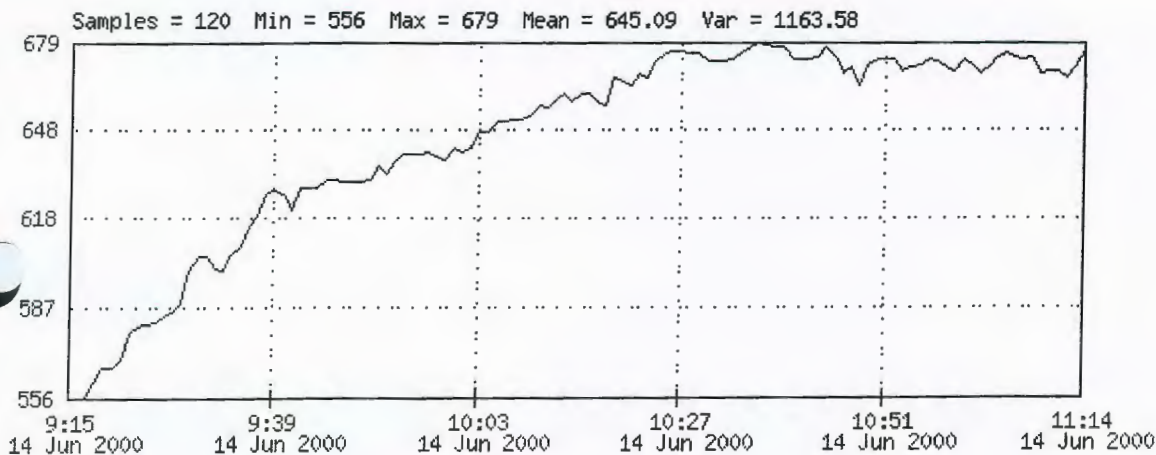
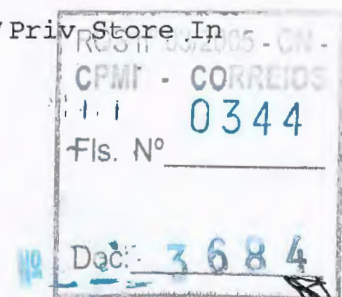


Figure 4-2: Sample History for Exchange User Count

### Collecting History for Private Store Message Reception

To collect history for Private Store message reception, enter the following command:

```
emphistory 5006 60 xchgISPrivInMessages.0 120 'Priv Store In  
Msg History'
```





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.....

## Collecting History for Private Store Message Delivery

To collect history for Private Store message delivery, enter the following command:

```
emphistory 5007 60 xchgISPrivOutMessages.0 120 'Priv Store  
Out Msg History'
```

## Using SystemEDGE Windows NT Event Monitoring

This section provides examples for using the SystemEDGE Windows NT event-monitoring capabilities to capture important Microsoft Exchange-related Windows NT events and forward them to the appropriate configuration-management software as SNMP traps. Add the commands in the following sections to the sysedge.cf file to monitor these Windows NT events. For more information, refer to the chapter on Windows NT event monitoring in the *SystemEDGE Agent User Guide*.

### Monitoring Exchange Events in the System Event Log

To watch for Exchange events in the system event log, enter the following command:

```
watch ntevent 5000 0x00 System All 'MSExchange' '..*'  
'Monitor Exchange System Events' ''
```

### Monitoring Exchange Events in the Security Event Log

To watch for Exchange events in the security event log, enter the following command:

```
watch ntevent 5000 0x00 System All 'MSExchange' '..*'  
'Monitor Exchange Security Events' ''
```

### Monitoring Exchange Events in the Application Event Log

To watch for Exchange events in the application event log, enter the following command:

```
watch ntevent 5000 0x00 System All 'MSExchange' '..*'  
'Monitor Exchange Application Events' ''
```



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.....

## Monitoring Exchange Database Error Events in the System Event Log

To watch for Exchange database error events in the system event log, enter the following command:

```
watch ntevent 5003 0x00 System Error 'EDB' '*' 'Monitor  
Exchange Database Events'
```

## Monitoring Exchange Database Error Events in the Security Event Log

To watch for Exchange database error events in the security event log, enter the following command:

```
watch ntevent 5004 0x00 Security Error 'EDB' '*' 'Monitor  
Exchange Database Events'
```

## Monitoring Exchange Database Error Events in the Application Event Log

To watch for Exchange database error events in the application event log, enter the following command:

```
watch ntevent 5005 0x00 Application Error 'EDB' '*' 'Monitor  
Exchange Database Events'
```

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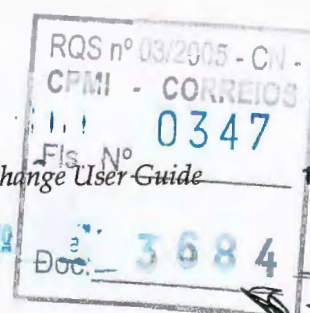
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## FOR MICROSOFT® IIS

### *User Guide*

Release 1.0 Patchlevel 2  
or Later

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### Patent Information

U. S. Patent 5,615,323  
Patents Pending

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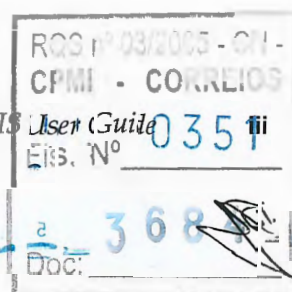
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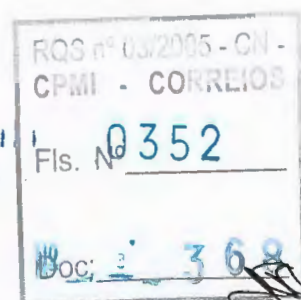
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## About This Guide

The *AdvantEDGE for Microsoft IIS User Guide* provides instructions for installing and using AdvantEDGE for Microsoft IIS for Windows NT x86 and Windows 2000 systems. This guide is intended for the person responsible for installing and configuring AdvantEDGE for Microsoft IIS.

This version supports AdvantEDGE for Microsoft IIS Release 1.0 Patchlevel 2 or later, and the SystemEDGE agent Release 4.0, Patchlevel 3 and later.

### NOTE

The acronym IIS stands for Internet Information Server in version 4.0 for Windows NT, and for Internet Information Services in version 5.0 for Windows 2000.

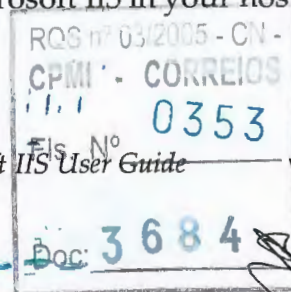
To use AdvantEDGE for Microsoft IIS, you should have a basic understanding of the Microsoft IIS application, the Concord SystemEDGE agent, and your host's operating systems environment. Refer to Microsoft documentation and the *SystemEDGE Agent User Guide* for more information.

## How This Guide Is Organized

This guide is organized as follows:

- Chapter 1, "Introduction," provides an overview of AdvantEDGE for Microsoft IIS and its capabilities for monitoring Microsoft IIS.
- Chapter 2, "Installing AdvantEDGE for Microsoft IIS," explains how to install, configure, and license the Concord AdvantEDGE for Microsoft IIS software on a host system.
- Chapter 3, "Using the AdvantEDGE for Microsoft IIS MIB," describes the information that is available through the Concord AdvantEDGE for Microsoft IIS MIB.
- Chapter 4, "Using AdvantEDGE for Microsoft IIS," explains how to configure and use Concord's AdvantEDGE for Microsoft IIS in your host environment.

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## Conventions in This Guide

The following paragraph shows a sample command. Due to space limitations in this guide, some commands wrap from one line to the next. Disregard these line breaks, and **enter each command as one line**. Otherwise, your command syntax will be incorrect.

For example, when you see a command such as the following:

```
watch process procAlive 'inetinfo|INETINFO' 5000 0x0
30 'IIS' ''
```

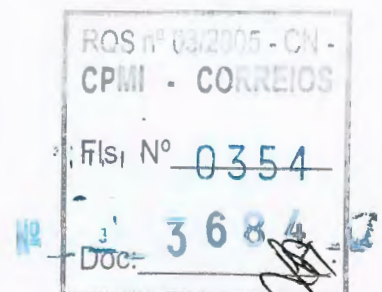
You **must** enter the command on one line, as shown here:

```
watch process procAlive 'inetinfo|INETINFO' 5000 0x0 30 'IIS' ''
```

## Contact Information

If you need any assistance with the SystemEDGE agent or the AdvantEDGE for Microsoft IIS Point module, contact Customer Support, using one of the following methods:

Phone:	(888) 832-4340 (for calls from the USA and Canada) (508) 303-4300 (for calls from other countries)
Fax:	(508) 303-4343
E-mail:	support@concord.com
Web site:	<a href="http://www.concord.com">http://www.concord.com</a>
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# Introduction

This chapter provides an overview of how you can use the AdvantEDGE for Microsoft IIS Point module to monitor the Microsoft IIS application. You must install this Point module on every IIS workstation that you want to monitor.

## NOTE

Unless otherwise stated, the term *IIS*, as used throughout this guide and the Management Information Base (MIB) specification, refers to the Microsoft IIS application in its entirety, which encompasses all of the services and optional components.

## Introducing AdvantEDGE for Microsoft IIS

AdvantEDGE for Microsoft IIS is a plug-in module for the SystemEDGE agent. This plug-in enables information technology (IT) operators to monitor the performance and availability of Microsoft IIS on Microsoft Windows NT 4.0 and Windows 2000. Microsoft IIS is a super server that consists of several services, which are described in the next section, "Microsoft IIS Architecture".

AdvantEDGE for Microsoft IIS makes important information about IIS available to management software through the SystemEDGE agent and Simple Network Management Protocol (SNMP). The SystemEDGE agent enables the monitoring of important IIS metrics, processes, and services, as well as the sending of SNMP traps when exceptions or exception conditions occur.

## NOTE

This document is not intended as a manual on how to install, administer, or use Microsoft IIS. For help with IIS, refer to your Microsoft documentation.

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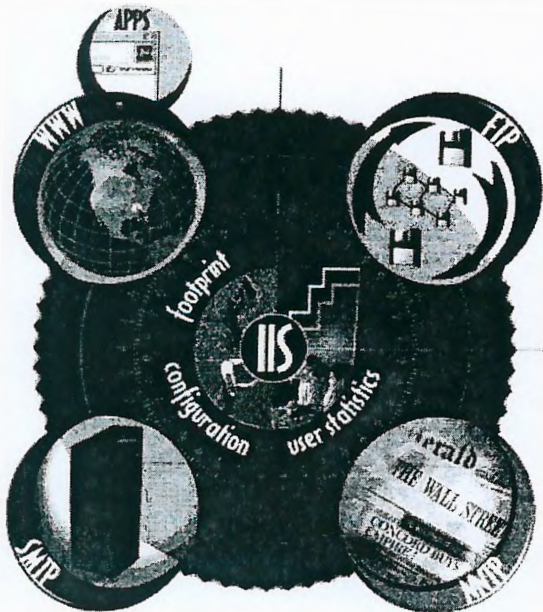
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## Microsoft IIS Architecture

Microsoft IIS is a complex piece of software with many components. At the core of IIS are the following services:

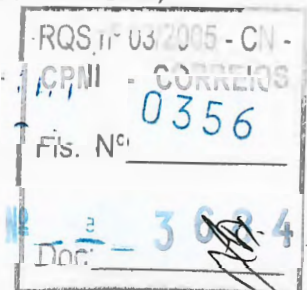
- World Wide Web (WWW) service, which services the Web content to and from users
- File Transfer Protocol (FTP) service, which services file transfer requests to and from users
- Simple Mail Transfer Protocol (SMTP) service, which provides a mail transport mechanism for IIS
- Network News Transfer Protocol (NNTP) service, which provides news groups for IIS

Figure 1-1 shows the core components of AdvantEDGE for Microsoft IIS.



**Figure 1-1: AdvantEDGE for Microsoft IIS Components**

IIS controls worker threads, and it can use each worker thread to provide a specific service that the user has requested. This architecture requires the monitoring of the IIS process and other processes in order to obtain sufficient information on the performance of IIS. Because IIS includes so many components, its proper functioning requires the availability of a variety of processes; configuration parameters and settings; and Windows NT services, queues, and system resources.





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## INTRODUCTION

*Using AdvantEDGE for Microsoft IIS*

.....

# Using AdvantEDGE for Microsoft IIS

AdvantEDGE for Microsoft IIS provides you with the tools and information that you need to monitor and respond to the IIS application and its use of your system resources. With AdvantEDGE for Microsoft IIS, you can fix potential problems before users—and your business—are affected.

You can use AdvantEDGE for Microsoft IIS with any SNMP-compliant management software, including Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others. With AdvantEDGE for Microsoft IIS and the SystemEDGE agent, you can perform the following types of tasks:

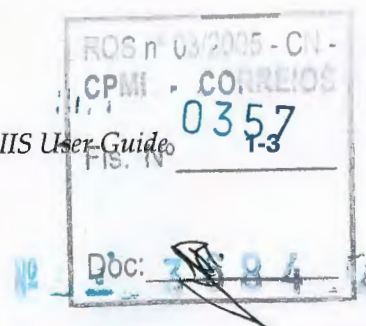
- Monitor the availability of IIS and its various services.
- Automatically restart any service that fails.
- Alert IT staff when IIS starts to consume significant levels of system resources, including CPU, disk space, and memory.
- Monitor logs for security, system, and application events across the Web, FTP, SMTP, and NNTP services.
- Detect error statistics across the Active Server Pages (ASP), Common Gateway Interface (CGI), and Internet Server Application Program Interface (ISAPI) application extension pages, including Web 404 (page not found) errors and ASP script errors.

## Using AdvantEDGE for Microsoft IIS with eHealth

You can use AdvantEDGE for Microsoft IIS and the SystemEDGE agent with the eHealth product suite to provide the historical data for long-term trending analysis and capacity planning. With eHealth – Application Assessment, you can run At-a-Glance, Trend, Top N, and MyHealth reports for the following types of information:

- Amount of Central Processing Unit (CPU), total memory, and disk space the IIS application is using
- Size of the IIS service logs
- Number of times the IIS application is using the database cache to redisplay information
- Number of bytes and number of files processed by the WWW and FTP services
- Number of users for the WWW and FTP services

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## 1 INTRODUCTION

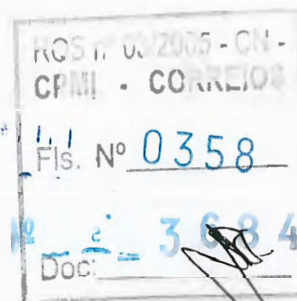
*Using AdvantEDGE for Microsoft IIS*

- Number of WWW requests the IIS application is processing per second
- Number of page not found errors the WWW service is encountering

For more information about the variables that you can monitor and reports that you can run when you integrate AdvantEDGE for Microsoft IIS with eHealth, refer to the eHealth Web Help.

## Using AdvantEDGE for Microsoft IIS with Live Health

You can also use AdvantEDGE for Microsoft IIS and the SystemEDGE agent with Live Health for real-time detection of potential problems. Live Health applies intelligent algorithms to the data, resulting in precise assessments of application health and performance. For more information about how Live Health can detect "brownouts" and service delays across applications, systems, and networks, refer to the Live Health Web Help.





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## Installing AdvantEDGE for Microsoft IIS

This chapter explains how to install, configure, and license AdvantEDGE for Microsoft IIS.

### NOTE

For the most current information about installing the AdvantEDGE for Microsoft IIS module, refer to the release notes (relnotes.txt) that ship on the installation CD.

## Installation Requirements

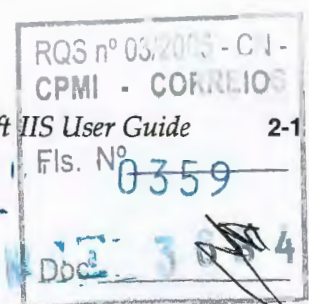
Before you install AdvantEDGE for Microsoft IIS, you must first install, license, and configure the SystemEDGE agent Release 4.0, Patchlevel 3 or later. For more information, refer to the *SystemEDGE Agent User Guide*.

Your system must also be running the Microsoft IIS application. Use Table 2-1 to determine which version of IIS and which service packs are required for your operating system.

**Table 2-1: Required IIS Version and Service Pack by Operating System**

Operating System	Required Software	Required Service Pack
Windows NT 4.0 x86	Microsoft Internet Information Server Version 4.0	6a
Windows 2000	Microsoft Internet Information Services Version 5.0	1

For more information, refer to Microsoft documentation.



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## Installing the Software

AdvantEDGE for Microsoft IIS is distributed as a self-extracting executable named **iismod.exe** for Windows NT and Windows 2000.

Follow these steps to install AdvantEDGE for Microsoft IIS:

1. Locate the IIS workstation that needs to be monitored.
2. Log on to the system as administrator.
3. Click **Start**.
4. Select **Programs → Command Prompt**.
5. Insert the CD containing the Concord software distributions into the CD-ROM drive.  
  
The operating system automatically mounts the drive using the CD-ROM drive's corresponding drive letter. The particular drive letter is specific to your system and depends on the number and types of disks attached to your system.
6. Determine which directory you want to use as the installation directory for AdvantEDGE for Microsoft IIS. If the SystemEDGE agent is installed at `C:\sysedge`, the recommended installation directory is `C:\sysedge\plugins`.
7. Run the self-extracting executable by entering the following at the command prompt, where `D:` is the CD-ROM drive for your system, and `C:\sysedge\plugins` is the installation directory:

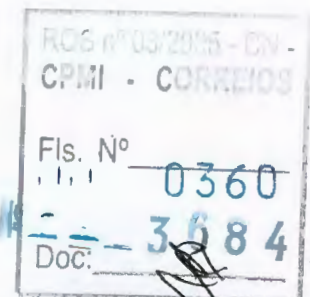
```
D:\iismod\ntx86\iismod.exe -dir C:\sysedge\plugins
```

**The -dir option is important because it instructs the self-extracting executable to create the intended subdirectory hierarchy that is used throughout this guide.** The distribution is then placed in an `iismod` subdirectory within the specified target directory (for example, `C:\sysedge\plugins\iismod`).

### NOTE

You cannot execute `iismod.exe` directly from the CD-ROM.

AdvantEDGE for Microsoft IIS is now installed.





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## INSTALLING ADVANTEDGE FOR MICROSOFT IIS

### *AdvantEDGE for Microsoft IIS Files*

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## AdvantEDGE for Microsoft IIS Files

Table 2-2 describes the files created by the installation process.

**Table 2-2: Files Installed by AdvantEDGE for Microsoft IIS**

File Name	Description
iismod.dll	AdvantEDGE for Microsoft IIS dynamic link library (DLL) module for Windows NT and Windows 2000
iismod.pdf	<i>AdvantEDGE for Microsoft IIS User Guide</i>
iismod.asn1	AdvantEDGE for Microsoft IIS MIB specification
examples	AdvantEDGE for Microsoft IIS monitoring examples
relnotes.txt	Release notes for AdvantEDGE for Microsoft IIS

## Configuring AdvantEDGE for Microsoft IIS

The SystemEDGE agent uses the configuration file `sysedge.cf` and the `sysedge_plugin` keyword to specify which AdvantEDGE modules to load at system initialization. By default, the SystemEDGE agent does not load any plug-ins at initialization time, but you can edit the `sysedge.cf` file to configure the agent to load any AdvantEDGE Point modules that you have installed.

The `sysedge.cf` file is located, by default, in your system directory; for example, `C:\winnt\system32`. To configure the SystemEDGE agent to start AdvantEDGE for Microsoft IIS, you must provide the complete path name to `iismod.dll`, the AdvantEDGE for Microsoft IIS dynamic link library. The actual path depends on the location you selected when you installed the AdvantEDGE for Microsoft IIS files. For example, enter this command if you installed the files in the `C:\sysedge\plugins\iismod` directory:

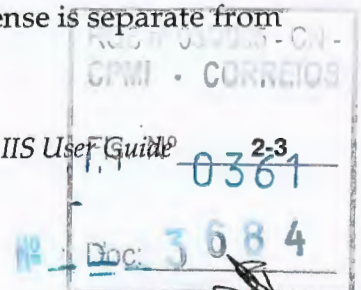
```
sysedge plugin C:\sysedge\plugins\iismod\iismod.dll
```

For more information about the `sysedge.cf` file, refer to the *SystemEDGE Agent User Guide*.

## Licensing AdvantEDGE for Microsoft IIS

Like the SystemEDGE agent, AdvantEDGE for Microsoft IIS utilizes a host-based license method. Copies of AdvantEDGE for Microsoft IIS can run only on systems that possess a valid license key. This license is separate from the one used for the SystemEDGE agent.

*AdvantEDGE for Microsoft IIS User Guide*



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## 2 INSTALLING ADVANTEDGE FOR MICROSOFT IIS

*Licensing AdvantEDGE for Microsoft IIS*

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The first time that you attempt to start the SystemEDGE agent after installing AdvantEDGE for Microsoft IIS, the agent will display a message saying that a valid license was not found for AdvantEDGE for Microsoft IIS. It then provides you with a *public key* that is used to generate a permanent license key for your host machine.

A license key is made up of four space-separated, 8-character sequences, totaling 32 characters. The AdvantEDGE for Microsoft IIS license is stored in the sysedge.lic file, the same file that contains the SystemEDGE agent licenses. Refer to the sample license file on page 2-6.

### Obtaining a License

To obtain a license, you can do any of the following:

- Run the Concord-supplied licenseutil.pl script.
- Run the licenseme.exe license utility.
- Use the AdvantEDGE View licensing procedure, which uses SNMP traps. For more information, refer to the AdvantEDGE View Web Help.
- Send an e-mail request to license@concord.com and place the returned license key in the appropriate license file.

#### NOTE

Always include the Customer ID and user name in license requests that you send through e-mail.

- Complete the online license form through the Internet, as described in the next section, "Generating the License".

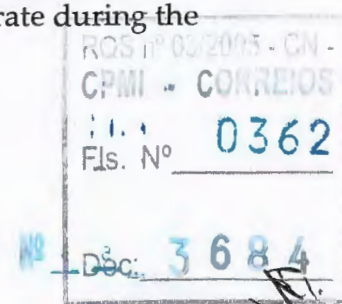
For more information about licensing, refer to the *SystemEDGE Agent User Guide* and the *Automating the Licensing of SystemEDGE and AdvantEDGE Point Plug-in Modules* white paper.

### Generating the License

This section describes how to generate the license using the Web-based license form. The SystemEDGE setup program can generate the licensing information for your system.

#### NOTE

If you are using an evaluation copy of AdvantEDGE for Microsoft IIS, you must request a temporary license that will enable it to operate during the evaluation period.





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## INSTALLING ADVANTEDGE FOR MICROSOFT IIS

*Licensing AdvantEDGE for Microsoft IIS*

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To generate a license, follow these steps:

1. Run the SystemEDGE agent setup command by entering the following at the command prompt:

```
sysedge\setup -l
```

The setup program displays a message similar to the following:

```
SystemEDGE Version 4.0 Patchlevel 3
```

```
Copyright 2001 by Concord Communications, Inc.
```

```
Please contact Concord Communications, Inc. to obtain a license
```

```
http://www.concord.com/support, Email: license@concord.com
```

```
Provide: sysedge neptune NTx86 4.0 346561363366b19c 4.0 Patchlevel 3
```

2. To obtain a license for AdvantEDGE for Microsoft IIS, fill out the online Web-based license form available from Concord's licensing Web server at the following URL:

```
http://license.concord.com
```

### NOTE

You must supply a user name and password to access the license form.

The license form asks you to supply the following information:

- Customer ID
- Name
- E-mail address
- Software version number (4.0 in the example above)
- Patchlevel
- System name (neptune in the example above)
- Operating system name (NTx86 in the example above)
- Operating system version (4.0 in the example above)
- System identifier (346561363366b19c in the example above)

### NOTE

When you are licensing AdvantEDGE for Microsoft IIS, select **iismod** as the product on the licensing form.

After you submit the license request, the Concord Web server generates a license and displays it to your Web browser. It also e-mails the license to the contact person in your organization.

AdvantEDGE for Microsoft IIS User Guide 2-5

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## 2 INSTALLING ADVANTEDGE FOR MICROSOFT IIS

*Licensing AdvantEDGE for Microsoft IIS*

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3. Copy the generated license key into the sysedge.lic file in the system32 subdirectory (for example, C:\winnt\system32), and then save the file.

The license key is case sensitive. Copy it exactly as it appears. If possible, use your system's cut-and-paste facility instead of entering it by hand.

If you do enter the license key by hand, be careful not to confuse characters such as the letters l and I and the number 1, or the letter O and the number 0.

4. Stop and then restart the Windows NT Master agent by entering the following commands at the command prompt:

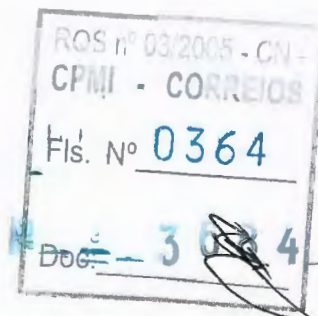
```
net stop snmp
net start snmp
```

The AdvantEDGE for Microsoft IIS module is now licensed and ready to use.

### Sample License File

The following is a sample SystemEDGE agent license file. A pound character (#) in column 1 indicates that the entire line is a comment.

```
# license file for SystemEDGE Agent
# Empire Technologies, Inc.
# A Concord Communications Company
# http://www.concord.com
#
# file /etc/sysedge.lic or %SystemRoot%\system32\sysedge.lic
# A valid license key has four parts of 8 characters per part
# parts are separated by space(s) with one license key per line
# sysedge neptune NT/x86 4.0 807cb1da007cb1da 4.0
e13311d3 0F2a7cb1 abC512dc fF8C923a
# iismod neptune NT/x86 4.0 807cb1da007cb1da 1.0
a7943fde 098a87ij a4kiuf39 afafEkj4
```





# Using the AdvantEDGE for Microsoft IIS MIB

This chapter explains the organization and content of the Concord Communications MIB for Microsoft IIS. This MIB specification (iismod.asn1) defines a collection of objects for monitoring and managing IIS. You must configure the SystemEDGE agent to monitor the AdvantEDGE for Microsoft IIS MIB objects that are relevant for your configuration. For more information about configuring the SystemEDGE agent to monitor the IIS application, refer to Chapter 4, "Using AdvantEDGE for Microsoft IIS."

Figure 3-1 shows the organization of the AdvantEDGE for Microsoft IIS MIB.

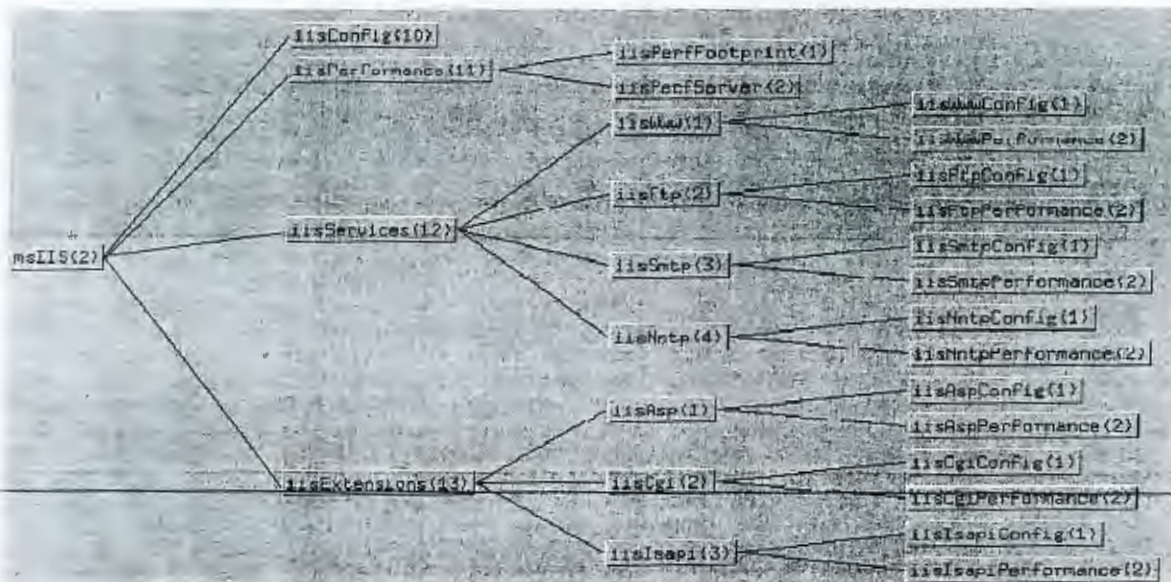


Figure 3-1: AdvantEDGE for Microsoft IIS MIB

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The MIB is organized into broad sections for server, services, and extension information. Within those broad sections are subsections for configuration and performance. Within the performance section, a footprint section defines MIB objects that convey how much of the underlying system's resources are consumed by IIS.

The following sections highlight important MIB objects from the IIS MIB. This chapter defines all sections of the IIS MIB, but it does **not** define all of the MIB objects. For a complete list of MIB objects, refer to the AdvantEDGE for Microsoft IIS MIB specification (iismod.asn1).

## Configuration Section

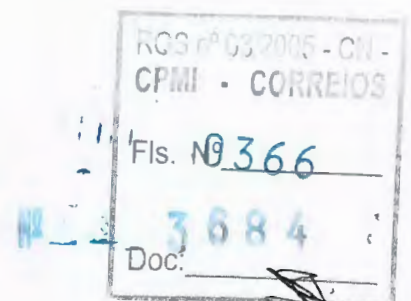
The Configuration section of the AdvantEDGE for Microsoft IIS MIB contains configuration parameters and settings that are important for streamlining the health and performance of IIS. It also includes information about server configuration.

### Server Configuration

The Server Configuration group contains configuration parameters, process IDs, and version numbers. Table 3-1 defines important Server Configuration parameters.

**Table 3-1: Selected MIB Objects – IIS Server Configuration Group**

MIB Object	Description
iisVersion	IIS version.
iisPid	IIS process ID.
iisObjectCacheTTL	How often the cache scavenger runs.
iisMAXPoolThreads	How many threads IIS will use to perform tasks.
iisListenBackLog	Maximum number of connection requests in the queue for each service.
iisOpenFilesInCache	Number of files IIS will keep open in the cache.





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Figure 3-2 shows a sample AdvantEDGE View process-status window for IIS.

Process	Status	PID	Start-Time
IIS	Up	278	Wed Jul 12 19:09:02 2000

Figure 3-2: Sample IIS Process ID and Status

## Performance Section

The Performance section of the AdvantEDGE for Microsoft IIS MIB contains performance data that is necessary for capacity planning and trend analysis, as well as for real-time performance and availability monitoring. The Performance group is divided into subgroups for footprint data and server performance.

### IIS Footprint

This group provides information about IIS CPU, memory, and disk resource consumption, more commonly called its *footprint*. Long-term trending analysis of footprint information is useful for anticipating and avoiding problems due to resource exhaustion. You can also monitor footprint information in real time to detect and correct temporary resource exhaustion due to viruses, security incidents, and hardware failures. Table 3-2 defines important IIS Footprint metrics.

Table 3-2: Selected MIB Objects – IIS Footprint Group

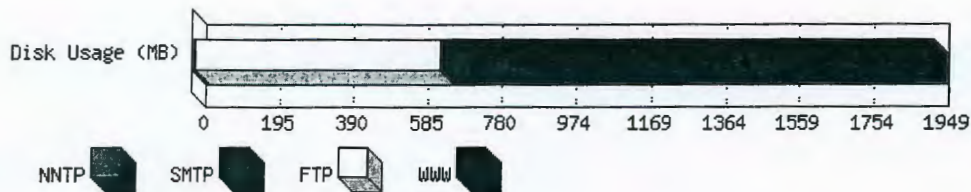
MIB Object	Description
iisCPUTime	IIS total accumulated CPU time.
iisPercentCPU	Percentage of CPU, over the last interval, used by IIS.
iisTotalRSS	Total real memory currently in use by IIS.
iisPercentMEM	Percentage of real memory currently in use by IIS.
iisTotalLogSize	Estimate of the current disk space used by all IIS services.
iisTotalDiskSize	Estimate of the current total disk space used by IIS.
iisTotalThreads	Total number of system threads used by IIS.

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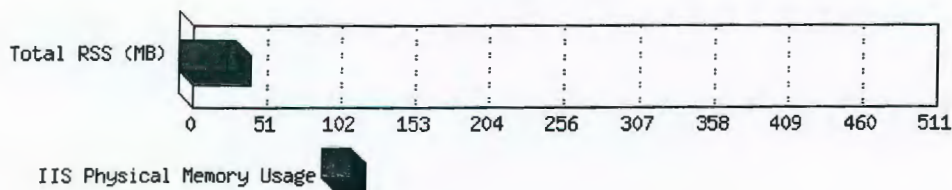
The following figures show sample AdvantEDGE View footprints for an IIS machine serving a medium-sized company. They represent real data collected from live IIS servers and displayed in AdvantEDGE View reports.

Figure 3-3 shows an example of disk usage by service:



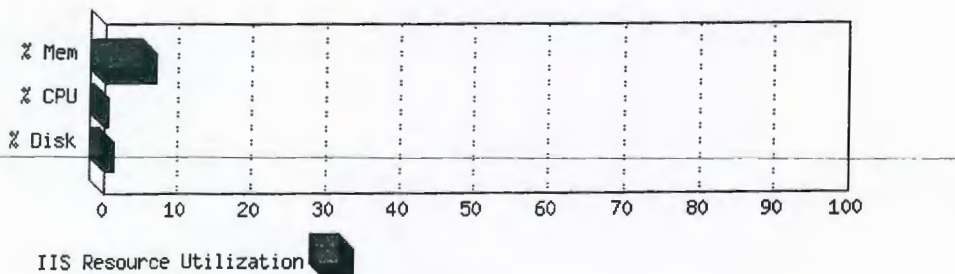
**Figure 3-3: IIS Disk Usage by Service**

Figure 3-4 shows an example of memory usage:

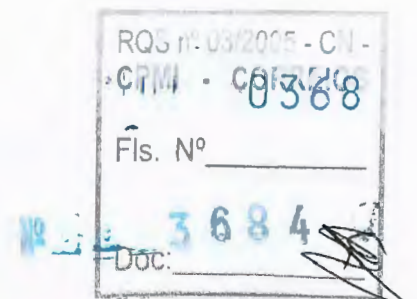


**Figure 3-4: IIS Memory Usage**

Figure 3-5 shows a sample IIS footprint summary:



**Figure 3-5: IIS Footprint Summary**





## Server Performance

The Server Performance group provides performance metrics and counters for IIS, including user statistics and transfer statistics. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-3 defines important Server Performance metrics.

**Table 3-3: Selected MIB Objects – IIS Server Performance Group (Page 1 of 2)**

MIB Object	Description
iisCacheHits	Total number of times an item was found by IIS in the object cache.
iisCacheMisses	Total number of times an item was not found by IIS in the object cache.
iisCacheFlushes	Number of times an item was deleted from the IIS object cache.
iisTtlCurAnonUsr	Total number of current anonymous users maintained by all IIS services.
iisTtlCurNAnonUsr	Total number of current non-anonymous users maintained by all IIS services.
iisTtlCurUsr	Total number of users maintained by all IIS services.
iisTtlMaxAnonUsr	Total maximum number of anonymous users maintained by all IIS services.
iisTtlMaxNAnonUsr	Total maximum number of non-anonymous users maintained by all IIS services.
iisTtlMaxUsr	Total maximum number of users maintained by all IIS services.
iisTtlAnonUsr	Running count of anonymous users maintained by all IIS services.
iisTtlNAnonUsr	Running count of non-anonymous users maintained by all IIS services.
iisTtlUsr	Running count of all users maintained by all IIS services.
iisTtlBytesSent	Count of KB sent by all IIS services.
iisTtlBytesRecv	Count of KB received by all IIS services.
iisTtlBytes	Count of KB transferred by all IIS services.
iisTtlFilesSent	Count of files sent by all IIS services.

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Table 3-3: Selected MIB Objects – IIS Server Performance Group (Page 2 of 2)

MIB Object	Description
iisTtlFilesRecv	Count of files received by all IIS services.
iisTtlFiles	Count of files transferred by all IIS services.
iisWebAppReqTtl	Total number of Web requests made by IIS.

Figure 3-6 shows a sample user statistics summary:

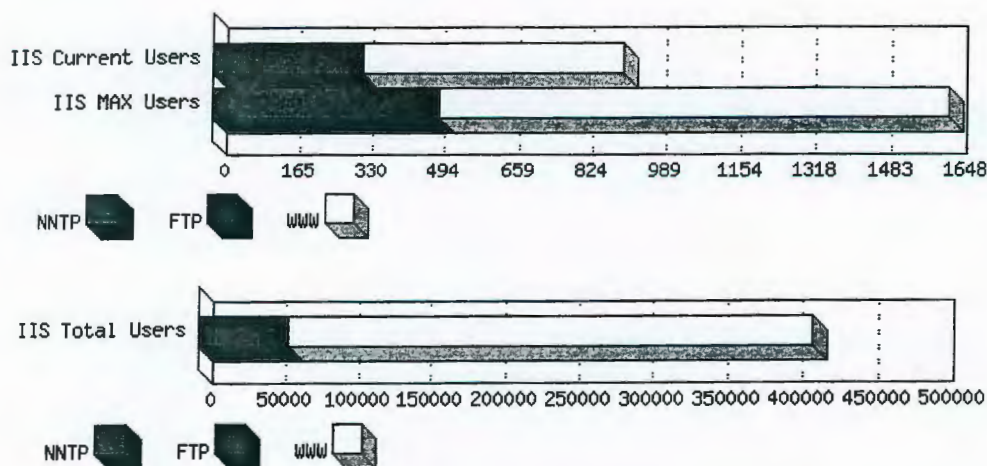


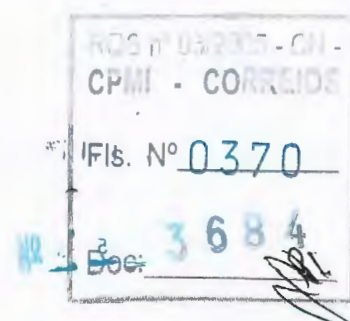
Figure 3-6: IIS User Statistics Summary

## Services Group

The Services group provides configuration information, performance metrics, and counters for IIS services, including WWW, FTP, SMTP, and NNTP. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis.

## WWW Group

The World Wide Web (WWW) group provides configuration information, performance metrics, and counters for the IIS WWW Service. It looks at the WWW Service as a whole and provides totals of all WWW service activities in IIS.





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## USING THE ADVANTEDGE FOR MICROSOFT IIS MIB

Services Group

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### WWW Configuration Group

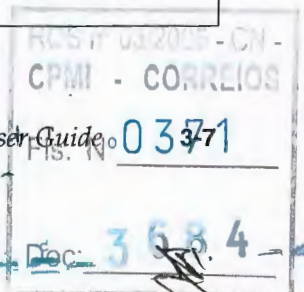
The WWW Configuration group provides version information for the IIS WWW service.

### WWW Performance Group

The WWW Performance group provides performance metrics and counters for the IIS WWW service, including user statistics and transfer statistics. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-4 defines important WWW Performance metrics.

**Table 3-4: Selected MIB Objects – IIS WWW Performance Group (Page 1 of 2)**

MIB Object	Description
iisWwwLogSize	Estimate of the current disk space used by the WWW service logs.
iisWwwTtlDiskSize	Total size in KB of log and service directories.
iisWwwRezSysSize	Size in KB of the WWW service resident system code.
iisWwwTtlNotFoundErr	Total count of the page-not-found errors for the WWW service.
iisWwwTtlConnAttempt	Total number of connections to the well-known port of the WWW service.
iisWwwTtlLogonAttempt	Total number of logins that have been attempted to the WWW service.
iisWwwTtlCurAnonUsr	Total number of current anonymous users maintained by the WWW service.
iisWwwTtlCurNAnonUsr	Total number of current non-anonymous users maintained by the WWW service.
iisWwwTtlCurUsr	Total number of users maintained by the WWW service.
iisWwwTtlMaxAnonUsr	Maximum number of anonymous users maintained by the WWW service.
iisWwwTtlMaxNAnonUsr	Maximum number of non-anonymous users maintained by the WWW service.
iisWwwTtlMaxUsr	Maximum number of users maintained by the WWW service.



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Table 3-4: Selected MIB Objects – IIS WWW Performance Group (Page 2 of 2)

MIB Object	Description
iisWwwTtlAnonUsr	Running count of anonymous users maintained by the WWW service.
iisWwwTtlNAnonUsr	Running count of non-anonymous users maintained by the WWW service.
iisWwwTtlUsr	Running count of all users maintained by the WWW service.
iisWwwTtlBytesSent	Count of KB sent by the WWW service.
iisWwwTtlBytesRecv	Count of KB received by the WWW service.
iisWwwTtlBytes	Count of KB transferred by the WWW service.
iisWwwTtlFilesSent	Count of files sent by the WWW service.
iisWwwTtlFilesRecv	Count of files received by the WWW service.
iisWwwTtlFiles	Count of files transferred by the WWW service.
iisWwwTtlGetReq	Total GET methods on the WWW service.
iisWwwTtlHeadReq	Total HEAD methods on the WWW service.
iisWwwTtlPostReq	Total POST methods on the WWW service.
iisWwwTtlPutReq	Total PUT methods on the WWW service.
iisWwwTtlTraceReq	Total TRACE methods on the WWW service.
iisWwwTtlDeleteReq	Total DELETE methods on the WWW service.
iisWwwTtlOtherReq	Total methods that are not using GET, POST, PUT, DELETE, TRACE, or HEAD.
iisWwwTtlMethodReq	Total methods that are using GET, POST, PUT, DELETE, TRACE, and HEAD.

## FTP Group

The FTP group provides performance metrics and counters for the IIS FTP service. It includes information such as user statistics and transfer statistics. This group looks at the FTP Service as a whole and provides totals of all FTP service activities in IIS.

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## FTP Configuration Group

The FTP Configuration group provides version information for the IIS FTP service.

## FTP Performance Group

The FTP Performance group provides performance metrics and counters for the IIS FTP service, including the total current users, total users, total files transferred, and total KB transferred. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-5 defines important FTP Performance metrics.

**Table 3-5: Selected MIB Objects – IIS FTP Performance Group (Page 1 of 2)**

MIB Object	Description
iisFtpLogSize	Estimate of the current disk space used by the FTP service logs.
iisFtpTtlDiskSize	Total size in KB of log and service directories.
iisFtpTtlConnAttempt	Total number of connections to the well-known port of the FTP service.
iisFtpTtlLogonAttempt	Total number of logins that have been attempted to the FTP service.
iisFtpTtlCurAnonUsr	Total number of current anonymous users maintained by the FTP service.
iisFtpTtlCurNAnonUsr	Total number of current non-anonymous users maintained by the FTP service.
iisFtpTtlCurUsr	Total number of users maintained by the FTP service.
iisFtpTtlMaxAnonUsr	Maximum number of anonymous users maintained by the FTP service.
iisFtpTtlMaxNAnonUsr	Maximum number of non-anonymous users maintained by the FTP service.
iisFtpTtlMaxUsr	Maximum number of users maintained by the FTP service.
iisFtpTtlAnonUsr	Running count of anonymous users maintained by the FTP service.
iisFtpTtlNAnonUsr	Running count of non-anonymous users maintained by the FTP service.

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Table 3-5: Selected MIB Objects – IIS FTP Performance Group (Page 2 of 2)

MIB Object	Description
iisFtpTtlUsr	Running count of all users maintained by the FTP service.
iisFtpTtlBytesSent	Count of KB sent by the FTP service.
iisFtpTtlBytesRecv	Count of KB received by the FTP service.
iisFtpTtlBytes	Count of KB transferred by the FTP service.
iisFtpTtlFilesSent	Count of files sent by the FTP service.
iisFtpTtlFilesRecv	Count of files received by the FTP service.
iisFtpTtlFiles	Count of files transferred by the FTP service.

## SMTP Group

The SMTP group provides configuration information, performance metrics, and counters for the IIS SMTP Service. This group contains information such as transfer statistics and queue lengths. It looks at the SMTP service as a whole and provides totals of all SMTP service activities in IIS.

### SMTP Configuration Group

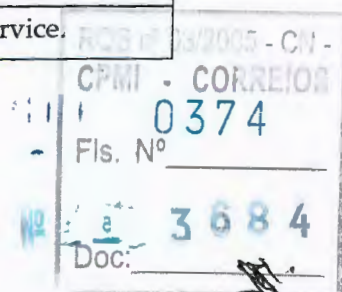
The SMTP Configuration group provides version information for the IIS SMTP service.

### SMTP Performance Group

The SMTP Performance group provides performance metrics and counters for the IIS SMTP service, including total messages transferred, total KB transferred, and various queue lengths. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-6 defines important SMTP Performance metrics.

Table 3-6: Selected MIB Objects – IIS SMTP Performance Group

MIB Object	Description
iisSmtplLogSize	Estimate of the current disk space used by the SMTP service logs.
iisSmtplTtlDiskSize	Total size in KB of log and service directories.
iisSmtplTtlConErr	Total connection errors for the SMTP service.





**Table 3-6: Selected MIB Objects – IIS SMTP Performance Group**

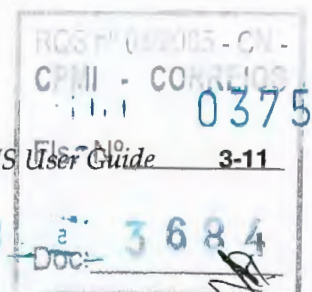
MIB Object	Description
iisSmtptTtlBytesSent	Count of KB sent by the SMTP service.
iisSmtptTtlBytesRecv	Count of KB received by the SMTP service.
iisSmtptTtlBytes	Count of KB transferred by the SMTP service.
iisSmtptTtlMsgSent	Count of messages sent by the SMTP service.
iisSmtptTtlMsgRecv	Count of messages received by the SMTP service.
iisSmtptTtlMsg	Count of messages transferred by the SMTP service.
iisSmtptCurInConn	Number of connections that are currently inbound.
iisSmtptCurOutConn	Number of connections that are currently outbound.
iisSmtptTtlInConn	Total number of inbound connections received.
iisSmtptTtlOutConn	Total number of outbound connections attempted.
iisSmtptLocQueLen	Number of messages in the local queue.
iisSmtptRtryQueLen	Number of messages in the local retry queue.
iisSmtptRemtQueLen	Number of messages in the remote queue.
iisSmtptRemtRtryQueLen	Number of messages in the remote retry queue for remote delivery.
iisSmtptPicupQueLen	Number of messages in the directory pickup queue.

## NNTP Group

The NNTP group provides configuration information, performance metrics, and counters for the IIS NNTP service. This group contains information such as transfer statistics and article statistics. It looks at the NNTP service as a whole and provides totals of all NNTP service activities in IIS.

### NNTP Configuration Group

The NNTP Configuration group provides version information for the IIS NNTP service.



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## NNTP Performance Group

The NNTP Performance group provides performance metrics and counters for the IIS NNTP service, including total current users, total users, total KB transferred, and total articles transferred. Table 3-7 defines important NNTP Performance metrics.

**Table 3-7: Selected MIB Objects – IIS NNTP Performance Group (Page 1 of 2)**

MIB Object	Description
iisNntpLogSize	Estimate of the current disk space used by the NNTP service logs.
iisNntpTtlDiskSize	Total size in KB of log and service directories.
iisNntpTtlLogonAtempt	Total number of logins that have been attempted to the NNTP service.
iisNntpTtlCurAnonUsr	Total number of current anonymous users maintained by the NNTP service.
iisNntpTtlCurNAnonUsr	Total number of current non-anonymous users maintained by the NNTP service.
iisNntpTtlCurUsr	Total number of users maintained by the NNTP service.
iisNntpTtlMaxAnonUsr	Maximum number of anonymous users maintained by the NNTP service.
iisNntpTtlMaxNAnonUsr	Maximum number of non-anonymous users maintained by the NNTP service.
iisNntpTtlMaxUsr	Maximum number of users maintained by the NNTP service.
iisNntpTtlAnonUsr	Running count of anonymous users maintained by the NNTP service.
iisNntpTtlNAnonUsr	Running count of non-anonymous users maintained by the NNTP service.
iisNntpTtlUsr	Running count of all users maintained by the NNTP service.
iisNntpTtlBytesSent	Count of KB sent by the NNTP service.
iisNntpTtlBytesRecv	Count of KB received by the NNTP service.
iisNntpTtlBytes	Count of KB transferred by the NNTP service.

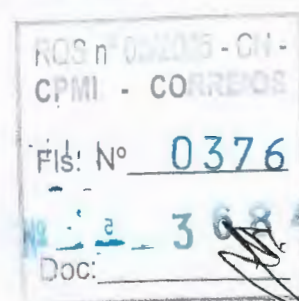




Table 3-7: Selected MIB Objects – IIS NNTP Performance Group (Page 2 of 2)

MIB Object	Description
iisNntpTtlArtclSent	Total articles sent for the NNTP service.
iisNntpTtlArtclRecv	Total articles received for the NNTP service.
iisNntpTtlArtcl	Total articles for the NNTP service.

## Extensions Group

The Extensions group provides performance metrics and counters that extend IIS services. This group contains metrics for ASP, CGI, and ISAPI.

### ASP Group

The ASP group contains ASP extension configuration and performance data. ASP is a server-side scripting environment used in Web-based applications. This group looks at ASP as a whole and provides totals of all ASP activities in IIS.

### ASP Performance Group

The ASP Performance group provides performance metrics and counters for Active Server Pages, including total requests, total requests that succeeded, and total number of script errors. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-8 defines important ASP Performance metrics.

Table 3-8: Selected MIB Objects – IIS ASP Performance Group (Page 1 of 2)

MIB Object	Description
iisAspMemAlcated	Total memory in KB that is currently allocated to ASP.
iisAspReqExecuting	Current number of ASP requests that are executing.
iisAspReqQued	Current number of ASP requests that are waiting for service from the queue.
iisAspReqDiscnt	Number of requests that were disconnected due to communications failure.
iisAspReqNAuth	Number of requests that failed due to insufficient access rights.

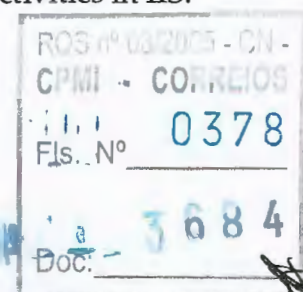
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Table 3-8: Selected MIB Objects – IIS ASP Performance Group (Page 2 of 2)

MIB Object	Description
iisAspReqNFnd	Number of requests for files that were not found.
iisAspReqRej	Number of requests that were not executed because of insufficient processing resources.
iisAspReqWaitTime	Number of milliseconds that the most recent request waited in the queue.
iisAspReqExecTime	Total number of milliseconds to execute the most recent request.
iisAspReqSucceeded	Number of requests that executed successfully.
iisAspReqTtl	Total number of requests since the service was started.
iisAspSessCur	Number of sessions being serviced.
iisAspSessDur	Number of milliseconds that the most recent session persisted.
iisAspSessTmdOut	Number of sessions that timed out.
iisAspSessTtl	Number of sessions since the service was started.
iisAspTrnsPending	Number of transactions in progress.
iisAspTrnsCommitted	Number of transactions committed.
iisAspTrnsAbort	Number of transactions aborted.
iisAspTrnsTtl	Total number of transactions since the service started.
iisAspErrScrpRun	Number of requests that failed due to runtime errors.
iisAspErrScrpCmp	Number of requests that failed due to script-compilation errors.
iisAspErrScrpTtl	Total number of script errors, both runtime and compilation.

## CGI Group

The CGI group contains CGI extension configuration and performance data. CGI is a server-side gateway interface used in Web-based applications. This group looks at CGI as a whole and provides totals of all CGI activities in IIS.





## CGI Performance Group

The CGI Performance group provides performance metrics and counters for the Common Gateway Interface, including number of current requests, maximum number of requests, and total number of requests. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-9 defines important CGI Performance metrics.

**Table 3-9: Selected MIB Objects – IIS CGI Performance Group**

MIB Object	Description
iisCgiReqCur	Number of current CGI requests.
iisCgiReqMax	Maximum number of simultaneous CGI requests.
iisCgiReqTtl	Total number of CGI requests since the service started.

## ISAPI Group

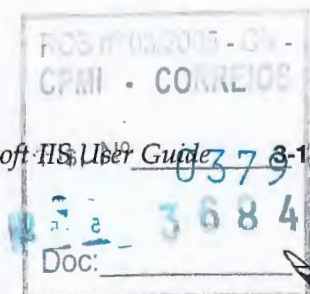
The ISAPI group contains ISAPI extension configuration and performance data. ISAPI is a server-side program interface used in Web-based applications. This group looks at ISAPI as a whole and provides totals of all ISAPI activities in IIS.

## ISAPI Performance Group

The ISAPI group provides performance metrics and counters for the ISAPI, including number of current requests, maximum number of requests, and total number of requests. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 3-10 defines important ISAPI Performance metrics.

**Table 3-10: Selected MIB Objects – IIS ISAPI Performance Group**

MIB Object	Description
iisIsapiReqCur	Number of current ISAPI requests.
iisIsapiReqMax	Maximum number of simultaneous ISAPI requests.
iisIsapiReqTtl	Total number of ISAPI requests since service startup.



## Using AdvantEDGE for Microsoft IIS

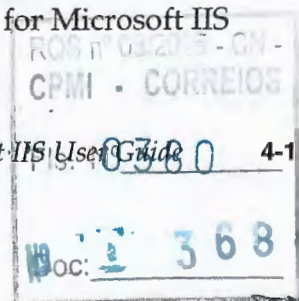
This chapter describes how to configure and use AdvantEDGE for Microsoft IIS. This Point module is implemented as a SystemEDGE agent plug-in. After you enable this plug-in in the sysedge.cf file and obtain a license for it, it will load automatically at SystemEDGE start time. For more information, refer to "Configuring AdvantEDGE for Microsoft IIS" on page 2-3 and "Licensing AdvantEDGE for Microsoft IIS" on page 2-3.

The AdvantEDGE for Microsoft IIS plug-in implements additional MIB objects that provide advanced information about the health and availability of IIS. AdvantEDGE for Microsoft IIS can operate with any SNMP-compliant management software, such as Concord's *eHealth* suite of products, AdvantEDGE View, HP OpenView, and others. If you are using AdvantEDGE for Apache with *eHealth*, refer to the *eHealth* Web Help for more information about the reports that you can generate.

The default configuration settings of the AdvantEDGE for Microsoft IIS plug-in enable you to use the advanced self-monitoring capabilities of the SystemEDGE agent in conjunction with AdvantEDGE for Microsoft IIS.

### Editing the SystemEDGE Configuration File

You can use AdvantEDGE View or another SNMP management tool to edit the SystemEDGE configuration file to utilize the MIB objects that exist in AdvantEDGE for Microsoft IIS with the process-monitoring, threshold-monitoring, Windows NT event-monitoring, and history-collection features of the SystemEDGE agent. All MIB objects related to AdvantEDGE for Microsoft IIS exist at object identifier (OID) branch 1.3.6.1.4.1.546.16.2 in the Concord Systems Management MIB. The MIB is defined in the iismod.asn1 file, which is available in the AdvantEDGE for Microsoft IIS product installation.





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## Assigning Entry Rows for the SystemEDGE Self-Monitoring Tables

All SystemEDGE self-monitoring tables (for example, log monitoring, Windows NT event monitoring, process/service monitoring, threshold monitoring, and history collection) require the use of unique row numbers. Each table contains an *Index* column which acts as a *key field* to distinguish rows in the table. This section describes the benefits of reserving a block of rows (somewhere in the range of 11 to the maximum number of rows in your table) for use by the system or application administrator.

### Setting Local Policy

You may choose, as a matter of local policy, to reserve a block of rows for system administration. This policy allows you to define row entries within a reserved block of rows without worrying about the row already being taken by another user's entry. In compliance with the local policy, all other users should use row indices that are outside of the reserved range when they define user-configured entries.

By reserving a block of rows, you can define a consistent set of conditions (row entries) to be monitored across all machines such that the same condition is defined in the same row number on each of the machines. For example, you can use row 3000 in each table to define entries monitoring the page-not-found errors (iisWwwTtlNotFoundErr). You can then distribute this configuration out to every host so that every machine running IIS uses row 3000 for monitoring page-not-found errors, whether it is the threshold monitoring table or the history table. Further, every machine can use row 3000 for monitoring the WWW service in the process/service monitoring table.

### Reserving Blocks of Rows

To reserve a block of rows for monitoring Microsoft IIS:

1. Decide on a block of rows that you want to reserve for use with monitoring Microsoft IIS.
2. Using that block of rows, define a set of row entries for each of the respective SystemEDGE self-monitoring tables. For more information, refer to the chapter on self-monitoring in the *SystemEDGE Agent User Guide*.

RQS n°	032015 - CN -
CPMI -	CORREIO
Fls. N°	0381
Ddc:	3684

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3. Distribute configuration file entries out to all hosts that are running IIS and AdvantEDGE for Microsoft IIS. For more information, refer to the *Automating the Deployment of SystemEDGE and AdvantEDGE Point Plug-in Modules* white paper.

**NOTE**

As an alternative, you can use this row-number assignment policy with AdvantEDGE View for group configuration operations.

4. Require end users to avoid your block of rows when defining their own self-monitoring table entries.

## Using the SystemEDGE Self-Monitoring Features

The examples in this section show SystemEDGE configuration-file commands for monitoring Microsoft IIS. Add these commands to the sysedge.cf file to enable monitoring of the MIB objects that they specify. Modify these examples as necessary to monitor the MIB objects that are relevant for your configuration.

The examples in the following sections present row numbers in the 5000 range; select a row number for your configuration that conforms to local policies. For more information on row assignment, refer to "Assigning Entry Rows for the SystemEDGE Self-Monitoring Tables" on page 4-2.

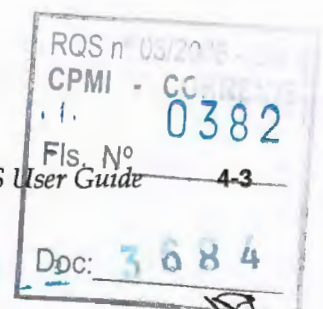
The following command, for example, instructs the SystemEDGE agent to monitor whether the IIS process is alive every 30 seconds and to store the data in row 5000 of the Process Monitoring table:

```
watch process procAlive 'inetinfo|INETINFO' 5000 0x0
30 'IIS' ''
```

For more information about the syntax for the commands in this section, refer to the *SystemEDGE Agent User Guide*.

**NOTE**

Enter the commands throughout this chapter as one line. Do not use a carriage return to match the formatting shown here.





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## Using SystemEDGE Process Monitoring

This section provides examples of how to use the SystemEDGE process- and service-monitoring capabilities to monitor the availability of crucial IIS processes and services. Add the commands in the following sections to the sysedge.cf file to monitor these processes. For more information on the SystemEDGE process- and service-monitoring capabilities, refer to the chapter on process and service monitoring in the *SystemEDGE Agent User Guide*.

### Monitoring IIS

To make sure IIS is running, enter the following command:

```
watch process procAlive 'inetinfo|INETINFO' 5000 0x0  
30 'IIS' ''
```

### Monitoring the IIS WWW Service

To make sure the IIS WWW Service is running, enter the following command:

```
watch ntservice 'World Wide Web Publishing Service' 5002 0x0  
30 'IIS WWW Service' ''
```

### Monitoring the IIS FTP Service

To make sure the IIS FTP Service is running, enter the following command:

```
watch ntservice 'FTP Publishing Service' 5003 0x0 30 'IIS FTP  
Service' ''
```

### Monitoring the IIS SMTP Service

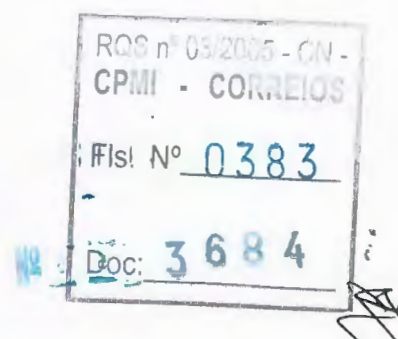
To make sure the IIS SMTP Service is running, enter the following command:

```
watch ntservice 'Microsoft SMTP Service' 5004 0x0 30 'IIS SMTP  
Service' ''
```

### Monitoring the IIS NNTP Service

To make sure the IIS NNTP Service is running, enter the following command:

```
watch ntservice 'Microsoft NNTP Service' 5005 0x0 30 'IIS NNTP  
Service' ''
```



## Using SystemEDGE Threshold Monitoring

This section outlines the use of SystemEDGE threshold-monitoring capabilities to monitor important IIS metrics. Add the commands in the following sections to the sysedge.cf file to monitor thresholds for these MIB objects. For more information on SystemEDGE threshold monitoring, refer to the chapter on threshold monitoring in the *SystemEDGE Agent User Guide*.

### NOTE

The choice of thresholds used in these examples may not be appropriate for your configuration; select thresholds that are appropriate for your environment.

### Monitoring the Total Current Users

To monitor the total number of current users, enter the following command:

```
monitor oid iisTtlCurUsr.0 5002 0x0 60 delta > 100 'Total  
Current Users exceeds threshold'
```

### Monitoring the KB Transferred

To monitor the number of KB transferred, enter the following command:

```
monitor oid iisTtlBytes.0 5003 0x0 60 delta > 524288 'Total  
KBytes Transferred exceeds threshold'
```

### Monitoring the Number of WWW 404 Errors

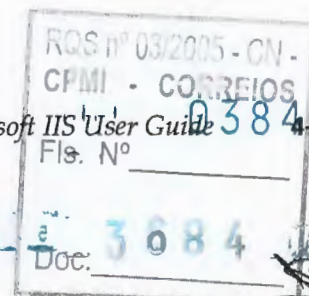
To monitor the number of WWW 404 (page-not-found) errors, enter the following command:

```
monitor oid iisWwwTtlNotFoundErr.0 5004 0x0 60 delta > 100  
'WWW Total 404 Errors exceeds threshold'
```

### Monitoring the Number of Web Application Requests

To monitor the number of Web application requests, enter the following command:

```
monitor oid iisWebAppReqTtl.0 5005 0x0 60 delta > 100 'Web  
Application Requests exceeds threshold'
```





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## Monitoring the Number of ASP Script Errors

To monitor the number of ASP script errors, enter the following command:

```
monitor oid iisAspErrScript.0 5006 0x0 60 absolute > 40 'ASP
Total Script Errors exceeds threshold'
```

## Monitoring WWW 404 Errors on an Individual Web Site

To monitor the number of WWW 404 (page not found) errors on an individual Web site, enter the following command:

```
monitor oid ntRegPerf.50.0 5007 0x0 60 absolute > 200 'WWW
Total 404 Errors on WebA exceeds threshold'
```

### NOTE

If you are monitoring WWW 404 errors on an individual Web site, you must use the corresponding ntRegPerf item. Refer to "Using the Windows NT RegPerf Extensions" on page 4-12.

## Monitoring the Number of Web Logon Failures Over Time

To monitor for 20 Web Logon Failure events in the system log within one minute, enter the following command:

```
monitor oid ntEventMonMatches.5012 50010 0x0 60 delta > 20
'More than 20 Logon Failures in Web Server in 1 Min' ''
```

### NOTE

To use this Web Logon Failure example, you need a corresponding Windows NT Event Monitor 5012 to monitor Web Logon Failures. For the corresponding entry, refer to "Monitoring IIS Web Logon Failure Events for IIS WWW Service in the System Event Log" on page 4-11.

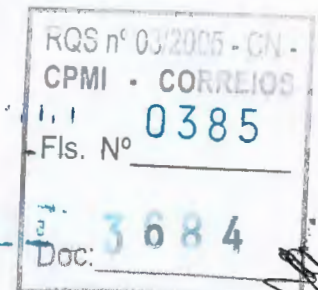
## Monitoring the Number of FTP Logon Failures Over Time

To monitor for 20 FTP Logon Failure events in the system log within one minute, enter the following command:

```
monitor oid ntEventMonMatches.5013 50011 0x0 60 delta > 20
'More than 20 Logon Failures on FTP Server in 1 Min' ''
```

### NOTE

To use this FTP Logon Failure example, you need a corresponding Windows NT Event Monitor 5013 looking at FTP Logon Failures. For the corresponding entry, refer to "Monitoring IIS FTP Logon Failure Events for IIS FTP Service in the System Event Log" on page 4-11.



## Using SystemEDGE History Collection

This section outlines the use of SystemEDGE history capabilities to track the value of important IIS metrics over time. Add the commands in the following sections to the sysedge.cf file to collect history for these MIB objects. For more information, refer to the chapter on history collection in the *SystemEDGE Agent User Guide*.

### NOTE

The number of samples and the interval between samples used in these examples may not be appropriate for your IIS system; select values that are appropriate for your environment.

### Collecting History for Current Number of Users for the IIS Service

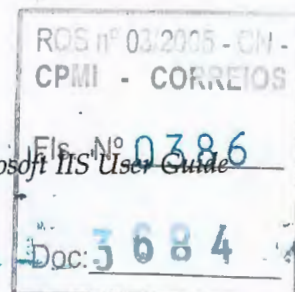
To collect history for the current number of users for the WWW service, enter the following command:

```
emphistory 5002 60 iisWwwCurUsrs.0 400 'WWW Num Current Users  
History'
```

### Collecting History for Current Number of Users for the IIS FTP Service

To collect history for the current number of users for the FTP service, enter the following command:

```
emphistory 5003 60 iisFtpCurUsrs.0 200 'FTP Num Current Users  
History'
```





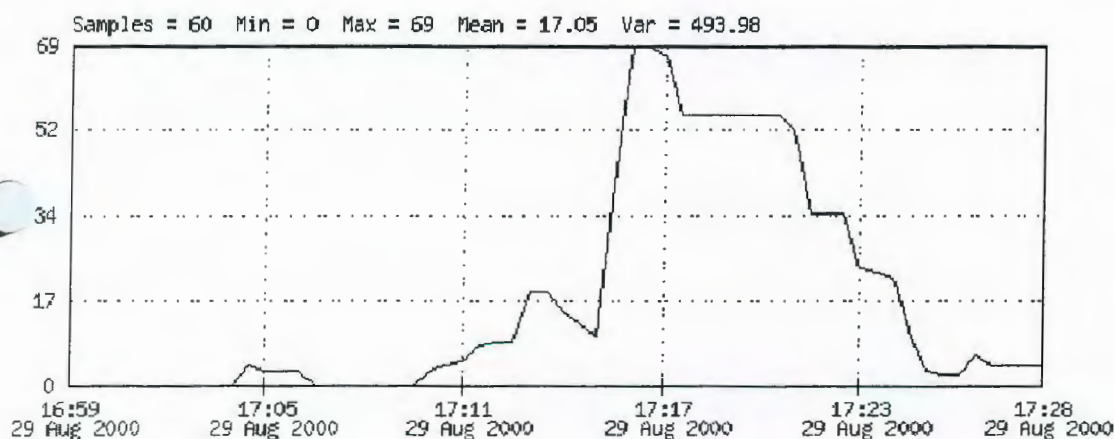
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Figure 4-1 shows a sample history for total current users.

**Object Identifier: iisTtlCurUsr**

Variable is of Type Gauge. The following graph shows **absolute** values.



**Figure 4-1: IIS Total Current Users Count History**

### Collecting History for Local Queue Length for the SMTP Service

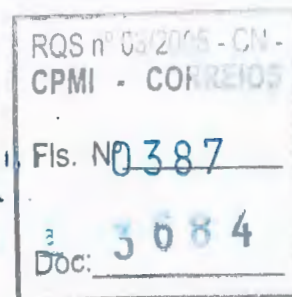
To collect history for the local queue length for the SMTP service, enter the following command:

```
emphistory 5004 60 iisSmtplocQueLen.0 480 'SMTP Local Queue
Len History'
```

### Collecting History for the Local Retry Queue Length for the SMTP Service

To collect history for the local retry queue length for the SMTP service, enter the following command:

```
emphistory 5005 60 iisSmtprtryQueLen.0 480 'SMTP Local Retry
Queue Len History'
```



*[Handwritten signature]*

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## Using SystemEDGE Windows NT Event Monitoring

This section outlines the use of SystemEDGE Windows NT event monitoring to capture important IIS-related Windows NT events and forward them to the appropriate management software as SNMP traps. The examples in this section show SystemEDGE configuration-file commands that instruct the SystemEDGE agent to monitor for certain types of Windows NT events that are related to IIS. Add the commands in the following sections to the sysedge.cf file to monitor for these Windows NT events. For more information, refer to the chapter on Windows NT event monitoring in the *SystemEDGE Agent User Guide*.

### Monitoring IIS WWW Service Events in the System Event Log

To monitor for WWW service events in the system event log, enter the following command:

```
watch ntevent 5000 0x00 System All 'W3SVC' '*' 'Monitor IIS  
WWW Service System Events' ''
```

### Monitoring IIS WWW Service Events in the Security Event Log

To monitor for WWW service events in the security event log, enter the following command:

```
watch ntevent 5001 0x00 Security All 'W3SVC' '*' 'Monitor IIS  
WWW Service Security Events' ''
```

### Monitoring IIS WWW Service Events in the Application Event Log

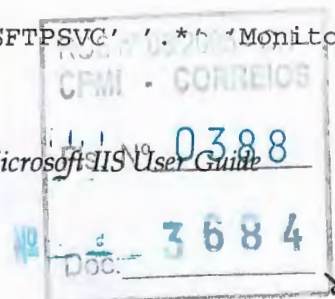
To monitor for WWW service events in the application event log, enter the following command:

```
watch ntevent 5002 0x00 Application All 'W3SVC' '*' 'Monitor  
IIS WWW Service Application Events' ''
```

### Monitoring IIS FTP Service Events in the System Event Log

To monitor for FTP service events in the system event log, enter the following command:

```
watch ntevent 5003 0x00 System All 'MSFTPSVC' '*' 'Monitor  
IIS FTP Service System Events' ''
```





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## Monitoring IIS FTP Service Events in the Security Event Log

To monitor for FTP service events in the security event log, enter the following command:

```
watch ntevent 5004 0x00 Security All 'MSFTPSVC' '*. *' 'Monitor
IIS FTP Service Security Events' ''
```

## Monitoring IIS FTP Service Events in the Application Event Log

To monitor for FTP service events in the application event log, enter the following command:

```
watch ntevent 5005 0x00 Application All 'MSFTPSVC' '*. *' 'Monitor
IIS FTP Service Application Events' ''
```

## Monitoring IIS SMTP Service Events in the System Event Log

To monitor for SMTP service events in the system event log, enter the following command:

```
watch ntevent 5006 0x00 System All 'SMTPSVC' '*. *' 'Monitor IIS
SMTP Service System Events' ''
```

## Monitoring IIS SMTP Service Events in the Security Event Log

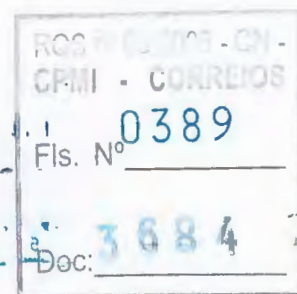
To monitor for SMTP service events in the security event log, enter the following command:

```
watch ntevent 5007 0x00 Security All 'SMTPSVC' '*. *' 'Monitor
IIS SMTP Service Security Events' ''
```

## Monitoring IIS SMTP Service Events in the Application Event Log

To monitor for SMTP service events in the application event log, enter the following command:

```
watch ntevent 5008 0x00 Application All 'SMTPSVC' '*. *'
'Monitor IIS SMTP Service Application Events' ''
```



*[Handwritten signature]*

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*Using the SystemEDGE Self-Monitoring Features*

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## **Monitoring IIS NNTP Service Events in the System Event Log**

To monitor for NNTP service events in the system event log, enter the following command:

```
watch ntevent 5009 0x00 System All 'NNTPSVC' '*. *' 'Monitor IIS  
NNTP Service System Events' ''
```

## **Monitoring IIS NNTP Service Events in the Security Event Log**

To monitor for NNTP service events in the security event log, enter the following command:

```
watch ntevent 5010 0x00 Security All 'NNTPSVC' '*. *' 'Monitor  
IIS NNTP Service Security Events' ''
```

## **Monitoring IIS NNTP Service Events in the Application Event Log**

To monitor for NNTP service events in the application event log, enter the following command:

```
watch ntevent 5011 0x00 Application All 'NNTPSVC' '*. *'  
'Monitor IIS NNTP Service Application Events' ''
```

## **Monitoring IIS Web Logon Failure Events for IIS WWW Service in the System Event Log**

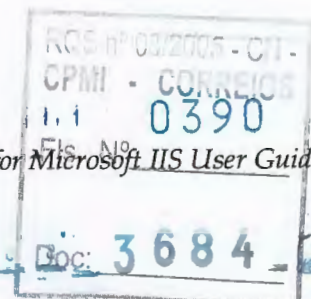
To monitor for Web Logon Failure events in the system event log, enter the following command:

```
watch ntevent 5012 0x00 System All 'W3SVC'  
'*. *Logon.*failure.*' 'Web Logon Failure' ''
```

## **Monitoring IIS FTP Logon Failure Events for IIS FTP Service in the System Event Log**

To monitor for FTP Logon Failure events in the system event log, enter the following command:

```
watch ntevent 5013 0x00 System All 'MSFTPSVC'  
'*. *Logon.*failure.*' 'FTP Logon Failure' ''
```





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## Monitoring IIS FTP Timeouts for IIS FTP Service in the System Event Log

To monitor for FTP Timeout events in the system event log, enter the following command:

```
watch ntevent 5014 0x00 System All 'MSFTPSVC'
'.*User.*timed-out.*' 'FTP User Time-out' ''
```

## Using the Windows NT RegPerf Extensions

This section outlines the use of SystemEDGE Windows NT RegPerf extension-monitoring capabilities to capture extended IIS-related information. The examples in this section show the SystemEDGE configuration-file commands that instruct the SystemEDGE agent to provide information on an individual Web site. You can use this variable with threshold monitoring to provide traps on specific user sites. Place these commands in the SystemEDGE configuration file, sysedge.cf.

Add the commands in the following sections to the sysedge.cf file to monitor these Windows NT RegPerf extensions. The following examples use values of 50 and 51; select values for your system that conform to local policies.

For more information, refer to the chapter on Windows NT Registry MIB objects in the *SystemEDGE Agent User Guide*.

### Monitoring IIS WWW 404 Errors

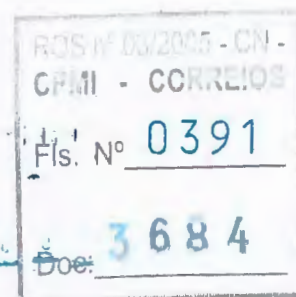
To monitor for WWW 404 errors on Web site A (WebA), enter the following command:

```
ntregperf 50 Integer Performance 'Web Service' 'Total Not
Found Errors' 'WebA'
```

### Monitoring Unauthorized ASP Requests

To monitor for ASP requests that are not authorized on Web site B (Web B), enter the following command:

```
ntregperf 51 Integer Performance 'Active Server Pages'
'Requests Not Authorized' 'WebB'
```



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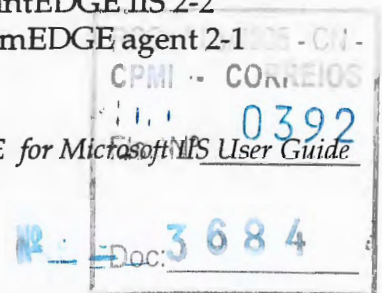
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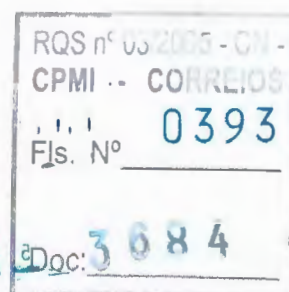
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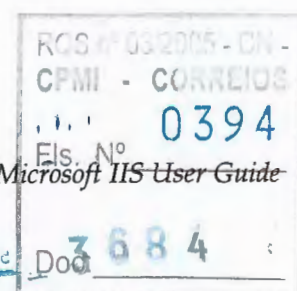
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December 2001

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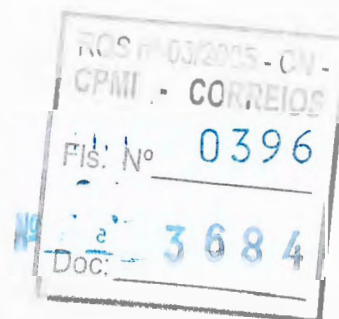
### Patent Information

U. S. Patent 5,615,323

Patents Pending

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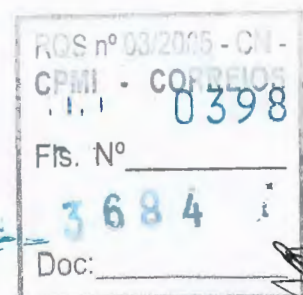
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## Preface

This guide explains how to install, license, and configure *eHealth Service Response* Release 1.2 Patchlevel 2. This release of *eHealth Service Response* supports the monitoring of common Internet applications on the following operating systems:

- Solaris 2.x and later
- HP-UX 10.x and 11.x
- IRIX 6.x
- AIX 4.2 and later
- Microsoft Windows 4.0, Windows 2000, and Windows XP
- Red Hat Linux 6.0 and later

This release of *eHealth Service Response* supports *eHealth SystemEDGE* Release 4.0 Patchlevel 3 and later.

## Audience

This guide is intended for the person who is installing and configuring *eHealth Service Response* to monitor the response time and availability of critical Internet applications. To use this guide, you must have a basic familiarity with the *SystemEDGE* agent, the Internet applications you are monitoring, and your host's operating system environment.

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## About This Guide

This section describes the changes and enhancements that have been made since the last release of this guide. It also includes the documentation conventions used in this guide.

## Revision Information

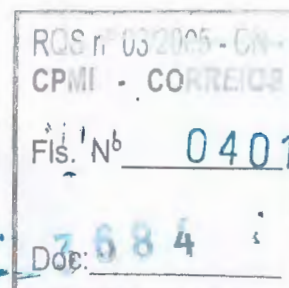
Since Release 1.2 Patchlevel 1, this guide has been updated to use a new documentation template and to include a glossary.

## Documentation Conventions

Table 1 lists the conventions used in this document.

Table 1. Documentation Conventions (Page 1 of 2)

Convention	Description
File or Directory Name	File or directory names.
code	System, code, or operating system command line examples.
<i>emphasis</i>	Emphasis and guide titles.
<b>enter</b>	Text that you must type exactly as shown.
Name	Text that defines menus, fields in dialog boxes, or keyboard keys.
New Term	A new term, that is, one that is being introduced.
<i>Variable</i>	Variable values that you substitute.
→	A sequence of menus or menu options. For example, <b>File</b> → <b>Exit</b> means "Choose <b>Exit</b> from the <b>File</b> menu."





Customer Support

Table 1. Documentation Conventions (Page 2 of 2)

Convention	Description
<b>NOTE</b> _____ _____	Important information, tips, or other noteworthy details.
<b>CAUTION</b> _____ _____	Information that helps you avoid data corruption or system failures.
<b>WARNING</b> _____ _____	Information that helps you avoid physical danger.

## Customer Support

If you need any assistance with eHealth Service Response, contact Customer Support at the following:

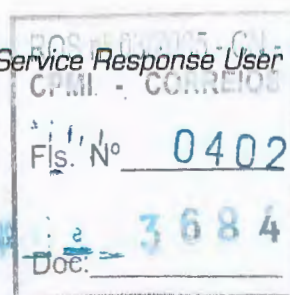
Phone: (888) 832-4340  
(508) 303-4300  
Fax: (508) 303-4343  
E-mail: support@concord.com  
Web site: http://www.concord.com

## Professional Services

If you need any assistance with customizing eHealth Service Response, contact Professional Services at the following:

Phone: (800) 851-8725 (Choose option 7)  
Fax: (508) 486-4555  
E-mail: proserv@concord.com  
Web site: http://www.concord.com

eHealth Service Response User Guide







# Introduction

## Introducing eHealth Service Response

eHealth Service Response is a plug-in to the SystemEDGE agent that monitors the response and availability of critical network services. Through the Service Response plug-in, the SystemEDGE agent performs real, active test transactions to measure response time and track availability for the following Internet applications from a user's perspective:

- Domain Name System (DNS)
- File Transfer Protocol (FTP)
- Hypertext Transfer Protocol (HTTP)
- Secure HTTP (HTTPS)
- Packet Inter-Network Groper (PING)
- Network News Transfer Protocol (NNTP)
- Post Office Protocol version 3 (POP3)
- Simple Mail Transfer Protocol (SMTP)
- Transmission Control Protocol connections (TCPConnect)

eHealth Service Response also enables you to define your own service tests through custom scripts and programs. You can perform these measurements from any system within the enterprise network.

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## Using eHealth Service Response

eHealth Service Response provides the flexibility you need to monitor service delivery. You can use eHealth Service Response to monitor all critical applications on a single system or to monitor a particular service or application across a group of systems. You can also modify Service Response tests in real time so that you always get the information you need.

The SystemEDGE agent provides configuration and reporting for the Service Response module through Simple Network Management Protocol (SNMP). Its self-monitoring and autonomous management capabilities work with the data that eHealth Service Response gathers.

You can configure eHealth Service Response and the SystemEDGE agent to do the following:

- Monitor the response times of various Web servers and send a warning when the servers become unavailable.
- Warn you of response slowdowns or unavailable applications.
- Test site access and issue an alarm if it detects a service disruption.

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## Performance Criteria Measured by eHealth Service Response

1

Table 2 shows the performance criteria that eHealth Service Response measures and reports for services.

Table 2. Performance Criteria for Each Service

Criterion	Description
Availability	Percentage of successful service requests.
Name Lookup Time	Time required to resolve the server name for the service to a network address. eHealth Service response provides values for Last Sample, Mean, Minimum, Maximum, and Sample Variance.
Connection Time	Time required to connect to the server providing this service. eHealth Service response provides values for Last Sample, Mean, Minimum, Maximum, and Sample Variance.
Transaction Time	Time required to perform the requested transaction, after the connection is established. For example, this value could be the amount of time required to download the Web page or check the mail status. eHealth Service response provides values for Last Sample, Mean, Minimum, Maximum, and Sample Variance.
Total Response Time	Total time required for the given service to correctly respond to the request. This value is simply the sum of the other three measurements: Name Lookup Time, Connection Time and Transaction Time. eHealth Service response provides values for Last Sample, Mean, Minimum, Maximum, and Sample Variance.



## Configuration Options

eHealth Service Response allows you to configure service measurement mechanisms to best meet the needs of your network environment. Table 3 shows the options that you can specify for each measurement entry.

**Table 3. Configuration Options for Each Measurement Entry**

Option	Description
Target Host	Host that provides the service to be tested.
Timeout	Time (in seconds) to wait before canceling the service request.
Sample Interval	Interval at which to perform the sample operation. For example, set this value to 60 to instruct Service Response to query the DNS server every 60 seconds.
Samples Per Interval	Number of samples to take at each interval. For example, set this option to 3 to instruct Service Response to PING the server three times in succession at each interval.
Sample Window	Time (in seconds) over which to make the statistics calculations. Service Response calculates the statistics over a sliding window of the most samples. For example, set this value to 600 to instruct Service Response to use all samples it took during the past 10 minutes to calculate the results.

For several of the services, eHealth Service Response requires additional configuration information to complete the sample transactions. Table 4 shows the additional information that is required for each service.

**Table 4. Information Required for Each Service (Page 1 of 2)**

Service	Additional Information Required
HTTP	Target URL [proxy host][username:user password:pass]
HTTPS	Target URL [proxy host][username:user password:pass]
SMTP	None
POP3	User name and password for valid POP user

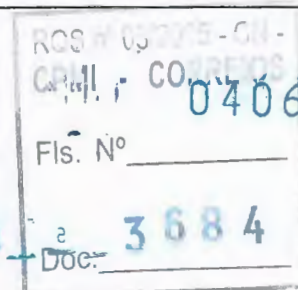






Table 4. Information Required for Each Service (Page 2 of 2)

Service	Additional Information Required
DNS	Internet name to lookup
NNTP	None
FTP	User name and password for valid FTP user
PING	Packet size
TCPCONNECT	Port number
CUSTOM	Name of script to run for each sample

1

## Using eHealth Service Response with AdvantEDGE View

You can use eHealth Service Response with AdvantEDGE View to run queries for monitoring the response and availability of Internet applications.

### To run an AdvantEDGE View Application query for Service Response:

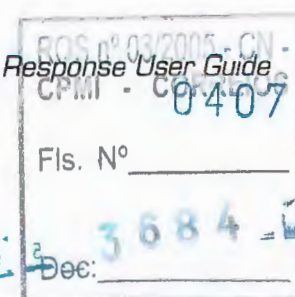
1. Select the target system or group from the **System or Group** list.
2. Select **Service Response** from the **Applications** list.
3. Click the **Applications** icon.



AdvantEDGE View runs the query for the specified application on the system or group you selected.

### NOTE

If you run a query for a group of systems, AdvantEDGE View may request additional information before running the query. For more information, refer to the AdvantEDGE View Web Help.





AdvantEDGE View displays the response time, service availability, and configuration details for all of the services that are running on the system or group that you selected. Figure 1 shows the Mean Service Response Times portion of the AdvantEDGE View Service Response query.

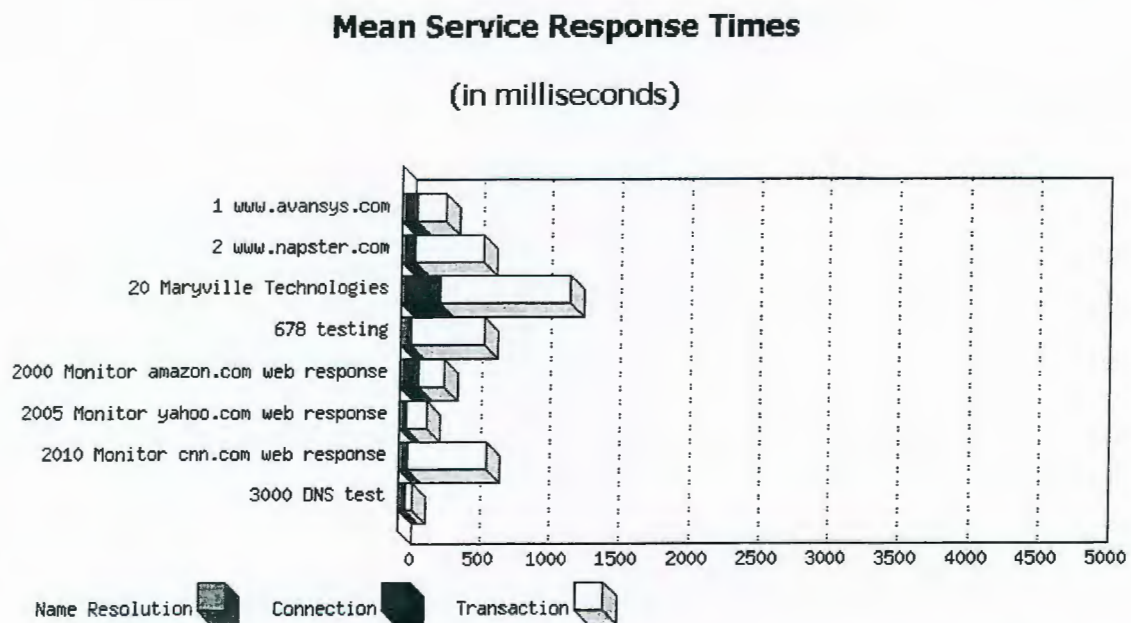
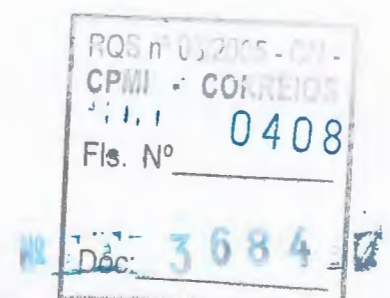


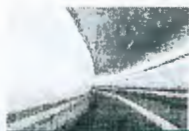
Figure 1. Sample Portion of AdvantEDGE View Service Response Query







2



# Installing eHealth Service Response

Throughout this guide, the term *Windows NT* encompasses *Windows NT 4.0*, *Windows 2000*, and *Windows XP*.

This chapter describes how to install and license eHealth Service Response for UNIX and Windows NT systems. If you are installing the software on a UNIX system, refer to “Installing eHealth Service Response on UNIX Systems.” If you are installing the software on a Windows NT system, refer to “Installing eHealth Service Response on Windows NT Systems” on page 2-18.

Before installing eHealth Service Response, you must install, license, and configure the SystemEDGE agent Release 4.0 Patchlevel 3 or later. For more information, refer to the *eHealth SystemEDGE User Guide*.

## Installing eHealth Service Response on UNIX Systems

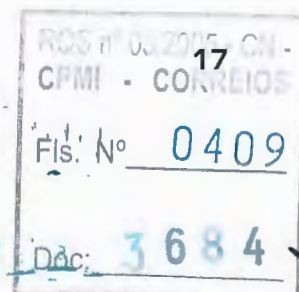
This section describes how to install eHealth Service Response on UNIX systems.

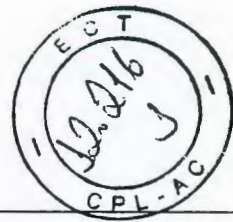
### Installing the Software

eHealth Service Response for UNIX systems is distributed as a tar file named `svcrsp.tar`.

#### To install the software:

1. Log in as root by entering **su** and the root password at the command prompt.





2. Verify that the **plugins** directory exists in the SystemEDGE agent distribution area. For most systems, the recommended directory is **/opt/EMPsysedge/plugins**. If that directory does not exist, verify that you have SystemEDGE agent Release 4.0 Patchlevel 3 or later installed, and then create the directory manually.
3. Insert the CD containing the software distributions into the CD-ROM drive and mount it on the partition **/cdrom**. For mounting instructions, refer to your system documentation. For example, enter the following command for Solaris systems:

```
mount -r -t hsfs /dev/sr0 /cdrom
```

4. Change directory to the eHealth Service Response home directory, and load the files from the CD-ROM. For example, enter the following commands for Solaris systems:

```
cd /opt/EMPsysedge/plugins  
tar xvf /cdrom/svcrsp/sol2/svcrsp.tar
```

eHealth Service Response is now installed.

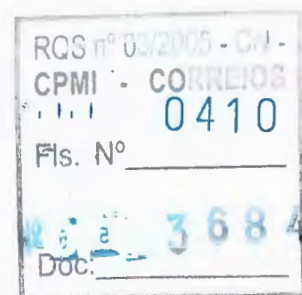
5. Review the installed files. For more information, refer to “eHealth Service Response Files” on page 2-20.
6. License eHealth Service Response. For more information, refer to “Licensing eHealth Service Response” on page 23.

## Installing eHealth Service Response on Windows NT Systems

This section describes how to install eHealth Service Response on Windows NT systems.

### Installing the Software

eHealth Service Response for Windows NT is distributed as a self-extracting executable named **svcrsp.exe**.







**To install eHealth Service Response:**

1. Log on to the Windows NT system as **administrator**.
2. Select **Start** → **Programs** → **Command Prompt**.
3. Insert the CD-ROM that contains the Concord software distributions into the CD-ROM drive.

2

Windows NT automatically mounts the drive using the CD-ROM drive's corresponding drive letter. The drive letter is specific to your system and depends on the number and types of disks attached to your system. Step 5 in this procedure uses *D:* as the CD-ROM drive. Modify that step if necessary to use the drive letter for your system's CD-ROM drive.

4. Determine which directory you want to use as the installation directory for eHealth Service Response. If the SystemEDGE agent is installed in *C:\sysedge*, the recommended installation directory is *C:\sysedge\plugins*.
5. Run the self-extracting executable by typing the following at the command prompt:

***D:\svcrsp\ntx86\svcrsp.exe -dir C:\sysedge\plugins***

where *D:* is the CD-ROM drive for your system, and *C:\sysedge\plugins* is the installation directory.

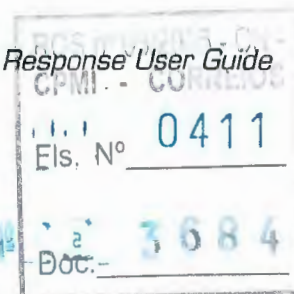
**NOTE**

The *-dir* option instructs the self-extracting executable to recreate the intended sub-directory hierarchy described throughout this guide. This command places the distribution in a *svcrsp* subdirectory within the specified target directory (for example, *C:\sysedge\plugins\svcrsp*).

eHealth Service Response is now installed.

6. Review the installed files. For more information, refer to "eHealth Service Response Files" on page 2-20.
7. License eHealth Service Response. For more information, refer to "Licensing eHealth Service Response" on page 23.

*eHealth Service Response User Guide*





## eHealth Service Response Files

This section describes the files installed with eHealth Service Response.

### Files Installed for UNIX Systems

Table 5 shows the files that the eHealth Service Response installation program installs on UNIX systems.

**Table 5. Files Installed on UNIX Systems**

File	Description
collector.exe	eHealth Service Response collector program.
svcrsp.asn1	eHealth Service Response MIB specification.
svcrsp.cf.example	Sample configuration file for eHealth Service Response.
svcrsp.pdf	<i>eHealth Service Response User Guide.</i>
svcrsp.so	Shared library module for eHealth Service Response.
svcwatch	Configuration utility program for eHealth Service Response.
svcwatch.1	Manual page that explains how to use the svcwatch utility.

### Files Installed for Windows NT Systems

Table 6 shows the files that the eHealth Service Response installation program installs on Windows NT systems.

**Table 6. Files Installed on Windows NT Systems (Page 1 of 2)**

File	Description
collector.exe	eHealth Service Response collector program.
svcrsp.asn1	eHealth Service Response MIB specification.
svcrsp.dll	Dynamic link library (DLL) module for eHealth Service Response.
svcrsp.cf.example	Sample configuration file for eHealth Service Response.

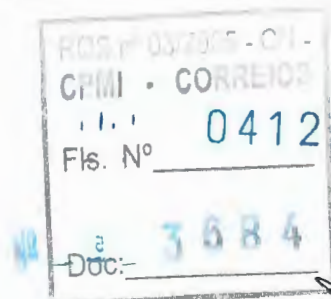






Table 6. Files Installed on Windows NT Systems (Page 2 of 2)

File	Description
svcrsp.pdf	<i>eHealth Service Response User Guide.</i>
svcwatch.exe	Configuration utility program for eHealth Service Response.
svcwatch.txt	Text file that explains how to use the svcwatch utility.

2

## Files Created for UNIX and Windows NT Systems

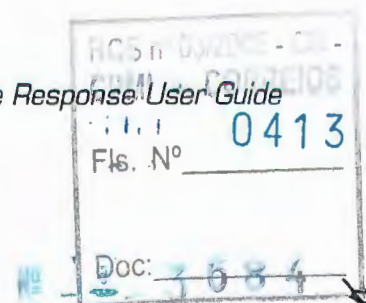
eHealth Service Response also creates two files while it is running. It creates these files in the directory that contains the executables and configuration files. Table 7 shows the files that eHealth Service Response creates.

Table 7. Files Created for UNIX and Windows NT Systems

File Name	Description
svcrsp.dat	Shared data file used by the collector.
svcrsp.lck	Lock file for access control.

## Configuring eHealth Service Response Startup

You must edit the `sysedge.cf` file to use the correct shared library file for your system and to enable the SystemEDGE agent to load eHealth Service Response. You can use the `sysedge_plugin` keyword in the `sysedge.cf` configuration file to specify which plug-in modules the SystemEDGE agent will load at system initialization. By default, the SystemEDGE agent does not load any plug-ins at initialization, but you can edit the `sysedge.cf` file to configure the agent to load any plug-ins that you have installed.





The `sysedge.cf` file is located in your system directory by default; for example, it is located in the `/etc/sysedge.cf` directory on UNIX systems and in the `C:\winnt\system32` directory on Windows NT systems. For more information about the `sysedge.cf` file, refer to the *eHealth SystemEDGE User Guide*.

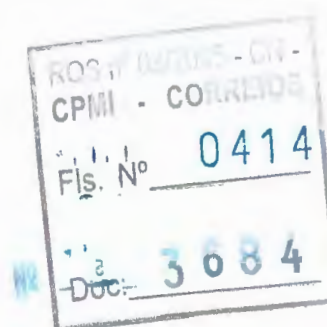
#### NOTE

To configure the SystemEDGE agent to start eHealth Service Response, you must provide the complete pathname to the shared library file for your version of eHealth Service Response. The path depends on the location you selected when you installed eHealth Service Response.

Table 8 shows the recommended path names for the shared library file for each operating system. Add the command shown in the right column to your `sysedge.cf` file to instruct the SystemEDGE agent to load eHealth Service Response at system initialization.

Table 8. `sysedge.cf` Entries

Platform	Recommended <code>sysedge.cf</code> Entry
Solaris SPARC (32-bit)	<code>sysedge_plugin /opt/EMPsysedge/plugins/svcrsp/svcrsp.so</code>
Solaris SPARC (64-bit)	<code>sysedge_plugin /opt/EMPsysedge/plugins/svcrsp/svcrsp-sparcv9.so</code>
Windows NT, Windows 2000, or Windows XP (x86)	<code>sysedge_plugin \sysedge\plugins\svcrsp\svcrsp.dll</code>
HPUX 10.x and 11.x	<code>sysedge_plugin /opt/EMPsysedge/plugins/svcrsp/svcrsp.so</code>
Linux	<code>sysedge_plugin /opt/EMPsysedge/plugins/svcrsp/svcrsp.so</code>
AIX	<code>sysedge_plugin /usr/lpp/EMPsysedge/plugins/svcrsp/svcrsp.so</code>
IRIX	<code>sysedge_plugin /opt/EMPsysedge/plugins/svcrsp/svcrsp.so</code>







## Licensing eHealth Service Response

Like the SystemEDGE agent, eHealth Service Response utilizes a host-based license method. Copies of eHealth Service Response can run only on systems that possess a valid license key. This license key is separate from the one used for the SystemEDGE agent.

2

The first time that you attempt to start the SystemEDGE agent after installing eHealth Service Response, the agent displays a message stating that it could not find a valid license for eHealth Service Response. It then provides you with a **public key** that is used to generate a permanent license key for your host machine.

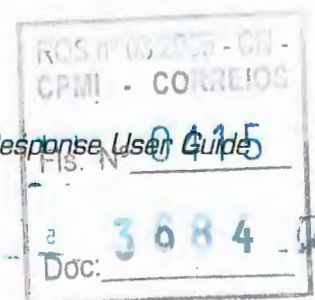
A license key is composed of four space-separated, 8-character sequences, totaling 32 characters. The `sysedge.lic` file contains the license for eHealth Service Response, as well as the SystemEDGE agent license and licenses for any eHealth application insight modules (AIMs) that you have installed. For an example, refer to the sample license file in “Sample License File” on page 30.

### Obtaining a License

To obtain a license, you can do any of the following:

- Run the Concord-supplied `licenseutil.pl` script.
- Run the `licenseme.exe` license utility.
- Use AdvantEDGE View to receive an SNMP license trap or to query and license the plug-in without a trap. For more information, refer to “Generating a License through AdvantEDGE View Event Processing” on page 27 or “Generating a License through AdvantEDGE View Host Administration” on page 29.
- Send an e-mail request to [licenses@concord.com](mailto:licenses@concord.com) and place the returned license key in the appropriate license file.

eHealth Service Response User Guide





**NOTE**

Always include the user name in license requests that you send through e-mail.

- Complete the online license form through the Internet, as described in the next section, "Generating the License through the Web-based License Form."

For more information about licensing, refer to the *eHealth SystemEDGE User Guide*.

## Generating the License through the Web-based License Form

This section describes how to generate the license using the Web-based license form.

**NOTE**

If you are using an evaluation copy of eHealth Service Response, you must request a temporary license that will enable it to operate during the evaluation period.

### To generate a license for eHealth Service Response:

1. Start the SystemEDGE agent.

Do the following for UNIX systems:

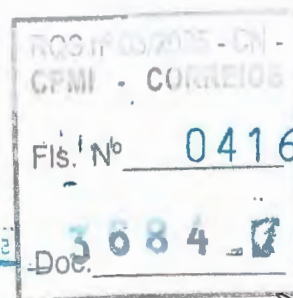
- a. Log in as **root**.
- b. Change directory (cd) to **/opt/EMPsysedge**.
- c. Enter the following:

```
./bin/sysedge -b
```

Do the following for Windows NT systems:

- a. Log in as **administrator**.
- b. Open a command prompt window, and enter the following:

```
C:\sysedge\setup -l
```







The SystemEDGE agent displays a message indicating that you need a license for the eHealth Service Response module on this system. It displays a message similar to the following:

2

SystemEDGE Version 4.0 Patchlevel 3

Copyright 2001 by Concord Communications, Inc.

Please contact Concord Communications, Inc. to obtain a license

<http://www.concord.com/support>, Email: [license@concord.com](mailto:license@concord.com)

Provide this: svcrsp pluto SunOS 5.8 8035b1f8f643ab43 1.2 Patchlevel 2

2. Using a Web browser, go to the licensing Web site at <http://license.concord.com>, and select the **Create License** option that matches your use of the module:

- **Create SystemEDGE/AdvantEDGE Eval License** (if you are evaluating the module or are a Concord partner or reseller)
- **Create SystemEDGE Outsource License** (if you are outsourcing the module)
- **Create SystemEDGE/AdvantEDGE License** (if you have purchased the module)

**NOTE**

You must specify a user name and password to access the license form.

If you do not have Web access, fill out the license request form, /config/license.txt (available as part of the eHealth Service Response installation), with the complete string generated by the SystemEDGE agent, and e-mail the completed form to [licenses@concord.com](mailto:licenses@concord.com).

3. Fill out the license form, entering the information that was printed by the SystemEDGE agent. You must supply the following information:

- Name
- E-mail address

eHealth Service Response User Guide

RCS: 002001-01 -  
CPMI - CORREION  
Fils. N° 0417  
Doc: 3684



- Software version number (1.2 in the example on page 25)
- Patchlevel (2 in the example on page 25)
- System name (pluto in the example on page 25)
- Operating system name (SunOS in the example on page 25)
- Operating system version (5.8 in the example on page 25)
- System identifier (8035b1f8f643ab43 in the example on page 25)

**NOTE**

Select the option for *eHealth Service Response* from the product list on the licensing form.

After you submit the license request form, the Concord Web server generates a license and displays it on your Web browser. It also e-mails the license to the contact person in your organization.

4. Copy the license into the `sysedge.lic` file (located in `/etc` or `C:\winnt\system32`), and save that file.
5. Restart the SystemEDGE agent.

For UNIX systems, enter the following:

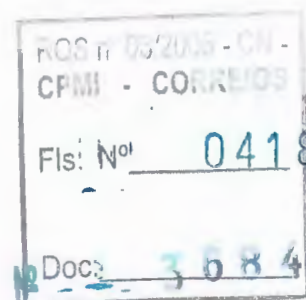
```
./bin/sysedge -b
```

For Windows NT systems, stop and start the Windows NT Master agent by entering the following:

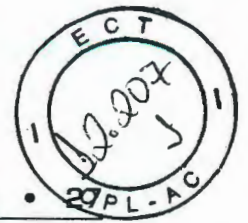
```
C:\net stop snmp
```

```
C:\net start snmp
```

*eHealth Service Response* is now licensed and ready to use.







## Generating a License through AdvantEDGE View Event Processing

In order to use AdvantEDGE View event processing to license eHealth Service Response, your system must meet the following requirements:

2

- You must be using SystemEDGE Release 4.0 Patchlevel 3 or later with AdvantEDGE View.
- You must configure the SystemEDGE agent to send SNMP traps to AdvantEDGE View. For more information, refer to the section on configuring the SystemEDGE agent in the *eHealth SystemEDGE User Guide*.
- You must configure the SystemEDGE agent with a read-write community so that AdvantEDGE View can issue an SNMP Set to transmit the license key to it. For more information, refer to the section on configuring the SystemEDGE agent in the *eHealth SystemEDGE User Guide*.
- Your AdvantEDGE View system must have access to the Internet, either directly or through a Web proxy.
- The AdvantEDGE View user who is generating the license must have either write or admin permissions.

### To generate a license through AdvantEDGE View:

1. Start the SystemEDGE agent with eHealth Service Response in unlicensed mode. SystemEDGE sends a license trap to AdvantEDGE View for that module.



2. Start AdvantEDGE View, and click the **Events** icon to display the Event Processing screen.



AdvantEDGE View displays a license trap for the system that requires a license.

3. Click the index number for that system to view the Trap Details form for **License Software** to display the AdvantEDGE View Software Licensing form.

ROS n° 057005 - C.J.
CPMI - CORALIO
Fils. N° 0419
N° 3684
Doc:



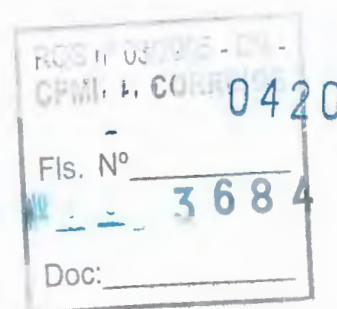
4. Complete the licensing form, and click **Get License**.

Software Licensing, System <i>SystemName</i>	
<b>License Account Info:</b>	
Username	<input type="text" value="user"/>
Password	<input type="password"/>
Name	<input type="text" value="AdvantEDGE View Usse"/>
Company	<input type="text" value="Company"/>
Email	<input type="text" value="user@company.com"/>
Phone	<input type="text" value="555.555.555"/>
CustomerID	<input type="text" value="666"/>
License Type	<input type="text" value="Permanent"/>
License Duration	<input checked="" type="radio"/> N/A <input type="radio"/> 3 months <input type="radio"/> 6 months <input type="radio"/> 9 months <input type="radio"/> 12 months <small>(Only applicable if leasing license)</small>
End-user Company	<input type="text"/> <small>(Only applicable if leasing license)</small>
<input type="button" value="Get License"/> <input type="button" value="Clear"/>	

**NOTE**

If you have configured AdvantEDGE View preferences, AdvantEDGE View fills in all of the information (except password) on this form.

AdvantEDGE View contacts the Web-based license server, obtains a license for eHealth Service Response, and issues an SNMP Set to the target SystemEDGE agent to inform it of the new software license key.







## Generating a License through AdvantEDGE View Host Administration

You can also license systems through AdvantEDGE View Host Administration.

2

To access Host Administration:



1. Start AdvantEDGE View, and click the **Administration** icon. AdvantEDGE View displays the Administration page.



2. Click the **Host Administration** icon. AdvantEDGE View displays the host list.

SystemEDGE Host Configuration

System Name	Community	Read/Write Community	Port	Timeout	Retries
aviewdemo	public		161	2	2
mailserver	public		161	6	3
nethealth	public		161	3	3
ntclient	public		161	6	3
ntserver	public		161	3	2
unixclient	public		161	6	3
unixserver	public		161	3	3
win2kclient	public		161	5	3
www	public		161	6	3

Add New Host

3. Click the name of the system that you want to license from the **System Name** column. AdvantEDGE View displays the Modify Host form.



Modify Host view:		
Community:	<input type="text" value="public"/>	Read community string for use with this host
Read/Write Community:	<input type="text"/>	Read/Write community string for use with this host
Port:	<input type="text" value="161"/>	UDP Port to use with this host (e.g. 161 or 1691)
Timeout:	<input type="text" value="5"/>	Timeout value (in seconds) to use with this host (e.g. 3)
Retries:	<input type="text" value="3"/>	Number of times to retry an operation on this host (e.g. 3)
<input type="button" value="Update Host"/> <input type="button" value="License Host/Software"/> <input type="button" value="Delete Host"/>		

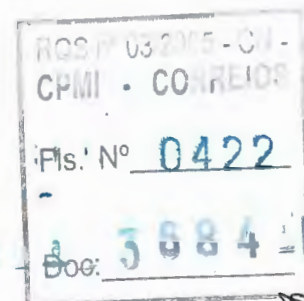
- Click **License Host/Software** to display the licensing form.
- Select the product you want to license from the **Product** list, and then click **License Software**.

AdvantEDGE View contacts the Web-based license server, obtains a license for the software, and issues an SNMP Set to the target SystemEDGE agent, informing it of the new software license key.

### Sample License File

The following is a sample SystemEDGE agent license file. A pound character (#) in column 1 indicates that the entire line is a comment.

```
# license file for SystemEDGE Agent
# Concord Communications, Inc.
# http://www.concord.com
#
# file /etc/sysedge.lic or %SystemRoot%\system32\sysedge.lic
# A valid license key has four parts of 8 characters per part
# parts are separated by space(s) with one license key per line
# sysedge jupiter sol2 5.8 807cb1da007cb1da 4.1 PL 1
e13311d3 0F2a7cb1 abC512dc fF8C923a
# svcrsp pluto SunOS 5.8 807cb1da007cb1da 1.2 PL 2
a7943fde 098a87ij a4kiuf39 afafEkj4
```







## Configuring eHealth Service Response

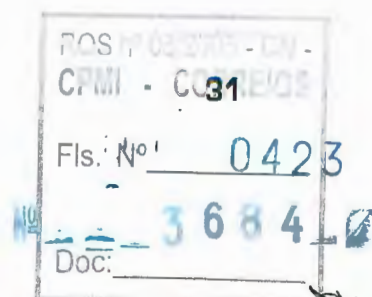
This chapter explains how to configure and use eHealth Service Response.

### The Service Response Table

eHealth Service Response is implemented as an SNMP table in the Systems Management MIB. The Service Response table provides information about each of the services that the SystemEDGE agent is currently monitoring. Each row of the table represents a single monitored service. You can specify as many service monitor entries (rows) as necessary for your Service Response implementation. For each entry, the table provides information such as the service being monitored, specific arguments (for example, the URL to query), how often the agent checks the service, and the measurement results.

In addition to the Service Response table, eHealth Service Response provides two additional MIB objects:

- svcRspVersion, which reports the eHealth Service Response version information.
- svcRspPID, which reports the process identifier of the eHealth Service Response collector process.





All MIB objects that are related to eHealth Service Response exist at object identifier (OID) branch 1.3.6.1.4.1.546.16.6 in the Systems Management MIB. The MIB is defined in the `svcrsp.asn1` file, which is installed as part of the eHealth Service Response installation. Table 9 shows the columns of the Service Response table.

**Table 9. Service Response Table (Page 1 of 5)**

MIB Object	Permissions	Description
svcRspTableIndex	Read-Only	An integer (1 through MAXINT) that indicates the row index for this entry.
svcRspTableDescr	Read-Only	A textual description of the row entry. This field is entirely for the user and is not interpreted by the software.
svcRspTableSvc	Read-Write	<p>An integer that indicates the type of service to be sampled. The following are possible values:</p> <ul style="list-style-type: none"> <li>• NNTP(1)</li> <li>• DNS(2)</li> <li>• POP3(3)</li> <li>• HTTP(4)</li> <li>• FTP(5)</li> <li>• SMTP(6)</li> <li>• PING(7)</li> <li>• TCPCONNECT(8)</li> <li>• CUSTOM(9)</li> <li>• HTTPS(10)</li> </ul> <p>Additional values will be defined in the future as new services are implemented.</p>

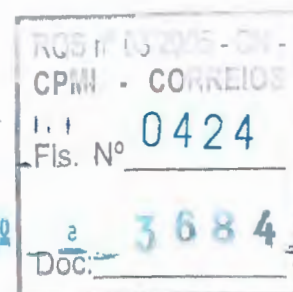






Table 9. Service Response Table (Page 2 of 5)

MIB Object	Permissions	Description
svcRspTableArgs	Read-Write	<p>A quoted string (0 through 128 characters) that specifies the service-specific arguments that the module uses for measuring purposes. The following are examples of service arguments:</p> <ul style="list-style-type: none"><li>• DNS - dns-server hostname</li><li>• HTTP - Target URL [proxy host][username:user password:pass]</li><li>• HTTPS - Target URL [proxy host][username:user password:pass]</li><li>• FTP - ftp-server username passwd</li><li>• POP3 - pop3-server username passwd</li><li>• NNTP - nntp-server</li><li>• SMTP - smtp-server</li><li>• PING - target-host [size]</li><li>• TCPCONNECT - target-host port-number</li><li>• CUSTOM - script-name</li></ul>
svcRspTableInterval	Read-Write	An integer value (30 through MAXINT) that indicates how often (in seconds) the agent should measure the service response. For example, the value 30 instructs the agent to sample the service every 30 seconds. This value <i>must</i> be a multiple of 30 seconds
svcRspTableSamplesPerInterval	Read-Write	An integer value (1 through MAXINT) that indicates the number of times that the agent should perform the sample query at each interval. For example, you can specify 3 to perform a PING measurement three times each interval.
svcRspTableTimeout	Read-Write	An integer value (1 through MAXINT) that indicates the time (in seconds) that this measurement should wait for a response. A sample that does not return within the timeout value is recorded as "unavailable" for the purposes of the availability measurement.

3

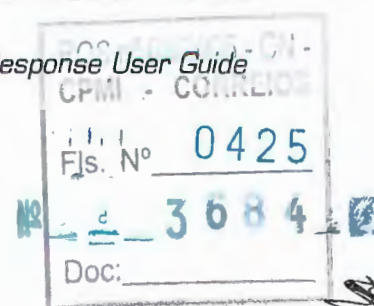




Table 9. Service Response Table (Page 3 of 5)

MIB Object	Permissions	Description
svcRspTableStatsWindow	Read-Write	An integer value (1 through MAXINT) that indicates the time in seconds to be used in the statistical calculations. For instance, a value of 1800 specifies that the agent will calculate all statistical results (for example, mean and availability) over the last 30 minutes.
svcRspTableStatus	Read-Write	Row status; one of the following values: <ul style="list-style-type: none"><li>• active</li><li>• notInService</li><li>• notReady</li><li>• createAndGo</li><li>• createAndWait</li></ul> These values are identical in meaning to the SNMPv2 SMI RowStatus textual convention. Normally, a row is either active or notInService.
svcRspTableLastUpdate	Read-Only	Time (based on sysUpTime) at which the agent last sampled this service. A value of 0 indicates that this service has not yet been sampled.
svcRspTableNumSamples	Read-Only	Total number of samples that the agent has taken for this response time entry since the row was initialized.
svcRspTableTotalLastSample	Read-Only	Last recorded total response time (in milliseconds) for this service. A value of 0 indicates that the last sample failed to respond within the given timeout.
svcRspTableTotalMin	Read-Only	Smallest successful total response time (in milliseconds) for this service during the current measurement window.
svcRspTableTotalMax	Read-Only	Largest successful total response time (in milliseconds) for this service during the current measurement window.

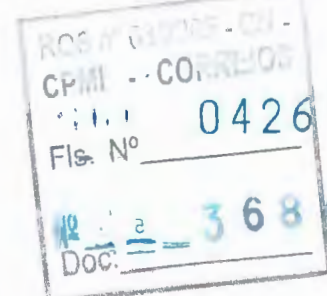






Table 9. Service Response Table (Page 4 of 5)

MIB Object	Permissions	Description
svcRspTableTotalMean	Read-Only	Sample mean of the successful total response times (in milliseconds) for this service during the current measurement window.
svcRspTableTotalVariance	Read-Only	Sample variance of the successful total response times (in milliseconds) for this service during the current measurement window.
svcRspTableTotalAvailability	Read-Only	Percentage of the total response measurement attempts that were successful during the current measurement window.
svcRspTableNameLastSample	Read-Only	Last recorded name lookup time (in milliseconds) for this service. A value of 0 indicates that the last sample failed to respond within the given timeout.
svcRspTableNameMin	Read-Only	Smallest successful name lookup time (in milliseconds) for this service during the current measurement window.
svcRspTableNameMax	Read-Only	Largest successful name lookup time (in milliseconds) for this service during the current measurement window.
svcRspTableNameMean	Read-Only	Sample mean of the successful name lookup times (in milliseconds) for this service during the current measurement window.
svcRspTableNameVariance	Read-Only	Sample variance of the successful name lookup times (in milliseconds) for this service during the current measurement window.
svcRspTableConnLastSample	Read-Only	Last recorded connection time (in milliseconds) for this service. A value of 0 indicates that the last sample failed to respond within the given timeout.
svcRspTableConnMin	Read-Only	Smallest successful connection time (in milliseconds) for this service during the current measurement window.

3

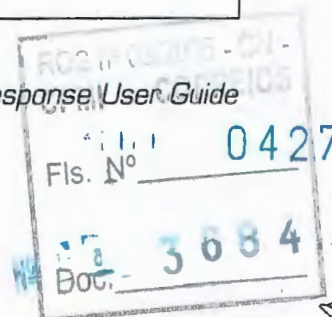
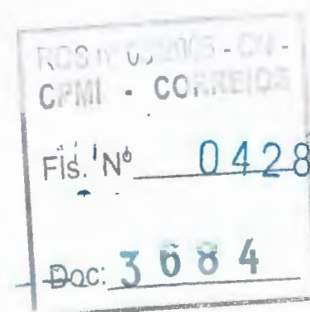




Table 9. Service Response Table (Page 5 of 5)

MIB Object	Permissions	Description
svcRspTableConnMax	Read-Only	Largest successful connection time (in milliseconds) for this service during the current measurement window.
svcRspTableConnMean	Read-Only	Sample mean of the successful connection times (in milliseconds) for this service during the current measurement window.
svcRspTableConnVariance	Read-Only	Sample variance of the successful connection times (in milliseconds) for this service during the current measurement window.
svcRspTableTranLastSample	Read-Only	Last recorded transaction time (in milliseconds) for this service. A value of 0 indicates that the last sample failed to respond within the given timeout.
svcRspTableTranMin	Read-Only	Smallest successful transaction time (in milliseconds) for this service during the current measurement window.
svcRspTableTranMax	Read-Only	Largest successful transaction time (in milliseconds) for this service during the current measurement window.
svcRspTableTranMean	Read-Only	Sample mean of the successful transaction times (in milliseconds) for this service during the current measurement window.
svcRspTableTranVariance	Read-Only	Sample variance of the successful transaction times (in milliseconds) for this service during the current measurement window.







## Sample Entry in the Service Response Table

The following shows a sample entry in the Service Response table for monitoring the HTTP service.

Index	Service	Arguments	Interval	SamplesPerInterval	Timeout	StatsWindow	Status
10	HTTP(4)	"http://www.empire.com"	60	1	10	3600	ACTIVE(1)

3

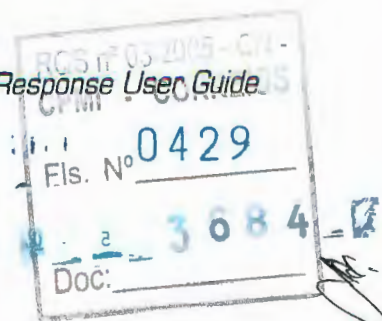
The entry is the 10th row in the table, and its purpose is to monitor the HTTP service by retrieving the Web page that is located at <http://www.empire.com>. The agent performs this query once every 60 seconds with a timeout of 10 seconds. The value of 3600 in the statistics window column indicates that the agent uses only the last 3600 seconds (or 1 hour) of samples to calculate statistical results. The current status of this row is active.

## Assigning Entry Rows for the Service Response Table

The `svcRspTableIndex` column is the row index of the Service Response table, and it acts as a key field to distinguish rows in the table. You may choose, as a matter of local policy, to reserve a block of rows to be used solely for system administration. By reserving a block of rows, you can define a consistent set of conditions (row entries) to be monitored across all systems such that the same condition is defined in the same row number on each of the systems. For example, you might use row 11 (`svcRspTableIndex` = 11) to define an entry for monitoring the DNS service throughout the enterprise. You can then distribute this configuration to every system so that they all use row 11 to measure the DNS service.

### To reserve a block of rows:

1. Decide on a block of rows that you want to reserve for your use in the Service Response table.





2. Define a set of row entries (services to be measured) in the `svcrsp.cf` configuration file (in the block of rows you decided to reserve). For more information, refer to the next section, “Configuring the Service Response Table.”
3. Distribute the `svcrsp.cf` configuration file to all systems on which eHealth Service Response is installed.
4. Require end users to avoid your block of rows when defining their own Service Response table entries.

## Configuring the Service Response Table

You can control the services that eHealth Service Response monitors by adding, deleting, or modifying entries in the Service Response table.

You can configure the Service Response table in one of the following ways:

- **Dynamically.** Use SNMP commands from a management station to modify the table. For more information, refer to the next section, “Dynamic Configuration During Operation.” For information about how to use the SystemEDGE agent `svcwatch` utility to dynamically configure the agent to monitor MIB variables, refer to “Using the `svcwatch` Utility” on page 52.
- **At start-up initialization.** Specify the process attributes to monitor through the `svcrsp.cf` configuration file. For more information, refer to “Initial Configuration During Start-Up” on page 39.
- **Through AdvantEDGE View configuration.** For more information, refer to the AdvantEDGE View Web Help.

### Dynamic Configuration During Operation

You can use your network management system (NMS) to issue SNMP SetRequest messages to the agent to modify the entries in the Service Response table. The agent uses the SNMPv2 SMI Row-Status textual convention for creating, deleting, and modifying rows in the table.







Each time the Service Response table is successfully modified, the agent updates the `svcrsp.cf` file to record the changes so that when the agent is restarted, it starts up with the same Service Response table configuration as it had when it was stopped.

#### NOTE

Service Response table entries are saved to the `svcrsp.cf` configuration file so that any changes made during the operation of the agent are preserved across agent and system restarts. You can edit the `svcrsp.cf` file *only* when the SystemEDGE agent is not running.

3

## Initial Configuration During Start-Up

On start-up, eHealth Service Response reads the `svcrsp.cf` file. You can use this file to specify the services that you want the agent to measure. If you are configuring several systems to measure services throughout an enterprise, you can create a single `svcrsp.cf` file and distribute that file to all of your systems.

The Service Response configuration file consists of a series of entries that are delimited by brackets (`{ }`). Within each entry, fields exist on separate lines. The format for an entry is as follows:

```
{  
    Index  
    Description  
    Service  
    Arguments  
    Interval  
    SamplesPerInterval  
    Timeout  
    Window Size  
    SNMP Row Status  
}
```

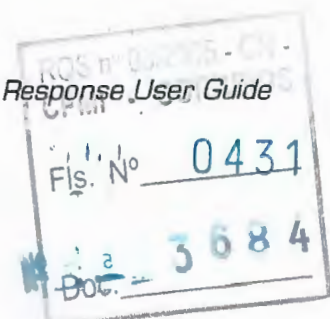
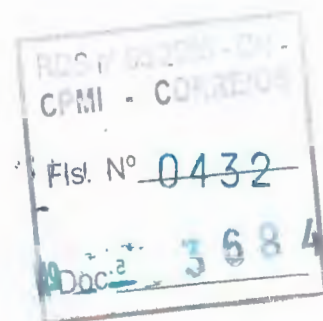




Table 10 describes each field of an entry in the svcrsp.cf file.

**Table 10. Configuration File Entries**

Entry	Description
Index	Row (index) of the Service Response table for this entry. Each row in the Service Response table is uniquely identified by an index number.
Description	Quoted string of up to 128 characters that describes the entry.
Service	Name of the service to be tested. Currently one of the following: <ul style="list-style-type: none"> <li>• NNTP</li> <li>• DNS</li> <li>• POP3</li> <li>• HTTP</li> <li>• HTTPS</li> <li>• FTP</li> <li>• SMTP</li> <li>• PING</li> <li>• TCPCONNECT</li> <li>• CUSTOM</li> </ul>
Arguments	Quoted string of up to 128 characters that contains the service-specific parameters.
Interval	Measurement interval in seconds. This value must be a multiple of 30.
SamplesPerInterval	Number of samples to be taken at each interval.
Timeout	Sample timeout in seconds.
Window Size	Time window in seconds to use for calculating statistical results.
Row Status	SNMP row status for this row. Values of active or notInService are recommended.







## Sample Entries for the svcrsp.cf Configuration File

This section contains several examples for using eHealth Service Response to monitor services through entries in the svcrsp.cf file.

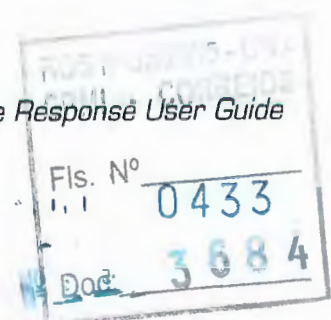
### Measuring Web Server Response (HTTP)

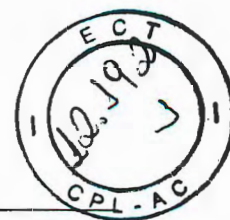
The following entry instructs eHealth Service Response to monitor the amount of time required to access the main Web page at [www.cnn.com](http://www.cnn.com).

3

```
{
    6
    "Test CNN Web Server"
    HTTP
    "http://www.cnn.com/"
    60
    1
    20
    300
    active
}
```

The entry is created as row 6 in the Service Response table. The agent tests the service once every 60 seconds and waits up to 20 seconds for a successful response. The agent calculates statistics over the last 300 seconds (5 minutes). This entry is active.



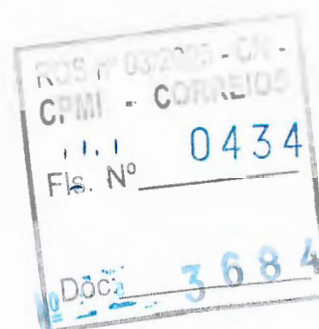


## Measuring Web Server Response by Proxy (HTTP)

The following entry instructs eHealth Service Response to monitor the amount of time required to access the main Web page at [www.weather.com](http://www.weather.com). In this case, the testing system does not access the site directly; instead, it uses the Web proxy host myproxy that is running on port 8080.

```
{  
  6  
  "Test Weather Channel Server Via Proxy"  
  HTTP  
  "http://www.weather.com/ myproxy:8080"  
  60  
  1  
  20  
  300  
  active  
}
```

The entry is created as row 6 in the Service Response table. The agents tests the service once every 60 seconds and waits up to 20 seconds for a successful response. The agent calculates statistics over the last 300 seconds (5 minutes). This entry is active.







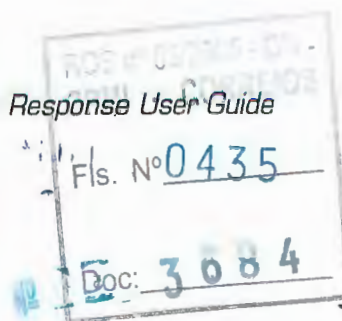
## Measuring Secure Web Server Response (HTTPS)

The following entry instructs eHealth Service Response to monitor the amount of time required to access the main Web page at charge.mycredit.

```
{
    12
    "Test Secure Web Server"
    "https://charge.mycredit/commit.exe username:empire password:tech"
    60
    1
    20
    300
    active
}
```

3

The entry is created as row 12 in the Service Response table. The agent tests the service once every 60 seconds and waits up to 20 seconds for a successful response. The agent calculates statistics over the last 300 seconds (5 minutes). This entry is active.



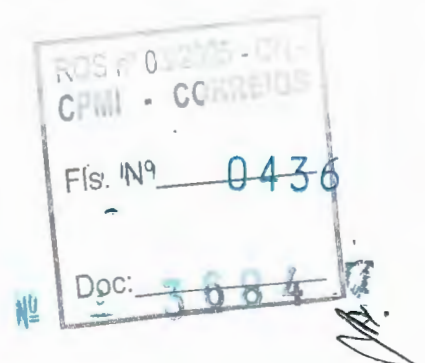


## Measuring Domain Name Service Response (DNS)

The following entry instructs eHealth Service Response to monitor the amount of time required to resolve the IP address for `www.cnn.com` using the name server at `194.13.12.92`. In this case, the agent is testing the response time for lookups at host `194.13.12.92`. In your environment, use the IP address of your local DNS server. The actual name that is being resolved is not the most critical parameter.

```
{
  11
  "Test DNS Lookup"
  DNS
  "194.13.12.92 www.cnn.com"
  300
  1
  10
  86400
  active
}
```

The entry is created as row 11 in the Service Response table. The agent tests the service once every 300 seconds (5 minutes) and waits up to 10 seconds for a successful response. The agent calculates statistics over the last 86,400 seconds (1 day). This entry is active.







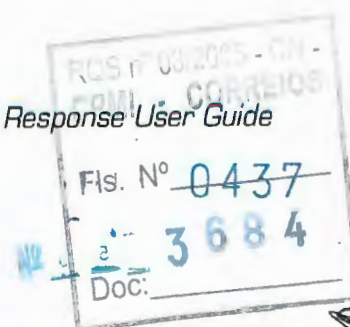
## Measuring Sendmail Response (SMTP)

The following entry instructs eHealth Service Response to monitor the amount of time required to connect to the SMTP service on host mailserver.yourdomain and to perform a null transaction. This test is a good measure of the baseline time that is required to send a mail message.

3

```
{  
  7  
  "Test Sendmail Response"  
  SMTP  
  "mailserver.yourdomain"  
  60  
  1  
  10  
  300  
  active  
}
```

The entry is created as row 7 in the Service Response table. The agent tests the service once every 60 seconds and waits up to 10 seconds for a successful response. The agent calculates statistics over the last 300 seconds (5 minutes). This configuration works well if you are using a polling station to sample the mean and availability values for this entry. This entry is active.



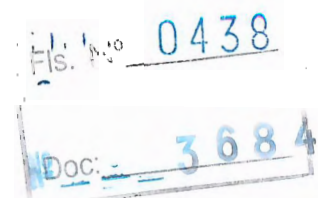


## Measuring Post Office Protocol Service Response (POP)

The following entry instructs eHealth Service Response to monitor the amount of time required to log in to and test the status of the POP mail service at host popserver.yourdomain. The username poptest and password pop123 must be a valid username-password combination for a POP user on this server. Any valid account works, and the sample query does not affect the contents of the mailbox.

```
{  
  5  
  "Test POPmail Response"  
  POP3  
  "popserver.yourdomain poptest pop123"  
  300  
  1  
  10  
  21600  
  active  
}
```

The entry is created as row 5 in the Service Response table. The agent tests the service once every 300 seconds (5 minutes) and waits up to 10 seconds for a successful response. The agent calculates statistics over the last 21,600 seconds (6 hours). This entry is active.







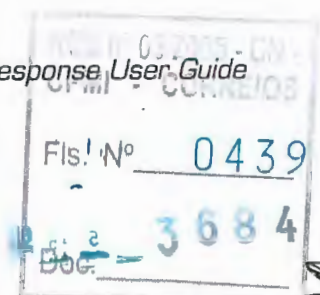
## Measuring Network News Service Response (NNTP)

The following entry instructs eHealth Service Response to monitor the amount of time required to connect to the NNTP service at host news.yourdomain and to perform a simple transaction.

```
{  
  1  
  "Test Net News Response"  
  NNTP  
  "news.yourdomain"  
  3600  
  1  
  10  
  86400  
  active  
}
```

**3**

The entry is created as row 1 in the Service Response table. The agent tests the service once every 3600 seconds (1 hour) and waits up to 10 seconds for a successful response. The agent calculates statistics over the last 86,400 seconds (1 day). This entry is active.



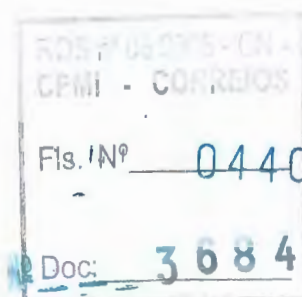


## Measuring File Transfer Service Response (FTP)

The following entry instructs eHealth Service Response to monitor the amount of time required to log in to and test the status of the FTP service at host ftpserver.yourdomain. The username ftptest and password ftp123 must be a valid username-password combination for an FTP user on this server. Any valid account works.

```
{
    2
    "Test FTP Service Response"
    FTP
    "ftpserver.yourdomain ftptest ftp123"
    3600
    1
    10
    604800
    active
}
```

The entry is created as row 2 in the Service Response table. The agent tests the service once every 3600 seconds (1 hour) and waits up to 10 seconds for a successful response. The agent calculates statistics over the last 604,800 seconds (1 week). This entry is active.







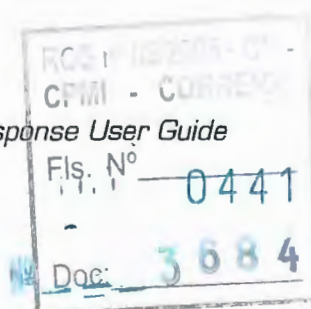
## Measuring Network Reachability (PING)

The following entry instructs eHealth Service Response to monitor the amount of time required to perform a network-level ping of host server.yourdomain. This test is an excellent way to determine whether the system is up and network connectivity exists.

3

```
{  
  3  
  "Test PING Response"  
  PING  
  "server.yourdomain"  
  60  
  3  
  5  
  86400  
  active  
}
```

The entry is created as row 3 in the Service Response table. The agent tests the service 3 times every 60 seconds (1 minute) and waits up to 5 seconds for a successful response. The agent calculates statistics over the last 86,400 seconds (1 day). This entry is active.



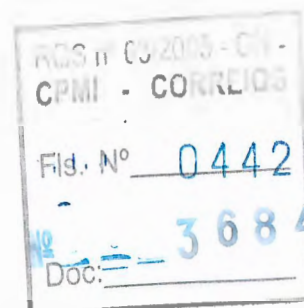


## Measuring TCP Service Connections

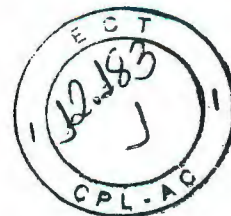
The following entry instructs eHealth Service Response to monitor the amount of time required to connect to port 2049 on host `server.yourdomain`. This test is an excellent way to determine whether the service is up and network connectivity exists.

```
{
  9
  "Test TCP Connection"
  TCPCONNECT
  "nfsserver.yourdomain 2049"
  60
  1
  5
  600
  active
}
```

The entry is created as row 9 in the Service Response table. The agent tests the service once every 60 seconds (1 minute) and waits up to 5 seconds for a successful response. The agent calculates statistics over the last 600 seconds (10 minutes). This entry is active.







## Measuring Custom Services

The following entry causes eHealth Service Response to execute the /local/bin/custom-response script and to use the output as the response time values for this custom service.

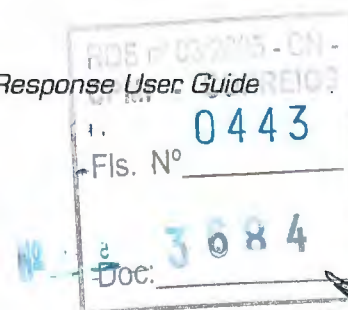
```
{
    99
    "Test Custom Service"
CUSTOM
    "/local/bin/custom-response"
    120
    1
    20
    3600
    active
}
```

3

The entry is created as row 99 in the Service Response table. The agent test the service once every 120 seconds (2 minutes) and waits up to 20 seconds for a successful response. The agent calculates statistics over the last 3600 seconds (1 hour). This entry is active.

You can create a custom script to perform any desired test or operation. You can write the script as a binary executable or in a scripting language such as UNIX shell or Perl. Custom response modules work very much like SystemEDGE agent extension objects. For more information, refer to the section on extension objects in the *eHealth SystemEDGE User Guide*.

eHealth Service Response expects the custom script to provide a single line of output with three values followed by a line feed. It interprets the values as the name lookup time, connection time, and transaction time. The script must report all times in milliseconds.





## Using the svcwatch Utility

svcwatch is a command-line utility that automatically configures eHealth Service Response to monitor the service that you specify. You identify the service, arguments, measurement interval, timeout, and statistics window, and the svcwatch utility issues an SNMP SetRequest to create the appropriate entry in the target Service Response table.

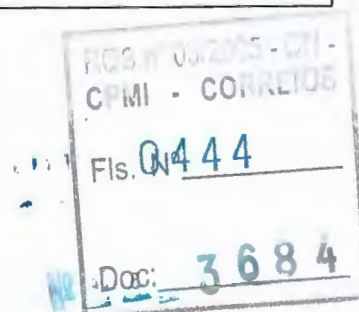
Use svcwatch as follows:

```
svcwatch hostname[:port][,timeout] community command
```

Table 11 describes the svcwatch arguments.

Table 11. svcwatch Arguments

Argument	Description
<i>hostname[:port][,timeout]</i>	Specifies the hostname or IP address (in dotted quad notation) of the system that contains the agent and MIB object to be monitored. If the agent is running on an alternative UDP port (for example, 1691), specify that port number along with the hostname/address with a colon-separator. In addition, you can specify an optional SNMP timeout value (in seconds) using a command-separator.
<i>community</i>	Specifies the community string that svcwatch uses in its SNMP requests to the agent. Because svcwatch uses SNMP SetRequests, the community string must provide read-write access to the target agent.
<i>command</i>	<p>Specifies the command and associated arguments. Supported commands include the following:</p> <ul style="list-style-type: none"><li>oid – for monitoring an object</li><li>filesystem – for monitoring a file system</li><li>list – for listing the current entries</li><li>setstatus – for setting the status of an entry</li><li>delete – for deleting an entry</li></ul> <p>For more information about these commands, refer to the next section, “svcwatch Command Arguments.”</p>







## svcwatch Command Arguments

These are the svcwatch commands and associated arguments:

- `add index "descr" service "arguments" interval samples timeout window`
- `setstatus index status`
- `delete index`
- `list`
- `version`

**3**

Table 12 describes the svcwatch arguments that are associated with the svcwatch commands.

Table 12. svcwatch Arguments Associated with Commands (Page 1 of 2)

Argument	Description
<i>index</i>	Specifies the row (index) of the Service Response table for this entry.
<i>"descr"</i>	Describes the rows in a quoted string of up to 128 characters.
<i>service</i>	Specifies the service to monitor. One of the following: <ul style="list-style-type: none"><li>• HTTP</li><li>• HTTPS</li><li>• FTP</li><li>• NNTP</li><li>• DNS</li><li>• SMTP</li><li>• POP3</li><li>• PING</li><li>• TCPCONNECT</li><li>• CUSTOM</li></ul>
<i>"arguments"</i>	Specifies the service-specific arguments in a quoted string of up to 128 characters.
<i>interval</i>	Specifies an integer value (30 to MAXINT) that indicates how often (in seconds) the service should be performed tested. This value <i>must</i> be a multiple of 30 seconds.



Table 12. svcwatch Arguments Associated with Commands (Page 2 of 2)

Argument	Description
<i>samples</i>	Specifies an integer value (1 to MAXINT) that indicates how many times the agent should monitor the service at each interval.
<i>status</i>	Row status; one of the following: <ul style="list-style-type: none"><li>• active – Activates a table row.</li><li>• notInService – Deactivates but preserves a row.</li><li>• destroy – Deletes a row.</li></ul>
<i>timeout</i>	Specifies the time in seconds to wait for the service (in an integer value).
<i>window</i>	Specifies the time window of samples to include in statistical calculations.

### svcwatch Example

Enter the following to create an entry, at index 11 in the Service Response table, that tests the network reachability to the pingtarget system:

```
svcwatch 143.45.0.12 private add 11 "Test PING" PING  
"pingtarget" 120 1 10 3600
```

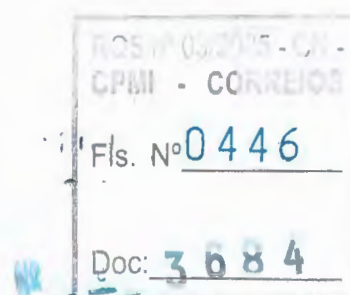
## Removing Service Response Entries

To stop the sampling of a particular service, you must remove the appropriate entry from the Service Response table. There are two options for removing these table entries:

- Manually removing the entry from the svcrsp.cf file
- Dynamically removing the entry with the svcwatch utility

### Manually Removing an Entry

You can remove an entry from the Service Response table by removing the entry from the svcrsp.cf configuration file.







#### NOTE

Before you edit the `svcrsp.cf` file, you must stop the SystemEDGE agent.

#### To remove an entry from the `svcrsp.cf` file:

1. Stop the SystemEDGE agent. For more information, refer to the *eHealth SystemEDGE User Guide*.
2. Edit the file `svcrsp.cf`. Locate and remove the entry you want to delete. Remove the entire entry, including the bracket characters (`{` and `}`).
3. Save the `svcrsp.cf` file.
4. Restart the SystemEDGE agent.

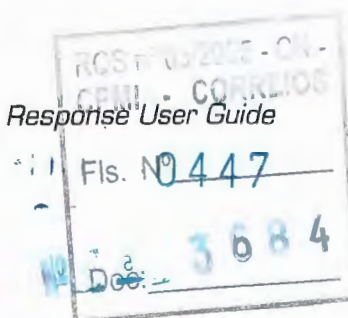
3

### Dynamically Removing an Entry

To dynamically remove an entry from the Service Response table, use the `svcwatch` utility. The following example deletes row 14 from the Service Response table on the 143.45.0.12 system. Enter the following to remove that row from memory and from the `svcrsp.cf` file.

```
svcwatch 143.45.0.12 private delete 14
```

In some cases, it may not be possible to use the `svcwatch` utility to delete entries. For example, if you have configured the SystemEDGE agent to prevent SNMP SET operations, the `svcwatch` utility does not work. In this situation, you need to remove the Service Response entry from the table manually. For more information, refer to “Manually Removing an Entry” on page 54.





## Using SystemEDGE Self-Monitoring to Monitor Service Response Metrics

This section describes how to use SystemEDGE threshold monitoring and history collection to monitor service-response metrics. In addition to using the `svcrsp.cf` file to add monitoring entries to the Service Response table, you can add entries directly to the SystemEDGE agent configuration file, `sysedge.cf`.

Each of the following examples presents a row number in the 5000 range; select a row number for your configuration that conforms to local policies. The metrics used in these examples were chosen for illustrative purposes only; you may choose to measure other metrics. You may also choose to use other thresholds, numbers of samples, and intervals between samples. Use values that make sense for your environment.

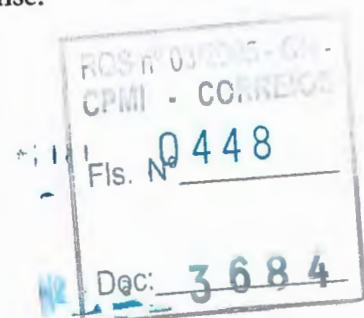
### NOTE

Enter the commands throughout this section as one line. Do *not* use a carriage return to match the formatting shown here.

## Using SystemEDGE Threshold Monitoring

This section provides examples for using SystemEDGE threshold monitoring to monitor Service Response metrics. Enter the following examples into the `sysedge.cf` file to instruct the agent to perform the monitoring they describe. For more information about SystemEDGE threshold monitoring, refer to the *eHealth SystemEDGE User Guide*.

There are nearly 30 useful values recorded for each Service Response entry. The most common values are the Mean Response Time (`svcRspTableTotalMean`) and Mean Availability (`svcRspTableTotalAvailability`). Other values also provide interesting real-time monitoring solutions. For example, you can monitor the variance (`svcRspTableTotalVariance`) to watch for periods of large variation in response.







## Sending a Trap when a Service Fails to Respond

To configure the agent to send a trap when a service fails to respond, you must monitor the `svcRspTableTotalLastSample` MIB variable. This value records the last sampled response time (in milliseconds) for this service entry. If the last test failed, the value is zero.

If, for example, you have created a Web server response-monitoring entry at row index 100 of the Service Response table, and this entry tests the server every 60 seconds, set up a SystemEDGE self-monitoring entry to watch the samples for that row and send a trap if the value is zero. To do so, enter the following in `sysedge.cf`:

3

```
monitor oid svcRspTableTotalAvailability.100 5001 0x0 60
absolute = 0 'Web Server Down' ''
```

## Sending a Trap when a Response Sample is Greater than 7000

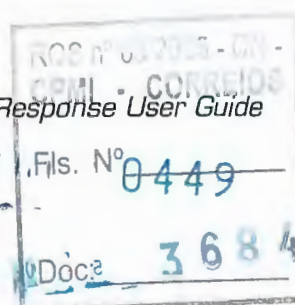
To send a trap if any response sample is greater than 7000, enter the following in `sysedge.cf`:

```
monitor oid svcRspTableTotalLastSample.100 5002 0x0 60 absolute
> 7000 'Web Server Too Slow' ''
```

## Sending a Trap when the Mean Response Time is Greater than 5000

To send a trap when the *mean* response time is greater than 5000, enter the following in `sysedge.cf`:

```
monitor oid svcRspTableTotalMean.100 10 0x0 60 absolute > 5000
'Web Server Too Slow On Average' ''
```





## Sending a Trap when a New Maximum Value Appears

To send a trap whenever a new maximum value appears, regardless of the value, enter the following in `sysedge.cf`:

```
monitor oid svcRspTableTotalMax.100 10 0x0 60 delta > 0 'New
Maximum Web Server Response' ''
```

## Using SystemEDGE History Collection

This section outlines the use of SystemEDGE history collection to track the value of important Service Response metrics over time. For more information about SystemEDGE history collection, refer to the *eHealth SystemEDGE User Guide*.

### Collecting History on Mean Response Time

To collect historical data on the mean service response time, you must gather history on the `svcRspTableTotalMean` MIB variable. This value records the mean over the sample window for this service entry.

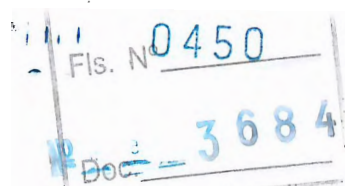
For example, if you have created a Web server response-monitoring entry at row index 100 of the Service Response table, and this entry tests the server every 60 seconds, you can set up a SystemEDGE History table entry to record the samples for that row. To do so, enter the following command in `sysedge.cf`:

```
emphistory 5002 60 svcRspTableTotalMean.100 400 'Web Response
History'
```

### Collecting History on Connect Time

Enter this command to collect history on the connect time:

```
emphistory 5002 60 svcRspTableConnMean.100 400 'Web Connection
History'
```







## Glossary

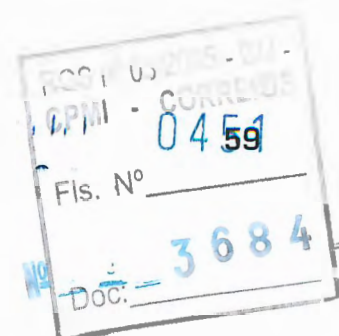
**Abstract Notation One (ASN.1)** A language that describes data types independent of computer structures and representations. For more information refer to ISO International Standard 8824.

**access list** A list of devices or IP addresses that can use a router, device, or application for particular services.

**AdvantEDGE View** A Web-based management interface for use with the SystemEDGE agent that enables an administrator to use a Web browser to manage systems and applications.

**agent** In network management, a program that provides information from a management information base (MIB) for SNMP agents. eHealth or a network management system (NMS) use the information about managed devices and take corrective action when appropriate.

**American Standard Code for Information Interchange (ASCII)** The most common format for character representation in computers and the Internet. Characters fit into a single byte. It was developed by the American National Standards Institute (ANSI).





**application** A program that performs a specific function for one or more users or for another application program. Types of applications include communication programs, management programs, word processors, databases, and drawing programs.

**ASCII** See American Standard Code for Information Interchange (ASCII).

**ASN.1** See Abstract Notation One (ASN.1).

**availability** The percentage of time that an element is operational during the report period.

**bandwidth** The throughput of a communications line usually measured in megabits per second (Mbps). Also refers to the difference between the highest and lowest frequencies in a communications channel, expressed in units of hertz (Hz), or cycles per second.

**baseline** A level of performance that is considered normal, average, or typical over a period of time such as a day, week, or month. Compare current performance metrics against baseline data to identify trends in performance levels and service delivery.

**buffer** A temporary storage area for data. Often implemented as holding areas between the backplane and an interface; data remains in the buffer until it can be transmitted on the interface or processed by the central processing unit (CPU).

**capacity** A measurement of the volume that an element can support. For interfaces, this is the bandwidth that can be carried. For hard disks, this is the disk size or the amount of information that can be stored on the disks.

**central processing unit (CPU)** The component within a device that performs the instruction execution for the applications and programs that run on the device. Also referred to as a processor or microprocessor.







**client** A computer system, usually a desktop computer or laptop, that presents data directly to a user and accepts input. They drive the computing process, supporting local processing and accessing remote servers as needed for data access and analysis.

Also refers to the application software residing on a machine that is used by an end user.

**client process** The client-side part of a distributed application.

**connect time** The total time that a user is connected to a network.

**CPU** See central processing unit (CPU).

**delay** The time required for a packet or frame to travel from the sending station (source) to the receiving station (destination).

**DHCP** See Dynamic Host Configuration Protocol

**disk thrashing** A condition that results when a server performs high disk input/output (I/O) operations—reads and writes to the disk—without producing actual work. Often occurs when a server performs excessive paging and swapping due to physical memory limitations.

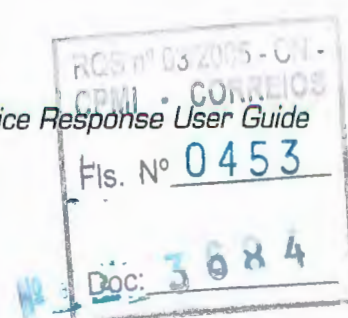
**DNS** See domain name system (DNS).

**domain name system (DNS)** The system that locates and translates Internet domain names such as concord.com into Internet Protocol (IP) addresses. A DNS server is typically a device that translates domain names to IP addresses within your network.

**Dynamic Host Configuration Protocol** A protocol that enables dynamic allocation of IP addresses so that they can be reused.

**eHealth AIM** See eHealth application insight module.

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**eHealth application insight module** A plug-in (supplementary program) that extends the functionality of the SystemEDGE agent. AIMs add the capability to manage application-specific events, processes, thresholds, and health.

**event** An occurrence on a system that typically results in a message, such as an SNMP trap, being sent to a configured management system. Common events include system failures, system reboots, exceeded thresholds, or any user-configurable situation that the user wants to identify.

**fault tolerance** A mechanism that protects networks and devices against downtime due to system failure. Fault tolerant solutions typically rely on redundancy in hardware and mirroring of applications and data.

**file cache** A block of memory that holds frequently or recently used data. A system can read those blocks at memory speed rather than the slower disk access speed.

**File Transfer Protocol (FTP)** A means for uploading and downloading files on the Internet (the oldest Internet protocol for retrieving files). You can use an FTP client application to request files from or transfer files to an FTP server.

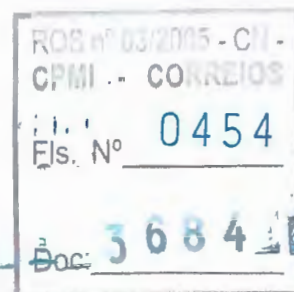
**filter** A set of selection criteria used to focus a report on the desired data.

**FTP** See File Transfer Protocol (FTP).

**Gbps** An acronym representing gigabits per second, a common measurement of data transfer rates. One Gbps is equivalent to  $10^9$  bits per second.

**group** A collection of monitored elements. Typically, groups are used to organize elements by geographic location, department, market segment, vendor, or customer. Users can enter localized text for group names.

**group list** A set of one or more groups. Users can enter localized text for group list names.







**Host Resources MIB** A MIB (management information base) that defines a set of objects that are useful for the management of host computers. For example, it defines host storage areas, devices, and file systems. This MIB is defined in RFC 1514.

**hostname** The name for an individual IP (Internet Protocol) address on a computer. While many computers have only one hostname, some machines, such as network servers have multiple hostnames.

**HTML** See Hypertext Markup Language (HTML).

**HTTP** See Hypertext Transfer Protocol (HTTP).

**Hypertext Markup Language (HTML)** A programmatic language used for controlling the way that text and images appear when a file is displayed on the World Wide Web.

**Hypertext Transfer Protocol (HTTP)** An application protocol that defines the set of rules for exchanging files (text, graphics, multimedia, and other files) on the World Wide Web.

**Hertz (Hz)** A unit of frequency of one cycle per second that measures the change in the state of an alternating current, sound wave, or other cyclical wave form.

**I/O** See input/output (I/O).

**ICMP** See Internet Control Message Protocol (ICMP).

**Information Technology (IT)** A widely-used term to describe all of the technologies used for creating, exchanging, managing, and using information in various forms.

**input/output (I/O)** Any operation, program, or device that transfers data to or from a computer.

**Integrated Services Digital Network (ISDN)** A high-speed carrier service offered by telecommunications companies.

**Internet Control Message Protocol (ICMP)** A protocol between a server and a gateway to the Internet.



**internet infrastructure** The applications, systems, and networks that a company uses to run its business, for both internal use and for interfaces to the outside world.

**Internet Protocol (IP)** The method (or protocol) by which packets of information are sent across the Internet. IP defines addressing, error handling, routing, and option codes for data transmission. IP requires no continuing connection between the endpoints that are communicating.

**Internet Service Provider (ISP)** A company that provides individuals and companies with access to the Internet. ISPs also provide related services such as Web site building and virtual hosting.

**IP** See Internet Protocol (IP).

**ISDN** See Integrated Services Digital Network (ISDN).

**ISP** See Internet Service Provider.

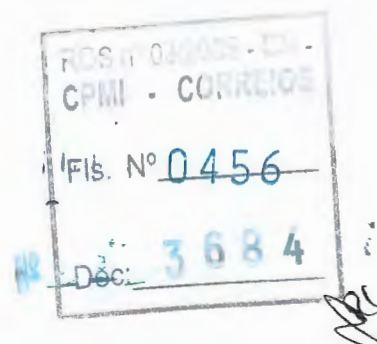
**IT** See Information Technology (IT).

**LAN** See local area network (LAN).

**latency** A measure of delay, often network delay. Depending on the type of element, eHealth reports can show two types of latency: round-trip latency, which is the length of time in milliseconds for a ping packet to travel from the eHealth system to a polled element and back. Alternate latency, which is the length of time in milliseconds for a ping packet to travel from a network resource (the alternate latency source) such as a router to other critical network resources such as routers and servers (the alternate latency partner).

---

**local area network (LAN)** A shared communication medium that connects computers and devices over a limited area. The area limitations of a LAN usually result from the electrical signal limits of the medium.







**management information base (MIB)** A formal description of a set of network objects that can be managed using Simple Network Management Protocol (SNMP).

**MB** Megabytes.

**Mbits** Megabits.

**MBps** An acronym representing megabytes per second.

**Mbps** An acronym representing megabits per second, a common measurement of data transfer rates.

**MIB** See management information base (MIB).

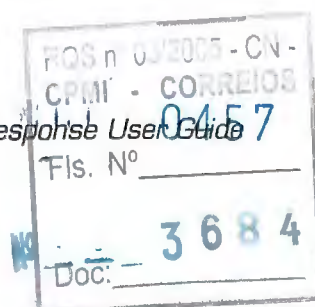
**MIB Translation File (MTF)** A file that normalizes the data collected from standard and proprietary SNMP (Simple Network Management Protocol) agents. *eHealth* uses an MTF to translate MIB variables into its own variables. Each MTF consists of the associated MIB and its filename, an agent for the element type, and a set of statements that map MIB variables to the appropriate *eHealth* database column.

**mirroring** A process by which data is duplicated on separate disk systems to provide faster access and fault tolerance in the event of a disk failure.

**MTF** See MIB Translation File (MTF).

**network** A collection of computers, printers, routers, switches, and other devices that are able to communicate using a common transmission media such as TCP/IP.

**network management system (NMS)** An application program usually residing on a computer that manages at least part of a network, including systems and applications. The NMS communicates with agents to monitor network statistics and resources, control network device configuration, and analyze network problems. See also agent.





**Network News Transfer Protocol (NNTP)** The predominant protocol used by computers for managing messages posted on Usenet newsgroups.

**network operations center (NOC)** The place where network administrators manage a telecommunications network or networks. It usually contains visualizations of the networks and workstations that are used to distribute software, troubleshoot problems, and monitor performance.

**network time** The time spent establishing network connections to complete a transaction.

**NMS** See network management system (NMS).

**NNTP** See Network News Transfer Protocol (NNTP).

**object identifier (OID)** a unique identifier of a managed object in a MIB hierarchy. See also management information base (MIB).

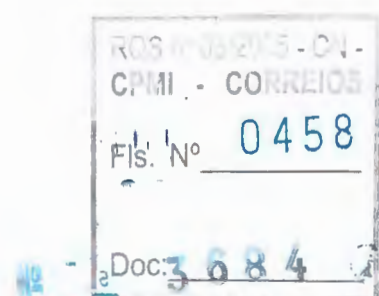
**OID** See object identifier (OID).

**operating system (OS)** The program that manages all other programs (applications or application programs) on a computer. Provides the following services: determining the order in which each application runs and the time allotted for that application, managing the sharing of internal memory among multiple applications and handling input to and output from attached hardware devices.

**operational support system (OSS)** A network management system (NMS) with a specific focus such as provisioning services or alarm surveillance.

**OS** See operating system (OS).

**OSS** See operational support system (OSS).







**packet** A logical unit of data routed between an origin and a destination on the Internet or any other packet-switched network. On the Internet, the Transmission Control Protocol (TCP) layer of TCP/IP divides a file into packets of manageable size for routing.

**page** In computers that utilize virtual memory, a unit of data storage. Systems transfer pages of data from disk storage to memory and back again.

On the World Wide Web, a file written using Hypertext Markup Language (HTML) that specifies how text, images, and other multimedia will be presented to the user. A Web site delivers information to the user one page at a time.

**partition** A logical division of a hard disk on a PC that is created so that each partition can have a different operating system or can be used for different purposes (for example, file management or multiple users).

**path** In networking, a path is a route from one location to another in a network.

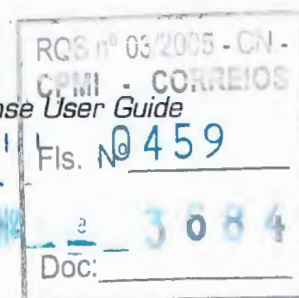
**PC** See personal computer (PC).

**personal computer (PC)** A computer designed for individual use. Prior to the PC, computers were designed to be used by many individuals and system resources were shared by all. A PC often refers to a computer with an Intel microprocessor architecture and an operating system such as Microsoft DOS or Windows.

**ping** An Internet echo message used to confirm the reachability of a network device. An abbreviation for Packet Internet or Inter-Network Groper.

**port** The physical (hardware) connection on a device that connects the device to a network.

**process** Typically, an instance of a program or application that is running on a server. Applications can have one or more associated processes.





**process set** A collection of one or more processes that relate to a specific application. Using eHealth – System At-a-Glance reports, you can obtain information about the impact and performance of process sets running on systems that have Concord SystemEDGE agents.

**protocol** The set of rules by which the endpoints in a telecommunication connection communicate. The protocol defines the packet format of the transmitted information. On the Internet, common protocols are TCP, IP, HTTP and FTP.

**queue** In a system, a set of jobs awaiting resources. In a network device such as a router, a collection of packets waiting to be processed or forwarded. Insufficient central processing unit (CPU) speed, memory, or interface speeds can contribute to long queues, and therefore, to delay on the network.

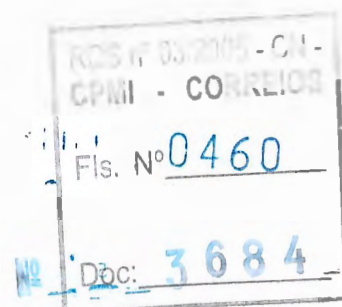
**RAID** See Redundant Array of Inexpensive Disks (RAID).

**RAS** See remote access server (RAS).

**real time** A level of computer responsiveness that an end user would deem as immediate or fast enough to show incremental changes of an external process (for example, to present visualizations of the weather as it constantly changes).

**Redundant Array of Inexpensive Disks (RAID)** A technology that merges several inexpensive disks into a single large disk to increase speed, capacity, and reliability. The RAID controller manipulates disks to share the work on file reads and writes for large files or to perform multiple simultaneous reads or writes for small files.

**remote access server (RAS)** A device that provides remote users with dial-up access to a network. RAS devices usually contain modem or Integrated Services Digital Network (ISDN) cards that provide the connection services.







**remote network monitoring (RMON)** A type of device that collects nine kinds of network management information, including packets sent, bytes sent, packets dropped, statistics by host, by conversations between two sets of addresses, and certain kinds of events that have occurred. A probe is an example of an RMON device.

**Request For Comments (RFC)** The name of the document series regarding Internet design. Most RFCs define protocol specifications such as Telnet and FTP. RFCs are widely available online.

**RFC** See Request For Comments (RFC).

**RMON** See remote network monitoring (RMON).

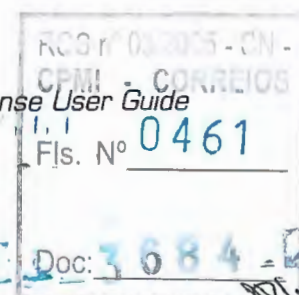
**RMON2** A type of device that collects network management information as specified in the latest version of the MIB (management information base) specification, RMON, version 2. For more information, refer to RFC 2021, a document widely available on the Internet.

**router** A device that connects networks. Routers learn the addresses of the network points that send data by reading the address information in the data frames. Hardware vendors often use the terms router and switch interchangeably.

**routing** The process of finding paths through a network to a destination.

**server** A program that provides services to other programs in the same and other computers. Also, a computer that performs file storage and application hosting as well as provides computing services to other devices and users on the network. Typically has one or more central processing units (CPUs), disks, interfaces, and storage partitions.

**server process** A server-side part of a distributed application.





**server time** The amount of time that a server requires to process a transaction. It is calculated by determining network time and subtracting it from remote time.

**server type** The kind of server process associated with a particular server request protocol.

**Simple Network Management Protocol (SNMP)** The network management protocol used almost exclusively in data networks. A method for monitoring and controlling network devices, as well as managing configurations, statistics collection, performance, and security.

**SNMP** See Simple Network Management Protocol (SNMP).

**SNMP agent** A program such as the SystemEDGE agent that conforms to a management information base (MIB) specification to collect information about managed devices and to take corrective action (using SNMP traps) when appropriate.

**speed** The capacity (bandwidth) of an interface in bits per second (bps).

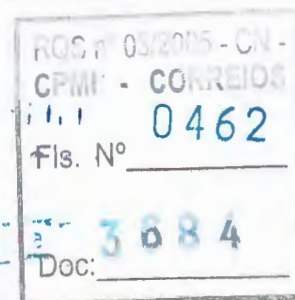
**swapping** The process in which a computer moves entire programs in and out of random access memory to and from auxiliary storage (swap partition or pagefile).

**SystemEDGE agent** Concord's SNMP agent that autonomously monitors system configuration, status, performance, users, applications, file systems, and other critical resources.

**Systems Management MIB** A set of MIB (management information base) objects that extends the capabilities of the Host Resources MIB. It provides greater visibility into systems and specific information about Windows NT and UNIX systems.

**TCP/IP** See Transmission Control Protocol (TCP) and "Internet Protocol (IP).

**throughput** The rate of data transfer on an interface over time.







**Transmission Control Protocol (TCP)** A connection-based protocol used along with the Internet Protocol (IP) to send data in the form of message units between computers over the Internet. While IP is responsible for the actual delivery of the data, TCP is responsible for dividing data into packets at the sending system and constructing the data message from individual packets at the receiving system.

**trap** A message sent by an SNMP agent to a console or network management system (NMS) to indicate that a threshold has been reached or another user-defined condition has occurred. The SystemEDGE agent defines a number of traps for system and application management.

**Trivial File Transfer Protocol (TFTP)** An Internet utility that uses User Datagram Protocol (UDP) instead of Transmission Control Protocol (TCP) to transfer files. TFTP is simpler than FTP, but does not support user authentication and directory visibility.

**UDP** See User Datagram Protocol (UDP).

**User Datagram Protocol (UDP)** A communications protocol that uses Internet Protocol (IP) to send and receive data and is similar to Transmission Control Protocol (TCP), but provides fewer packet management services.

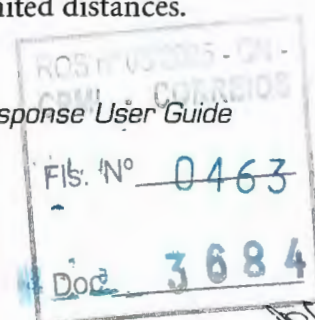
**variable** A performance metric for an element. A characteristic or behavior upon which eHealth gathers data and evaluates the performance of the element. The SystemEDGE agents can also monitor local variables to reduce network polls and increase scalability.

**variance** A statistical term that indicates how closely most of the data points differ from the average of the data points.

**WAN** See wide area network (WAN).

**Web** See World Wide Web (WWW, Web).

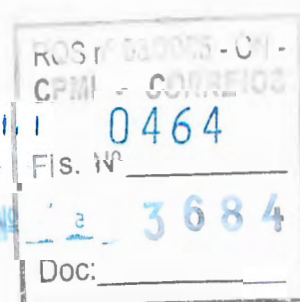
**wide area network (WAN)** A network that interconnects multiple systems or networks over unlimited distances.





**workstation** A powerful computer that is equipped with a fast processor, a large amount of random access memory, and other features such as high-speed graphical rendering that make it suitable for business users such as engineers, graphic designers, and architects.

**World Wide Web (WWW, Web)** All of the resources on the Internet that use Hypertext Transfer Protocol (HTTP). Users of the Web access information through browser software.







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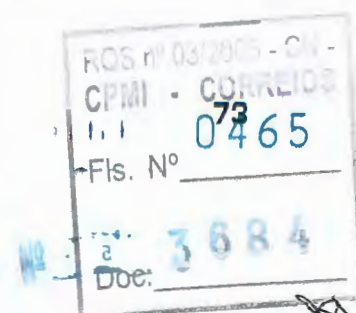
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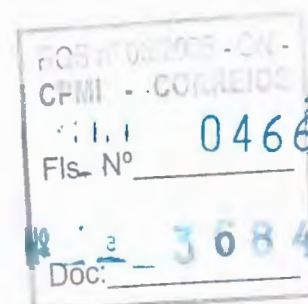
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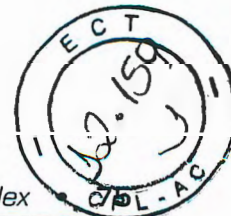
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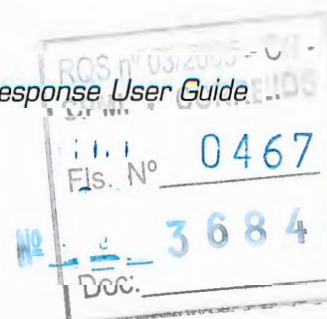
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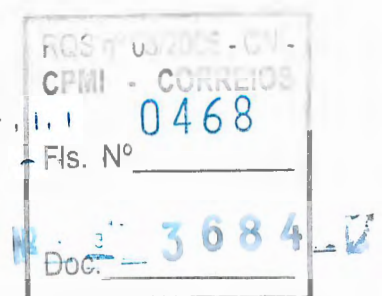
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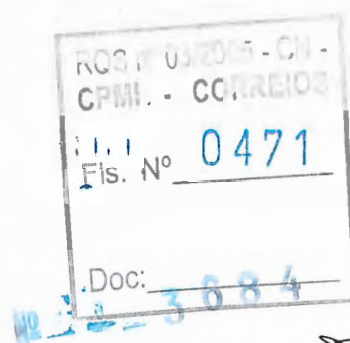
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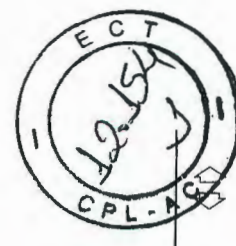
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U. S. Patent 5,615,323  
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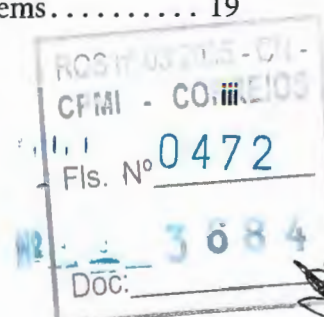
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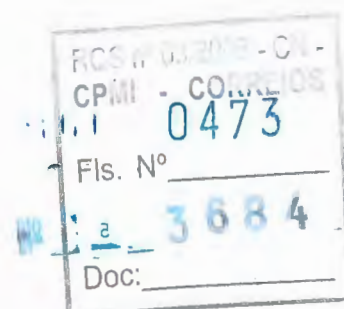
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eHeath AIM for Apache User Guide

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## Preface

This guide describes how to install and use the *eHealth* application insight module (AIM) for Apache for Solaris SPARC, Linux x86, HP-UX, and Windows NT 4.0, Windows 2000, and Windows XP systems. This guide supports the following:

- *eHealth* AIM for Apache Release 1.0 Patchlevel 2 and later
- *eHealth* SystemEDGE Release 4.0 Patchlevel 3 and later

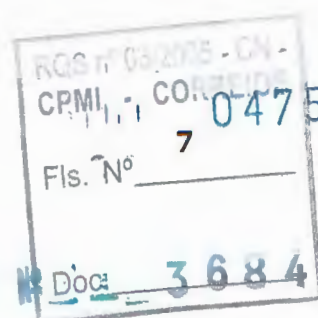
This product supports the Apache Web server Version 1.3.2 and later.

## Audience

This guide is intended for the person responsible for installing and configuring *eHealth* AIM for Apache. To use *eHealth* AIM for Apache, you should have a basic understanding of the Apache Web server, *eHealth* SystemEDGE, and your host's operating system environment. For more information, refer to Apache documentation (<http://www.apache.org>) and the *eHealth* SystemEDGE User Guide.

## About This Guide

This section describes the changes and enhancements that have been made since the last release of this guide. It also includes the documentation conventions used in this guide.





## Revision Information

This guide now includes installation and configuration instructions for eHealth AIM for Apache on Windows NT, Windows 2000, Windows XP, and HP-UX 10.x and 11.x systems.

## Documentation Conventions

Table 1 lists the conventions used in this document.

Table 1. Documentation Conventions (Page 1 of 2)

Convention	Description
File or Directory Name	File or directory names.
code	System, code, or operating system command line examples.
<i>emphasis</i>	Emphasis and guide titles.
<b>enter</b>	Text that you must type exactly as shown.
<b>Name</b>	Text that defines menus, fields in dialog boxes, or keyboard keys.
<b>New Term</b>	A new term, that is, one that is being introduced.
<i>Variable</i>	Variable values that you substitute.
→	A sequence of menus or menu options. For example, <b>File</b> → <b>Exit</b> means "Choose <b>Exit</b> from the <b>File</b> menu."

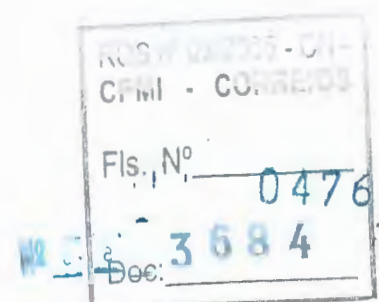






Table 1. Documentation Conventions (Page 2 of 2)

Convention	Description
<b>NOTE</b> _____ _____	Important information, tips, or other noteworthy details.
<b>CAUTION</b> _____ _____	Information that helps you avoid data corruption or system failures.
<b>WARNING</b> _____ _____	Information that helps you avoid physical danger.

## Technical Support

If you need any assistance with this product or the SystemEDGE agent, contact Technical Support at the following:

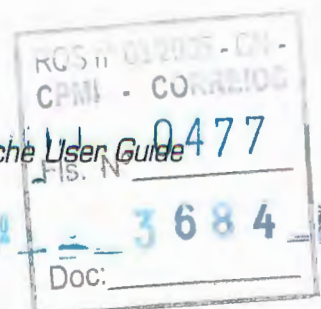
Phone: (888) 832-4340  
(508) 303-4300  
Fax: (508) 303-4343  
E-mail: support@concord.com  
Web site: http://www.concord.com

## Professional Services

If you need any assistance with customizing this product, contact Professional Services at the following:

Phone: (800) 851-8725 (Choose option 7)  
Fax: (508) 486-4555  
E-mail: proserv@concord.com  
Web site: http://www.concord.com

eHealth AIM for Apache User Guide





# Introduction

This chapter provides an overview of *eHealth AIM* for Apache.

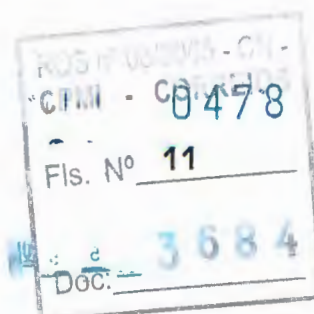
## Introducing *eHealth AIM* for Apache

*eHealth AIM* for Apache is a plug-in for the SystemEDGE agent that enables information technology (IT) operators to monitor the Apache Web server. The power and flexibility of the Apache Web server make it the server of choice for many corporations.

*eHealth AIM* for Apache enables you to monitor the Apache server's performance and availability on these operating systems:

- Sun Solaris Release 2.5 and later
- RedHat Linux Release 6.0 and later
- HP-UX Release 10.x and 11.x (not including 10.01)
- Microsoft Windows NT 4.0, Windows 2000, and Windows XP

To use *eHealth AIM* for Apache, you must install it on every Apache server that you want to monitor. For more information, refer to Chapter 2, "Installing *eHealth AIM* for Apache."





**NOTE**

This guide is not intended to describe how to install, administer, or use the Apache Web server. For help with Apache, refer to your Apache Web server documentation.

## Features

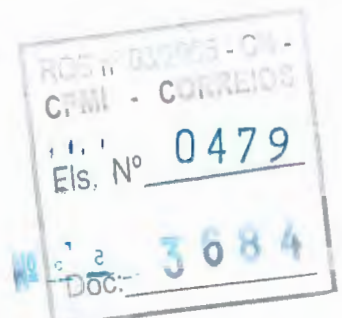
eHealth AIM for Apache monitors the following:

- Apache server processes
- Apache server log files
- Performance metrics that are specific to Apache
- Web service response and availability

eHealth AIM for Apache monitors httpd process attributes. For example, it monitors whether each process is running (alive). It can also restart processes, if necessary. In addition, it monitors memory usage, memory size, and page faults.

Because the Apache Web server records Web accesses and errors in log files, eHealth AIM for Apache can use the SystemEDGE agent log-file monitoring capability to scan those logs and forward certain events as Simple Network Management Protocol (SNMP) traps when appropriate.

eHealth AIM for Apache is designed to monitor one or more Apache servers running on a single system. To support multiple servers, the data presented in the eHealth AIM for Apache management information base (MIB) is organized into tables that are indexed by server port number. For instance, if you have a server running on port 80 and another on port 8080, entries appear in each table for index 80 and index 8080. For more information, refer to Chapter 3, "Using the eHealth AIM for Apache MIB."





## Using the mod\_info and mod\_status Facilities

1

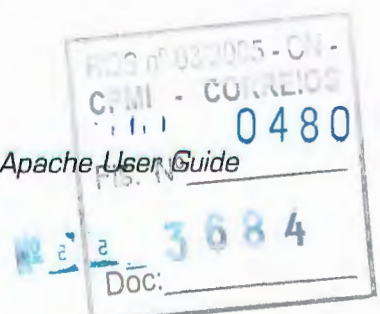
eHealth AIM for Apache obtains server status and behavior information from the Apache server through the Apache `mod_info` and `mod_status` facilities. To access this type of information, you must enable these facilities in your Apache configuration file (`httpd.conf`). If these facilities are secured through the use of an authentication mechanism, you must also provide a valid user name and password for accessing these resources in the `apachemod.cf` file. For more information, refer to “Editing the `httpd.conf` File” on page 23 and “Editing the `apachemod.cf` File” on page 25.

## Caching Disk Space Information

As part of the application footprint calculations, eHealth AIM for Apache can calculate the total amount of disk space used by your Apache server. On some systems with large amounts (greater than 1 GB) of Web data, this calculation can take a long time. For this reason, eHealth AIM for Apache is designed to cache the disk space information to avoid frequent recalculations. You can control the frequency of the disk space calculations in the eHealth AIM for Apache configuration file (`apachemod.cf`). For more information, refer to “Editing the `apachemod.cf` File” on page 25.

## Using eHealth AIM for Apache

eHealth AIM for Apache provides you with the tools and information that are necessary for monitoring the health and availability of the Apache Web server. It makes important information about Apache available to management software through the SystemEDGE agent and SNMP.







eHealth AIM for Apache works with the SystemEDGE agent to closely manage the Apache Web server, providing real-time fault detection and automatically correcting problems, if necessary. You can use eHealth AIM for Apache with any SNMP-compliant management software, including Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others.

eHealth AIM for Apache and the SystemEDGE agent can provide you with the following types of information:

- Number of "hits" your Web server is receiving, which can help you keep up with daily volume and set monitor points to watch for unusual traffic loss or denial of service attacks
- Amount of space your Web log and Web server files are consuming
- How effectively the Apache processes monitor idle services, warn you when the number of idle services is too low, and monitor the number of active processes
- How much of your system resources (Central Processing Unit [CPU] and memory) Apache is using on your server
- Whether bottlenecks on your Web servers are caused by problems with the CPU, memory, disk, or network

## Using eHealth AIM for Apache with AdvantEDGE View

You can use AdvantEDGE View with eHealth AIM for Apache to monitor the performance, configuration, availability, and health of the Apache Web server.

To run an AdvantEDGE View query for Apache:

1. Select the target system or group from the **System** or **Group** list in the AdvantEDGE View interface.
2. Select **Apache** from the **Applications** list.
3. Click the **Applications** icon.

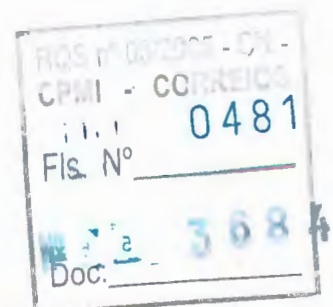




Figure 1 shows a sample image map that AdvantEDGE View displays when you run a query on the target Apache workstation. Click the area for which you want to display information.

1



Configuration Footprint Performance

Figure 1. AdvantEDGE View Image Map for Apache Queries

For example, if you click the **Footprint** area, AdvantEDGE View displays information about Apache's CPU, memory, and disk resource consumption. Figure 2 shows the Disk Usage section of the AdvantEDGE View Footprint query for an Apache Web server.

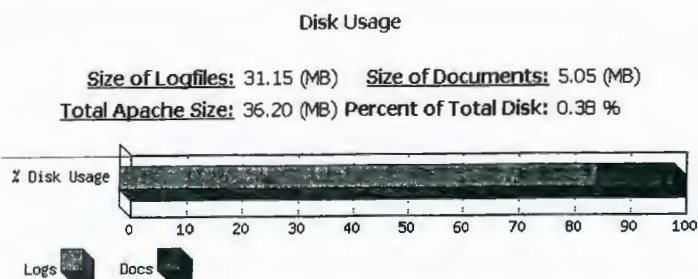
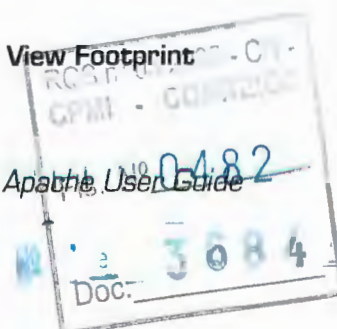


Figure 2. Sample Section of an AdvantEDGE View Footprint Query for Apache







## Using eHealth AIM for Apache with eHealth

*In previous releases, eHealth – Application Insight was called eHealth – Application Assessment.*

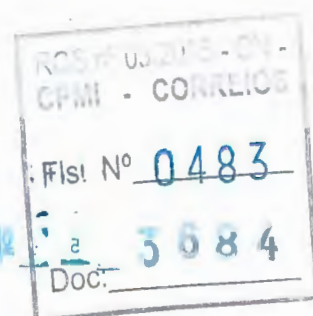
You can use eHealth AIM for Apache and the SystemEDGE agent with the eHealth product suite to provide historical data for long-term trending analysis and capacity planning. With eHealth – Application Insight, you can run At-a-Glance, Trend, Top N, and MyHealth reports for the following types of information:

- Amount of Central Processing Unit (CPU), total memory, and disk space the Apache Web server is using
- Number of users who are connected to the Apache server
- Number and type of processes that are running
- Amount of Web traffic
- Total size of the Apache service logs
- End-to-end performance summaries for your Apache application, host system, and network

For more information about the variables you can monitor and reports that you can run when you integrate eHealth AIM for Apache with eHealth, refer to the eHealth Web Help.

## Using eHealth AIM for Apache with Live Health

You can also use eHealth AIM for Apache and the SystemEDGE agent with Live Health for real-time detection of potential problems. Live Health applies intelligent algorithms to the data, resulting in precise assessments of application health and performance. For more information about how Live Health can detect “brownouts” and service delays across applications, systems, and networks, refer to the Live Health Web Help.





# Installing eHealth AIM for Apache

This chapter explains how to install, configure, and license eHealth AIM for Apache.

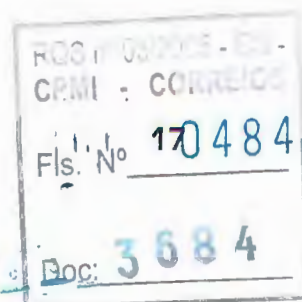
## NOTE

For the most current information about installing this module, refer to the `relnotes.txt` file on the eHealth AIM for Apache installation CD-ROM.

## Installation Requirements

Before you install eHealth AIM for Apache, you must first install, license, and configure the SystemEDGE agent Release 4.0, Patchlevel 3 or later. For more information, refer to the *eHealth SystemEDGE User Guide*. Also, your system must be running the Apache Web server Release 1.3.2 or later on one of these operating systems:

- Sun Solaris (SPARC) Release 2.5 or later
- Red Hat Linux (x86) Release 6.0 or later
- HP-UX Release 10.x and 11.x (not including 10.01)
- Microsoft Windows NT 4.0, Windows 2000, or Windows XP







## Installing the Software

This section describes how to install eHealth AIM for Apache for Solaris, Linux, HP-UX, and Windows operating systems.

### Installing the Software for UNIX Systems

For Solaris, Linux, and HP-UX systems, eHealth AIM for Apache is distributed as a tar file.

To install eHealth AIM for Apache:

1. Locate the Apache server that you want to monitor.
2. Log in to the UNIX system where that server is located as **root**.
3. Copy the **apachemod.tar** file from the CD-ROM to the **/tmp** directory.
4. Change directory to the SystemEDGE agent directory on your system by entering the following:  
**cd /opt/EMPsysedge**
5. Create the **plugins** directory, if it is not already present, by entering the following:  
**mkdir plugins**
6. Change directory to the **plugins** directory by entering the following:  
**cd plugins**
7. Enter the following to start the installation.

For Solaris, enter the following command:

```
tar xvf /tmp/apachemod_1.0p2_sol.tar
```

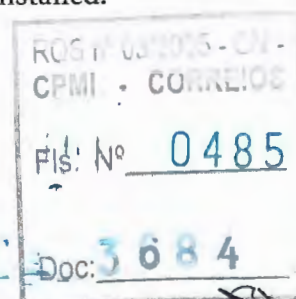
For Linux, enter the following command:

```
tar xvf /tmp/apachemod_1.0p2_linux.tar
```

For HP-UX, enter the following command:

```
tar xvf /tmp/apachemod_1.0p2_hpuX.tar
```

The installation creates files in the **plugins/apachemod** directory. eHealth AIM for Apache is now installed.





## Installing the Software for Windows NT Systems

Throughout this guide, the term *Windows NT* encompasses *Windows NT 4.0*, *Windows 2000*, and *Windows XP*.

For Windows NT 4.0, Windows 2000, and Windows XP systems, *eHealth AIM for Apache* is distributed as a self-extracting executable named `apachemod_1.0p2_ntx86.exe`.

2

### To install *eHealth AIM for Apache*:

1. Log in to the Windows NT system as administrator.
2. Click **Start**.
3. Select **Programs** → **Command Prompt**.
4. Insert the CD containing the Concord software distributions into the CD-ROM drive.
5. Windows automatically mounts the drive using the CD-ROM drive's corresponding drive letter. The particular drive letter is specific to your system and depends on the number and types of disks attached to your system.
6. Determine which directory you want to use as the installation directory for *eHealth AIM for Apache*. If the SystemEDGE agent is installed in `C:\sysedge`, the recommended installation directory is `C:\sysedge\plugins`.

### NOTE

You *cannot* run `apachemod.exe` by double-clicking the executable from the CD-ROM.

7. Run the self-extracting executable by entering the following at the command prompt, where `D:` is the CD-ROM drive for your system, and `C:\sysedge\plugins` is the installation directory:

```
D:\apachemod\ntx86\apachemod1.0p2_ntx86.exe -dir C:\sysedge\plugins
```

The `-dir` option instructs the self-extracting executable to create the intended subdirectory hierarchy that is described throughout this guide. It then places the distribution in an `apachemod` subdirectory within the specified target directory (such as `C:\sysedge\plugins`). *eHealth AIM for Apache* is now installed.





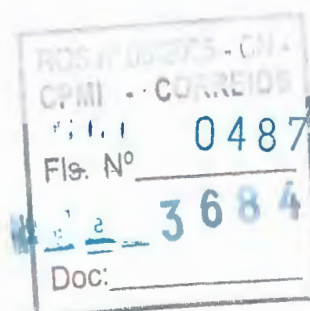


## eHealth AIM for Apache Files

Table 2 describes the files created by the eHealth AIM for Apache installation procedure.

**Table 2. Files Installed by eHealth AIM for Apache**

File Name	Description
apachemod.asn1	eHealth AIM for Apache MIB specification
apachemod.cf	eHealth AIM for Apache configuration file
apachemod.pdf	<i>eHealth AIM for Apache User Guide</i>
apachemod.dll (Windows only)	eHealth AIM for Apache dynamic link library (DLL) module for Windows NT, Windows 2000, and Windows XP
apachemod.so (Solaris and Linux only)	eHealth AIM for Apache shared library for 32-bit Solaris and Linux operating systems
apachemod-sparcv9.so (Solaris only)	eHealth AIM for Apache shared library for 64-bit Solaris operating systems
apachemod-hpux.so (HP-UX only)	eHealth AIM for Apache shared library for 32-bit HP-UX (10.x and 11.x) operating systems
apachemod-hpux11-64.so (HP-UX only)	eHealth AIM for Apache shared library for 64-bit HP-UX (11.x) operating systems
relnotes.txt	Release notes for eHealth AIM for Apache





## Configuring eHealth AIM for Apache

After you install eHealth AIM for Apache, you must configure it by editing the following files:

- sysedge.cf
- httpd.conf
- apachemod.cf

2

### Editing the sysedge.cf File

By default, the SystemEDGE agent does not load any plug-ins at initialization time, but you can edit the `sysedge.cf` file to configure the agent to load any eHealth AIMs that you have installed. To enable the SystemEDGE agent to load eHealth AIM for Apache at startup, you must edit the `sysedge.cf` configuration file. This file is located in your system directory by default; for example, it is located in the `/etc/sysedge.cf` directory on UNIX systems and in `C:\winnt\system32` for Windows NT and 2000 systems. Use the `sysedge_plugin` keyword as described in the following sections to configure SystemEDGE to load eHealth AIM for Apache at startup.

#### NOTE

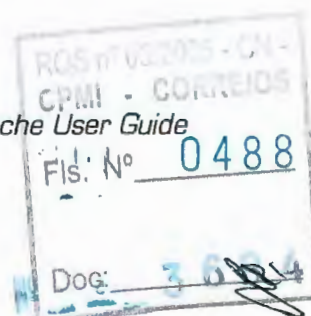
To configure the SystemEDGE agent to start eHealth AIM for Apache, you must provide the *complete pathname* to the shared library file for your system.

### Enabling eHealth AIM for Apache for UNIX Systems

Add one of the following lines to the `sysedge.cf` file.

For Solaris or Linux systems in 32-bit mode, add the following line:

```
sysedge_plugin /opt/EMPSysedge/plugins/apachemod/apachemod.so
```







For Solaris 2.7 and later systems in 64-bit mode, add the following line:

```
sysedge_plugin /opt/EMPsysedge/plugins/apachemod/apachemod-sparcv9.so
```

For HP-UX 10.x systems in 32-bit mode, add the following line:

```
sysedge_plugin /opt/EMPsysedge/plugins/apachemod/apachemod-hpux.so
```

For HP-UX 10.x and 11.x systems in 64-bit mode, add the following line:

```
sysedge_plugin /opt/EMPsysedge/plugins/apachemod/apachemod-hpux11-64.so
```

## Enabling eHealth AIM for Apache for Windows Systems

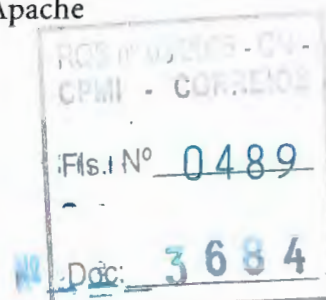
To enable eHealth AIM for Apache for Windows NT, Windows 2000, and Windows XP systems, you must provide the complete path name to `apachemod.dll`. The actual path depends on the location you selected when you installed eHealth AIM for Apache. For example, enter the following command if you installed the files in the `C:\sysedge\plugins\apachemod` directory:

```
sysedge_plugin C:\sysedge\plugins\apachemod\apachemod.dll
```

For more information about the `sysedge.cf` file, refer to the *eHealth SystemEDGE User Guide*.

## Editing the `httpd.conf` File

Edit the `httpd.conf` file to enable the Apache `mod_info` and `mod_status` facilities. These facilities control access to HTML pages that provide information about the server's status and behavior. When these modules are enabled, eHealth AIM for Apache can use them to obtain information about the Apache server's status and behavior. For more information about the `mod_info` and `mod_status` modules, refer to Apache documentation (at <http://www.apache.org>).





**NOTE**

You must ensure that your server has server-status and server-info built into Apache by enabling the mod\_status and mod\_info facilities, as described in the following section. If you do not, you may experience process-termination errors.

2

To enable the mod\_info and mod\_status features in your Apache server:

1. Remove the pound sign (#) in front of the following lines in httpd.conf:

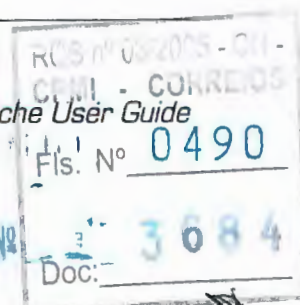
```
LoadModule status_module modules/mod_status.so
LoadModule info_module modules/mod_info.so
```

2. Add the following lines to httpd.conf:

```
# Turn on Extended Status Information
ExtendedStatus On
# Enable server-status access from the local host
<Location /server-status>
    SetHandler server-status
    Order deny,allow
    Deny from all
    Allow from 127.0.0.1
</Location>
# Enable server-info access from the local host
<Location /server-info>
    SetHandler server-info
    Order deny,allow
    Deny from all
    Allow from 127.0.0.1
</Location>
```

**NOTE**

You must restart the Apache server after you make these changes to ensure that they take effect.







## Editing the apachemod.cf File

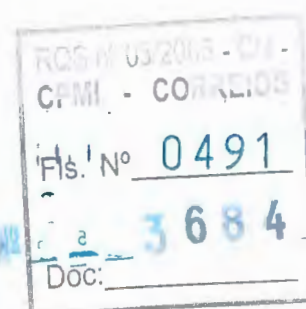
You can edit the apachemod.cf file to do the following:

- Indicate which Transmission Control Protocol (TCP) port your Apache server is using.
- Assign user names and passwords for the mod\_info and mod\_status facilities. You must include user names and passwords to the apachemod.cf file, even if they are not specifically required by the Apache Web server. The Apache Web server requires these fields *only* if you have enabled the mod\_info and mod\_status facilities as described in the previous section, “Editing the httpd.conf File,” and you are using authentication (through user names and passwords) to restrict access to those modules. The apachemod.cf file, however, *always* requires these fields.

### NOTE

Even if you do not password protect your server-info and server-status pages, you must configure artificial user name/password combinations in apachemod.cf. The Apache Web server and eHealth AIM for Apache then ignore those user names and passwords.

- Indicate which Apache server(s) eHealth AIM for Apache should monitor if you are running more than one Apache server on your system through port numbers. Port 80 is the default Web server port.
- Set the interval for calculating the total amount of disk space being used by the Apache server, or disable this checking.





## Sample apachemod.cf File

The following is a sample apachemod.cf file:

```
# apachemod.cf
# Configuration file for eHealth AIM for Apache
#
# For each apache server running on your system, specify the following:
# apache port username password filestat-interval
# port - port number on which the server is running
# username - the username for accessing server-status and server-info pages
# password - the password for accessing server-status and server-info pages
# filestat-interval - interval in seconds between checks of the file sizes
#                  specify "0" to disable file size checking
# Primary server - example
apache 80 status statpass1 3600
# Application server - example
# apache 8080 status statpass1 3600
```

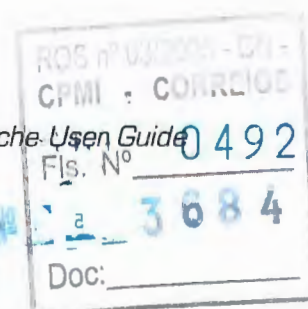
### NOTE

After you make any changes to the apachemod.cf file, you must restart the SystemEDGE agent to ensure that the changes take effect.

## Licensing eHealth AIM for Apache

Like the SystemEDGE agent, eHealth AIM for Apache utilizes a host-based license method. Copies of eHealth AIM for Apache can run only on systems that possess a valid license key. This license is separate from the one used for the SystemEDGE agent.

eHealth AIM for Apache User Guide







The first time that you attempt to start the SystemEDGE agent after installing eHealth AIM for Apache, the agent displays a message stating that it could not find a valid license for eHealth AIM for Apache. It then provides you with a **public key** that is used to generate a permanent license key for your host machine.

A license key is composed of four space-separated, 8-character sequences, totaling 32 characters. The `sysedge.lic` file contains the eHealth AIM for Apache license, as well as the SystemEDGE agent license and other eHealth AIM licenses. For an example, refer to the sample license file in “Sample License File” on page 34.

## Obtaining a License

To obtain a license, you can do any of the following:

- Complete the online license form through the Internet, as described in the next section, “Generating the License through the Web-Based License Form.”
- Use AdvantEDGE View to receive an SNMP license trap or to query and license the plug-in without a trap. For more information, refer to “Generating a License through AdvantEDGE View Event Processing” on page 30 or “Generating a License through AdvantEDGE View Host Administration” on page 32.
- Send an e-mail request to `licenses@concord.com`, and place the returned license key in the `sysedge.lic` file. Always include your user name in license requests that you send through e-mail.
- Run the Concord-supplied `licenseutil.pl` script.
- Run the `licenseme.exe` license utility.

For more information about licensing, refer to the *eHealth SystemEDGE User Guide* and the *Automating the Licensing of the AdvantEDGE Point Plug-in Modules* white paper.



## Generating the License through the Web-Based License Form

This section describes how to generate the eHealth AIM for Apache license through the Web-based license form.

2

### NOTE

If you are using an evaluation copy of eHealth AIM for Apache, you must request a temporary license to enable it to operate during the evaluation period.

### To generate a license:

1. Start the SystemEDGE agent as follows:
  - a. Log in as **root**.
  - b. Change directory (cd) to **/opt/EMPSysedge**.
  - c. Enter the following:

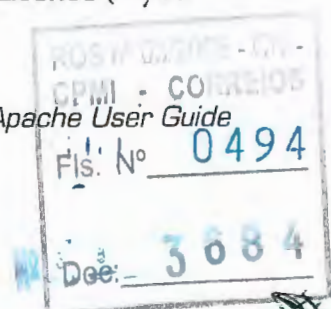
**bin/sysedge**

The SystemEDGE agent displays a message indicating that you need a license for the eHealth AIM for Apache module on this host system. It then displays a message similar to the following:

SystemEDGE Version 4.1 Patchlevel 1  
Copyright 2001 by Concord Communications, Inc.  
Please contact Concord Communications, Inc. to obtain a license  
<http://www.concord.com/support>, Email: [licenses@concord.com](mailto:licenses@concord.com)  
Provide this: `apachemod neptune sol2 5.9 346561363366b19c 1.0 Patchlevel 2`

2. Using a Web browser, go to the licensing Web site at <http://license.concord.com>, and select the **Create License** option that matches your use of the agent:
  - **Create SystemEDGE/AdvantEDGE Eval License** (if you are evaluating the AIM or are a Concord partner or reseller)
  - **Create SystemEDGE Outsource License** (if you are outsourcing the AIM)
  - **Create SystemEDGE/AdvantEDGE License** (if you have purchased the AIM)

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**NOTE**

You must supply a user name and password to access the license form.

3. Complete the license form, entering the information that was printed by the SystemEDGE agent. You must supply the following information:

- Name
- E-mail address
- Software version number (1.0 in the example)
- Patchlevel (2 in the example)
- System name (neptune in the example)
- Operating system name (sol2 in the example)
- Operating system version (5.9 in the example)

**NOTE**

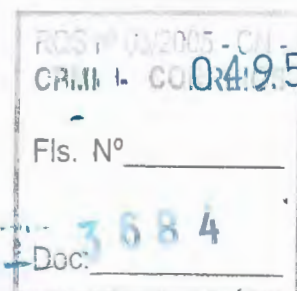
When you request a license, select the option for eHealth AIM for Apache in the product field of the licensing form.

After you submit the license request form, the Concord Web server generates a license and displays it on your Web browser. It also e-mails the license to the contact person in your organization.

4. Copy the license into the `sysedge.lic` file. This file is located in the `/etc` directory for UNIX operating systems and in the `\winnt\system32` directory for Windows NT, Windows 2000, and Windows XP operating systems.

The license key is case sensitive. Copy it exactly as it appears. If possible, use your system's copy-and-paste facility instead of typing it by hand. If you are entering the license key manually, be careful not to confuse characters such as the letters l and I and the number 1, or the letter O and the number 0.

5. Save the `sysedge.lic` file.





6. Restart the SystemEDGE agent.

For UNIX systems, restart the SystemEDGE agent by entering the following when you are logged in as root:

```
bin/sysedge -b
```

For Windows systems, stop and restart the Windows NT Master agent by entering these commands at the command prompt:

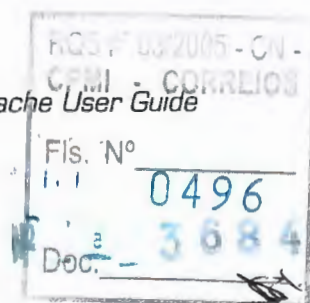
```
net stop snmp  
net start snmp
```

2

## Generating a License through AdvantEDGE View Event Processing

In order to use AdvantEDGE View event processing to license eHealth AIM for Apache, your system must meet the following requirements:

- You must be using SystemEDGE Release 4.0 Patchlevel 3 or later with AdvantEDGE View.
- You must configure the SystemEDGE agent to send SNMP traps to AdvantEDGE View. For more information, refer to the section on configuring the SystemEDGE agent in the *eHealth SystemEDGE User Guide*.
- You must configure the SystemEDGE agent with a read-write community so that AdvantEDGE View can issue an SNMP Set to transmit the license key to it. For more information, refer to the section on configuring the SystemEDGE agent in the *eHealth SystemEDGE User Guide*.
- Your AdvantEDGE View system must have access to the Internet, either directly or through a Web proxy.
- The AdvantEDGE View User who is generating the license must have either write or admin permissions.



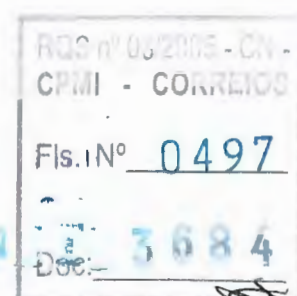




**To generate a license through AdvantEDGE View:**

1. Start the SystemEDGE agent with eHealth AIM for Apache in unlicensed mode. SystemEDGE sends a license trap to AdvantEDGE View for that module.
2. Start AdvantEDGE View, and click the **Events** icon to display the Event Processing screen.  
AdvantEDGE View displays a license trap for the system that requires a license.
3. Click the index number for that system to view the Trap Details form for **License Software** to display the AdvantEDGE View Software Licensing form.
4. Complete the licensing form, and click **Get License**.

Software Licensing, System <i>SystemName</i>	
<b>License Account Info:</b>	
Username	<input type="text" value="user"/>
Password	<input type="password" value=""/>
Name	<input type="text" value="AdvantEDGE View User"/>
Company	<input type="text" value="Company"/>
Email	<input type="text" value="user@company.com"/>
Phone	<input type="text" value="555.555.555"/>
CustomerID	<input type="text" value="566"/>
License Type	<input type="text" value="Permanent"/>
License Duration	<input type="text" value="N/A"/> <input type="text" value="3 months"/> <input type="text" value="6 months"/> <input type="text" value="9 months"/> <input type="text" value="12 months"/> (Only applicable if leasing license)
End-user Company	<input type="text" value=""/> (Only applicable if leasing license)
<input type="button" value="Get License"/>	<input type="button" value="Clear"/>



**NOTE**

If you have configured AdvantEDGE View preferences, AdvantEDGE View fills in all of the information (except password) on this form. You must enter the password each time you use the form for security purposes.

**2**

AdvantEDGE View contacts the Web-based license server, obtains a license for eHealth AIM for Apache and issues an SNMP Set to the target SystemEDGE agent to inform it of the new software license key.

## Generating a License through AdvantEDGE View Host Administration

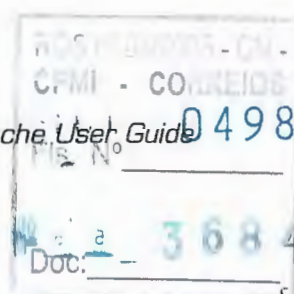
You can also license systems through AdvantEDGE View Host Administration.

**To access Host Administration:**

1. Start AdvantEDGE View, and click the **Administration** icon. AdvantEDGE View displays the Administration page.
2. Click the **Host Administration** icon. AdvantEDGE View displays the host list.

**SystemEDGE Host Configuration**

System Name	Community	Read/Write Community	Port	Timeout	Retries
aviewdemo	public		161	2	2
mailserver	public		161	6	3
nethealth	public		161	3	3
ntclient	public		161	6	3
ntserver	public		161	3	2
unixclient	public		161	6	3
unixserver	public		161	3	3
win2kclient	public		161	5	3
www	public		161	6	3

[Add New Host](#)





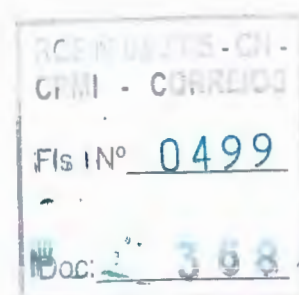
- Click the name of the system that you want to license from the **System Name** column. AdvantEDGE View displays the Modify Host form.

Modify Host view:

Community:	<input type="text" value="public"/>	Read community string for use with this host
Read/Write Community:	<input type="text"/>	Read/Write community string for use with this host
Port:	<input type="text" value="161"/>	UDP Port to use with this host (e.g. 161 or 1691)
Timeout:	<input type="text" value="5"/>	Timeout value (in seconds) to use with this host (e.g. 3)
Retries:	<input type="text" value="3"/>	Number of times to retry an operation on this host (e.g. 3)
<input type="button" value="Update Host"/> <input type="button" value="License Host/Software"/> <input type="button" value="Delete Host"/>		

- Click **License Host/Software** to display the licensing form.
- Select the product you want to license from the **Product** list, and then click **License Software**.

AdvantEDGE View contacts the Web-based license server, obtains a license for the software, and issues an SNMP Set to the target SystemEDGE agent, informing it of the new software license key.





## Sample License File

The following is a sample SystemEDGE agent license file. A pound character (#) in column 1 indicates that the entire line is a comment.

2

```
# license file for SystemEDGE Agent
# Concord Communications, Inc.
# http://www.concord.com
#
# file /etc/sysedge.lic or %SystemRoot%\system32\sysedge.lic
# A valid license key has four parts of 8 characters per part
# parts are separated by space(s) with one license key per line

# sysedge neptune sol2 5.8 807cb1da007cb1da 4.1 Patchlevel 1
e13311d3 0F2a7cb1 abc512dc fF8C923a
# apachemod neptune sol2 5.8 807cb1da007cb1da 1.0 Patchlevel 2
a7943fde 098a87ij a4kiuf39 afafEkj4
```



## Using the eHealth AIM for Apache MIB

This chapter explains the organization and content of the Concord Communications MIB for the Apache Web server. The MIB specification (`apachemod.asn1`) defines a collection of objects for monitoring and managing Apache. You must configure the SystemEDGE agent to monitor the MIB objects that are relevant for your configuration. For more information, refer to Chapter 4, "Using eHealth AIM for Apache." Figure 3 shows the organization of the Apache MIB.

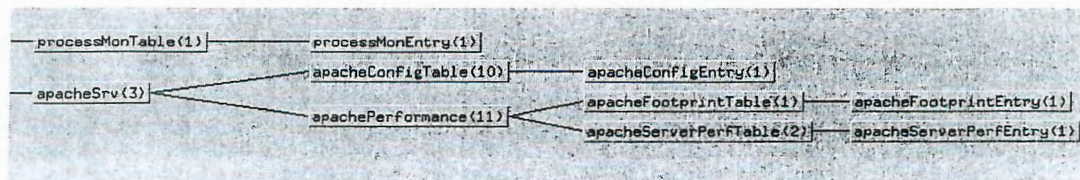
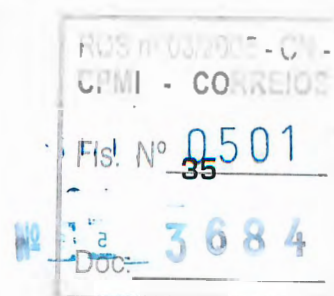


Figure 3. eHealth AIM for Apache MIB

The figures in the following sections represent AdvantEDGE View queries on information that is available through the AdvantEDGE for Apache MIB.

The MIB is organized into sections for server configuration and performance. Within the performance section, a footprint section defines MIB objects that convey how much of the underlying system's resources are consumed by Apache. This chapter defines all sections of the Apache MIB and highlights important MIB objects from each section. For a complete list of MIB objects, refer to the eHealth AIM for Apache MIB specification (`apachemod.asn1`).





## Configuration Section

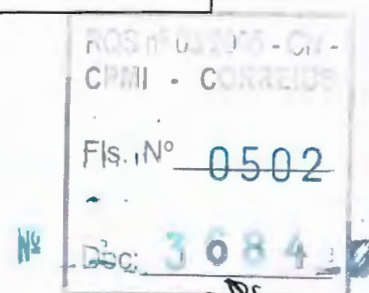
The Configuration section of the eHealth AIM for Apache MIB contains configuration parameters and settings that are important for streamlining the health and performance of the Apache Web server. It also includes information about server configuration.

### Server Configuration

The Server Configuration group contains configuration parameters, process IDs, and version numbers. Table 3 defines important Server Configuration parameters.

**Table 3. Selected MIB Objects – Apache Server Configuration Group**  
(Page 1 of 2)

MIB Object	Description
apacheConfigTable	Table of configuration settings for each Apache installation.
apacheConfigEntry	Entry in the Apache configuration table.
apacheConfigPort	TCP port currently used by this Apache configuration. <b>NOTE</b> This value serves as the index for this table.
apacheConfigVersion	Apache Web server version.
apacheConfigPID	Process ID (PID) of the master Apache process; zero if the server is not running.
apacheConfigRunMode	Current operating mode (for example, standalone).
apacheConfigUser	User who is currently running the server processes.
apacheConfigGroup	Group that is currently running the server processes.
apacheConfigHostname	Host name used by this Apache configuration.
apacheConfigStartProcs	Number of server processes started by the Apache server at startup.
apacheConfigMinIdleProcs	Minimum number of idle server processes maintained by the Apache server.







**Table 3. Selected MIB Objects – Apache Server Configuration Group**  
(Page 2 of 2)

MIB Object	Description
apacheConfigMaxIdleProcs	Maximum number of idle server processes allowed by the Apache server.
apacheConfigMaxProcs	Maximum number of server processes allowed by the Apache server.
apacheConfigRequestsMaxPerChild	Number of requests handled by a server process before it is recycled by the Apache server.
apacheConfigRequestsKeepAlive	Status of whether keep-alive mode is enabled for persistent connections: disabled = 0; enabled = 1.
apacheConfigRequestsMaxPerConn	Number of requests handled in a single connection if keep-alive mode is enabled.
apacheConfigThreadsPerChild	Maximum number of threads per child process.
apacheConfigConnectionTimeout	Timeout value for closing inactive connections.
apacheConfigKeepAliveTimeout	Keep-alive timeout value for open connections.
apacheConfigServerRoot	Root directory for this Apache installation.
apacheConfigConfigFile	Current configuration file for this Apache installation.
apacheConfigPIDFile	Current PID file for this Apache installation.
apacheConfigScoreboardFile	Current scoreboard file for this Apache installation.
apacheConfigDocumentRoot	Current document root directory for this Apache installation.
apacheConfigAccessLogFile	Current access or transaction log file for this Apache installation.
apacheConfigErrorLogFile	Current error log file for this Apache installation.
apacheConfigScriptLogFile	Current script log file for this Apache installation.

3

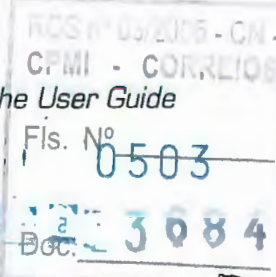




Figure 4 shows a sample AdvantEDGE View Apache Server Configuration query.

Server Configuration

Port: 80

Apache Version: Apache/1.3.9

Server Hostname: aview.empire.com

Apache User: aview(101)

Apache Group: 101

Server Root: /opt/aview/apache

Config File: conf/httpd.conf

Document Root: /opt/aview/htdocs

Access Log: /opt/aview/var/log/access\_log

Error Log: /opt/aview/var/log/error\_log

Script Log: /opt/aview/var/log/script\_log

Apache Tuning Settings

<u>Start Procs:</u> 5	<u>Max Procs:</u> 150
<u>Min Idle Procs:</u> 5	<u>Max Idle Procs:</u> 10
<u>KeepAlive Enabled?:</u> 1	<u>Max Per Connection:</u> 100
<u>Requests Per Child:</u> 1000	<u>Threads Per Child:</u> 0
<u>Connection Timeout:</u> 0	<u>Keep Alive Timeout:</u> 0

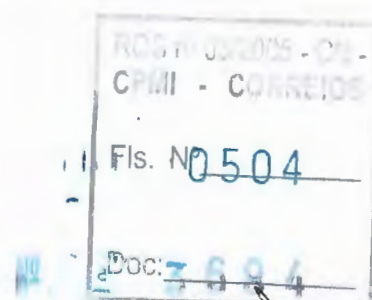
Figure 4. Sample AdvantEDGE View Server Configuration Query for Apache

## Performance Section

The Performance section of the eHealth AIM for Apache MIB contains performance data that is necessary for capacity planning and trend analysis, as well as real-time performance and availability monitoring. The Performance group is divided into subgroups for footprint data and server performance.

### Apache Footprint

The Footprint group provides information about the Apache CPU, memory, data flow, and disk-resource consumption, which is more commonly called the *footprint*. Long-term trending analysis of footprint information is useful for anticipating and avoiding problems due to resource exhaustion.







You can also monitor footprint information in real time to detect and correct temporary resource exhaustion due to viruses, security incidents, and hardware failures. Table 4 defines important Apache Footprint metrics.

Table 4. Selected MIB Objects – Apache Footprint Group (Page 1 of 2)

3

MIB Object	Description
apacheFootprintTable	Table that reports the performance footprint for each Apache service.
apacheFootprintEntry	Entry in the Apache Performance Footprint table.
apacheFootprintPort	TCP port that is currently used by this Apache configuration. <b>NOTE</b> This value serves as the index for this table.
apacheFootprintCPUTime	CPU time, in seconds, accumulated by the Apache server, including all Apache processes.
apacheFootprintPercentCPU	Percentage of CPU utilization by the Apache server over the last sample interval; the value reported is percentage multiplied by 100.
apacheFootprintTotalMEMSize	Combined size of Apache's text, data, and stack segments in KB; summation of the process sizes for all Apache server processes.
apacheFootprintTotalRSS	Real memory (resident set) size (RSS) of the Apache server in KB; summation of all process RSS for all Apache server processes.
apacheFootprintPercentMEM	Percentage (0 to 100) of real memory used by the Apache server, which includes all Apache server processes.
apacheFootprintNumThreads	Number of threads executing within all Apache processes of which the operating system is aware.
apacheFootprintInBlks	Number of blocks of data input by the processes.
apacheFootprintOutBlks	Number of blocks of data output by the processes.
apacheFootprintMsgsSent	Number of messages sent by the processes.
apacheFootprintMsgsRecv	Number of messages received by the processes.
apacheFootprintSysCalls	Number of system calls invoked by the processes.



Table 4. Selected MIB Objects – Apache Footprint Group (Page 2 of 2)

MIB Object	Description
apacheFootprintMinorPgFlts	Number of minor page faults (which do not require input/output [I/O] to retrieve the page) incurred by the processes.
apacheFootprintMajorPgFlts	Number of major page faults (which require I/O to retrieve the page) incurred by the processes.
apacheFootprintNumSwaps	Number of times the processes have been swapped.
apacheFootprintVolCtx	Number of voluntary context switches incurred by the processes.
apacheFootprintInvolCtx	Number of involuntary context switches incurred by the processes.
apacheFootprintTotalLogSize	Size in KB of the Apache service logs; sum of the access and error log file sizes.
apacheFootprintDocSize	Size in KB of the Apache document root directory and all files beneath it.
apacheFootpringTotalDiskSize	Size in KB of all the Apache disk storage areas; summation of log sizes and service directories.

The following figures show sample AdvantEDGE View Footprint queries for an Apache system that is serving a medium-sized company. Figure 5 shows a sample Disk Usage query.

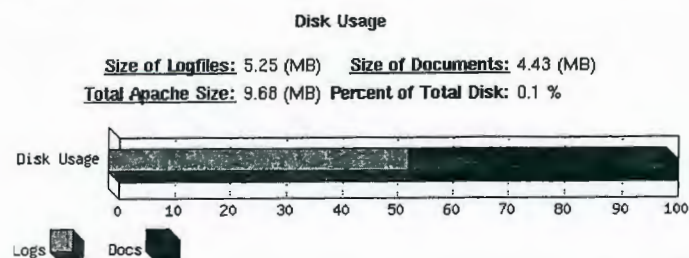


Figure 5. AdvantEDGE View Disk Usage Query for Apache

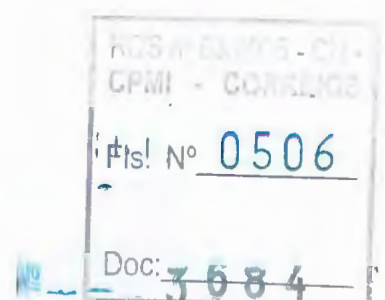
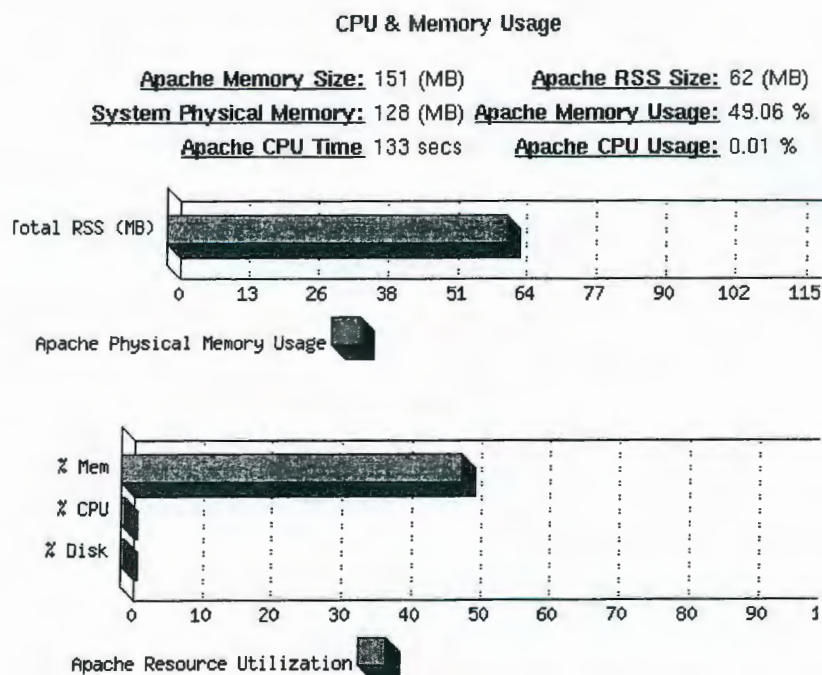






Figure 6 shows a sample CPU and Memory Footprint query.



3

Figure 6. AdvantEDGE View CPU and Memory Footprint Query for Apache

## Server Performance

The Server Performance group provides performance metrics and counters for the Apache Web server, including user statistics and transfer statistics. These metrics include those useful for real-time management and longer-term capacity planning and trend analysis. Table 5 defines important Server Performance metrics.



**Table 5. Selected MIB Objects – Apache Server Performance Group**  
(Page 1 of 2)

MIB Object	Description
apacheServerPerfTable	Table that reports the performance of each Apache service.
apacheServerPerfEntry	Entry in the Apache Server Performance table.
apacheServerPerfPort	TCP port that is currently used by this Apache configuration; index for this table.
apacheServerPerfUptime	Number of seconds that the Apache server has been running.
apacheServerPerfTotalAccesses	Number of accesses (hits) to this server since it was last started.
apacheServerPerfTotalTraffic	Number of KB transferred by this server since it was last started.
apacheServerPerfCurrentUsers	Number of current active users (connections) maintained by the Apache server.
apacheServerPerfCurrentIdleProcs	Number of current idle processes available on the Apache server.
apacheServerPerfCurrentStartupProcs	Number of processes that are currently in startup mode on the Apache server.
apacheServerPerfCurrentReadProcs	Number of processes that are currently reading requests on the Apache server.
apacheServerPerfCurrentReplyProcs	Number of processes that are currently replying to requests on the Apache server.
apacheServerPerfCurrentKeepAliveProcs	Number of processes that are currently in keep-alive mode on the Apache server.
apacheServerPerfCurrentDNSProcs	Number of processes that are currently doing a Domain Name System (DNS) lookup on the Apache server.

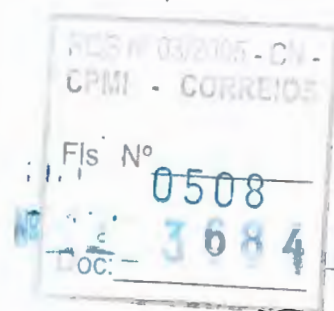






Table 5. Selected MIB Objects – Apache Server Performance Group  
[Page 2 of 2]

MIB Object	Description
apacheServerPerfCurrentLoggingProcs	Number of processes that are currently logging transactions on the Apache server.
apacheServerPerfCurrentFinishingProcs	Number of processes that are currently finishing transactions on the Apache server.
apacheServerPerfCurrentTotalProcs	Total number of Apache processes that are currently running on the Apache server.

3

Figure 7 shows an Apache server Performance summary.

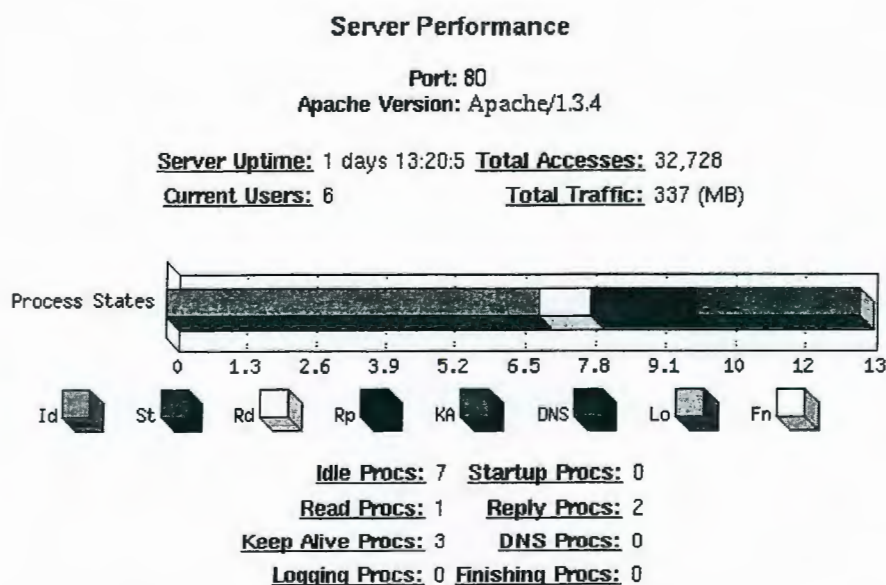
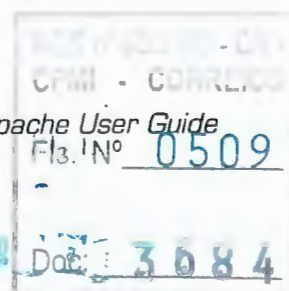


Figure 7. AdvantEDGE View Server Performance Summary for Apache





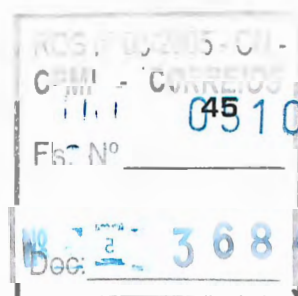
## Using eHealth AIM for Apache

This chapter describes how to use eHealth AIM for Apache. This module is implemented as a SystemEDGE agent plug-in. After you enable this plug-in in the `sysedge.cf` file and obtain a license for it, it will load automatically at SystemEDGE start time. For more information, refer to “Editing the `sysedge.cf` File” on page 21 and “Licensing eHealth AIM for Apache” on page 25.

### Overview

The eHealth AIM for Apache plug-in implements additional MIB objects that provide advanced information about the health and availability of the Apache Web server. It can operate with any SNMP-compliant management software such as Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others. If you are using eHealth AIM for Apache with eHealth, refer to the eHealth Web Help for more information about the reports you can generate.

The default configuration settings of eHealth AIM for Apache enable you to use the advanced self-monitoring capabilities of the SystemEDGE agent in conjunction with eHealth AIM for Apache.







## eHealth AIM for Apache MIB Branch

You can use AdvantEDGE View or another SNMP tool to edit the SystemEDGE configuration file to utilize the MIB objects found in eHealth AIM for Apache with the process-monitoring, threshold-monitoring, and history-collection features of the SystemEDGE agent. All MIB objects related to eHealth AIM for Apache exist at object identifier (OID) branch 1.3.6.1.4.1.546.16.3 in the Concord Systems Management MIB. The MIB is defined in the `apachemod.asn1` file, which is available in the eHealth AIM for Apache product installation.

## Assigning Entry Rows for the SystemEDGE Self-Monitoring Tables

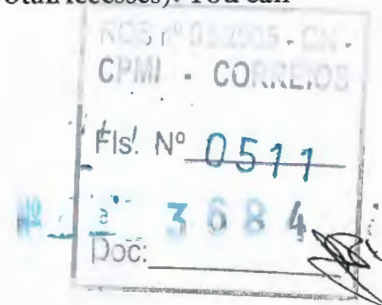
All SystemEDGE self-monitoring tables require the use of unique row numbers. Each table contains an Index column which acts as a key field to distinguish rows in the table. This section describes the benefits of reserving a block of rows (in the range of 11 to the maximum number of rows in your table) for use by the system or application administrator.

### Setting Local Policy

You may choose, as a matter of local policy, to reserve a block of rows for system administration. This policy allows you to define row entries within a reserved block of rows without being concerned that the row might already be taken by another user's entry. In compliance with the local policy, all other users should use row indices that are outside the reserved range when defining user-configured entries.

### Reserving Blocks of Rows

By reserving a block of rows, you can define a consistent set of conditions (row entries) to be monitored across all machines such that the same condition is defined in the same row number on each machine. For example, you can use row 3000 in each table to define entries monitoring the number of accesses to the server (`apacheServerPerfTotalAccesses`). You can





then distribute this configuration to every host so that every system that is running Apache uses row 3000 for monitoring the number of accesses to the server in any of the SystemEDGE agent monitoring tables.

**To reserve a block of rows for monitoring Apache:**

1. Decide which block of rows you want to reserve for use with monitoring Apache.
2. Use that block of rows to define a set of row entries for each SystemEDGE self-monitoring table. For more information, refer to the chapter on self monitoring in the *eHealth SystemEDGE User Guide*.
3. Distribute configuration file entries to all hosts that are running the Apache Web server and eHealth AIM for Apache. For more information, refer to the *Automating the Deployment of SystemEDGE and the AdvantEDGE Point Plug-in Modules* white paper.

4

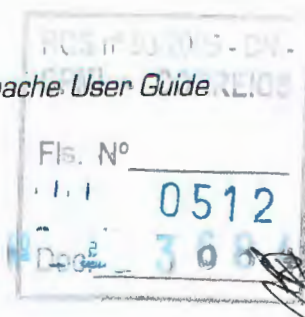
**NOTE**

As an alternative, you can use this row-number assignment policy with AdvantEDGE View for group-configuration operations.

4. Require end users to avoid your block of rows when defining their own self-monitoring table entries.

## Using the SystemEDGE Self-Monitoring Features

This section provides examples of how to use SystemEDGE process, threshold, and history monitoring to monitor the Apache Web server. Add these commands to the `sysedge.cf` file to enable monitoring of the MIB objects that they specify. Modify these examples as necessary to monitor the MIB objects and thresholds that are relevant for your configuration.







The examples in the following sections present row numbers in the 5000 range; select a row number for your configuration that conforms to local policies. For more information on row assignment, refer to “Assigning Entry Rows for the SystemEDGE Self-Monitoring Tables” on page 46.

The following command, for example, instructs the SystemEDGE agent to monitor whether the Apache process is alive at 30-second intervals and to store the data in row 5000 of the Process Monitoring table:

```
watch process procAlive 'httpd' 5000 0x0100 30 'Apache Web Server' ''
```

For more information about the syntax for the commands in this section, refer to the *eHealth SystemEDGE User Guide*.

#### NOTE

*Enter the commands throughout this chapter on one line. Do not use a carriage return to match the formatting shown here.*

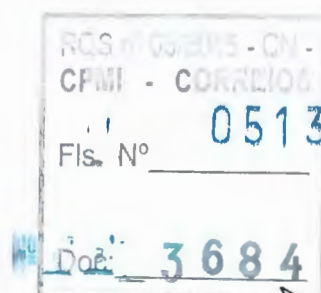
## Using SystemEDGE Process Monitoring

This section provides an example of how to use the SystemEDGE agent to monitor the availability of a critical Apache process. For more information, refer to the section on process and service monitoring in the *eHealth SystemEDGE User Guide*.

To ensure that the Apache Web server is running, enter the following command in the `sysedge.cf` file:

```
watch process procAlive 'httpd' 5000 0x0100 30 'Apache Web Server' ''
```

You must include the `0x0100` flag to force the SystemEDGE agent to monitor the parent process of the Apache process group.





## Using SystemEDGE Threshold Monitoring

This section provides examples of how to use the SystemEDGE agent to monitor thresholds for important Apache metrics. Add the commands in the following sections to the `sysedge.cf` file to monitor thresholds for these MIB objects. For more information, refer to the section on threshold monitoring in the *eHealth SystemEDGE User Guide*.

### NOTE

The thresholds in this section may not be appropriate for your Apache Web server. Select thresholds that are appropriate for your environment.

4

### Monitoring Idle Apache Processes

To monitor the number of idle Apache processes on the server that is running on port 80, enter the following:

```
monitor oid apacheServerPerfCurrentIdleProcs.80 5000 0x0 60
absolute < 10 'Idle Server Processes' ''
```

### Monitoring Total Resident Memory Size of an Apache Service

To monitor the total resident memory size of the Apache service that is running on port 80, enter the following:

```
monitor oid apacheFootprintTotalRSS.80 5001 0x0 60 absolute > 50000
'Total Resident Memory' ''
```

### Monitoring Total Size of Apache Service Log Files

To monitor the total size of the log files for the Apache service that is running on port 80, enter the following:

```
monitor oid apacheFootprintTotalLogSize.80 5002 0x0 60
absolute > 100000 'Total Log Size' ''
```

*eHealth AIM for Apache User Guide*

Form with fields and stamps:

- Top stamp: RGS 11/04/2010 - CH - CPMI - CORREIOS
- Field: Fls. Nº 0514
- Field: 3684
- Field: Doc: (with signature)





## Monitoring Total Size of Apache Service Document Files

To monitor the total size of the document files for the Apache service that is running on port 80, enter the following:

```
monitor oid apacheFootprintTotalDocSize.80 5003 0x0 60
absolute > 500000 'Total Document Size' ''
```

## Using SystemEDGE History Collection

This section provides examples of how to use SystemEDGE history collection to track the value of important Apache metrics over time. Add the commands in the following sections to the `sysedge.cf` file to collect history for these MIB objects. For more information, refer to the section on history collection in the *eHealth SystemEDGE User Guide*.

### NOTE

The number of samples and the interval between samples used in this section may not be appropriate for your Apache system; select values that are suitable for your environment.

## Collecting History on Number of Hits to the Server

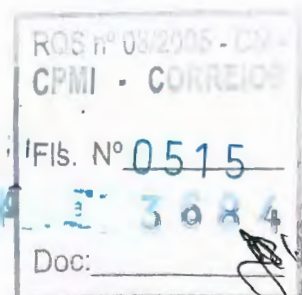
To collect history on the number of hits to the server on port 8080, enter the following:

```
emphistory 5000 60 apacheServerPerfTotalAccesses.8080 300 'Total Hits
To Port 8080 Server'
```

## Collecting History on the Number of Current Active Users

To collect history on the number of current active users that are being maintained by the Apache server on port 8080, enter the following:

```
emphistory 5001 60 apacheServerPerfCurrentUsers.8080 300 'Total Users
On Port 8080 Server'
```





## Glossary


**Abstract Notation One (ASN.1)** A language that describes data types independent of computer structures and representations. For more information refer to ISO International Standard 8824.

**Active Server Page (ASP)** An HTML file that includes one or more scripts written using VBScript, JavaScript, or ActiveX Data Objects program statements. ASP files (named with the ".asp" suffix) receive a user request and create a customized Web page for the user (usually based on database information).

**AdvantEDGE View** A Web-based management interface for use with the SystemEDGE agent that enables an administrator to use a Web browser to manage systems and applications.

**agent** In network management, a program that provides information from a management information base (MIB) for SNMP agents. eHealth or a network management system (NMS) use the information about managed devices and take corrective action when appropriate.

**American Standard Code for Information Interchange (ASCII)** The most common format for character representation in computers and the Internet. Characters fit into a single byte. It was developed by the American National Standards Institute (ANSI).



RDS 11032003 - 001 -
CPMI - CORRIGES
50516
Fils: N°
3684
Doc:





**Apache** A freely distributed Web server that runs on most UNIX, Linux, and Windows NT operating systems. For details about the Apache server, refer to the Apache Web site, <http://www.apache.org>.

**application** A program that performs a specific function for one or more users or for another application program. Types of applications include communication programs, management programs, word processors, databases, and drawing programs.

**ASCII** See American Standard Code for Information Interchange (ASCII).

**ASN.1** See Abstract Notation One (ASN.1).

**ASP** See Active Server Page (ASP).

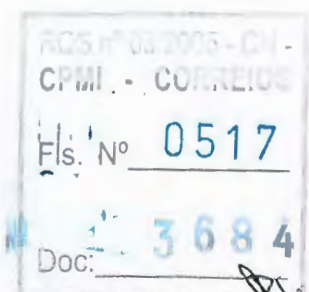
**buffer** A temporary storage area for data. Often implemented as holding areas between the backplane and an interface; data remains in the buffer until it can be transmitted on the interface or processed by the central processing unit (CPU).

**central processing unit (CPU)** The component within a device that performs the instruction execution for the applications and programs that run on the device. Also referred to as a processor or microprocessor.

**CGI** See Common Gateway Interface (CGI).

**client** A computer system, usually a desktop computer or laptop, that presents data directly to a user and accepts input. They drive the computing process, supporting local processing and accessing remote servers as needed for data access and analysis.

Also refers to the application software residing on a machine that is used by an end user.





**Common Gateway Interface (CGI)** A server-side interface for Web-based applications that defines how a Web server can exchange data with an application. The Active Server Pages (ASP) and Internet Server Application Program Interface (ISAPI) technologies are alternatives to CGI.

**congestion** A condition in which the network traffic is greater than the amount that the network can carry. Often causes performance problems and delays on a network.

**CPU** See central processing unit (CPU).

**DHCP** See Dynamic Host Configuration Protocol

**DNS** See domain name system (DNS).

**domain name system (DNS)** The system that locates and translates Internet domain names such as concord.com into Internet Protocol (IP) addresses. A DNS server is typically a device that translates domain names to IP addresses within your network.

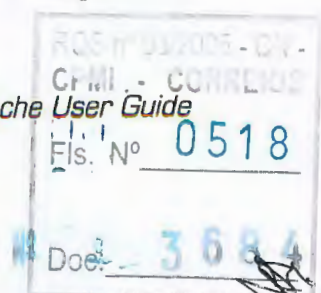
**Dynamic Host Configuration Protocol** A protocol that enables dynamic allocation of IP addresses so that they can be reused.

**eHealth AIM** See eHealth application insight module.

**eHealth application insight module** A plug-in (supplementary program) that extends the functionality of the SystemEDGE agent. AIMs add the capability to manage application-specific events, processes, thresholds, and health.

**event** An occurrence on a system that typically results in a message, such as an SNMP trap, being sent to a configured management system. Common events include system failures, system reboots, exceeded thresholds, or any user-configurable situation that the user wants to identify.

**file cache** A block of memory that holds frequently or recently used data. A system can read those blocks at memory speed rather than the slower disk access speed.







**File Transfer Protocol (FTP)** A means for uploading and downloading files on the Internet (the oldest Internet protocol for retrieving files). You can use an FTP client application to request files from or transfer files to an FTP server.

**FTP** See File Transfer Protocol (FTP).

**Host Resources MIB** A MIB (management information base) that defines a set of objects that are useful for the management of host computers. For example, it defines host storage areas, devices, and file systems. This MIB is defined in RFC 1514.

**hostname** The name for an individual IP (Internet Protocol) address on a computer. While many computers have only one hostname, some machines, such as network servers have multiple hostnames.

**HTML** See Hypertext Markup Language (HTML).

**HTTP** See Hypertext Transfer Protocol (HTTP).

**Hypertext Markup Language (HTML)** A programmatic language used for controlling the way that text and images appear when a file is displayed on the World Wide Web.

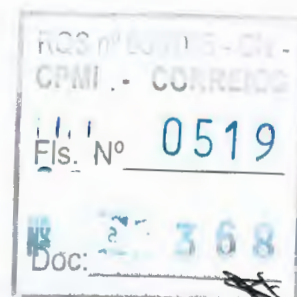
**Hypertext Transfer Protocol (HTTP)** An application protocol that defines the set of rules for exchanging files (text, graphics, multimedia, and other files) on the World Wide Web.

**I/O** See input/output (I/O).

**Information Technology (IT)** A widely-used term to describe all of the technologies used for creating, exchanging, managing, and using information in various forms.

**input/output (I/O)** Any operation, program, or device that transfers data to or from a computer.

**Internet Control Message Protocol (ICMP)** A protocol between a server and a gateway to the Internet.





**Internet Protocol (IP)** The method (or protocol) by which packets of information are sent across the Internet. IP defines addressing, error handling, routing, and option codes for data transmission. IP requires no continuing connection between the endpoints that are communicating.

**IP** See Internet Protocol (IP).

**IT** See Information Technology (IT).

**management information base (MIB)** A formal description of a set of network objects that can be managed using Simple Network Management Protocol (SNMP).

**MIB** See management information base (MIB).

**network** A collection of computers, printers, routers, switches, and other devices that are able to communicate using a common transmission media such as TCP/IP.

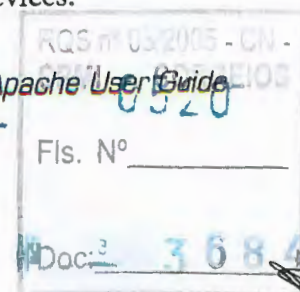
**network management system (NMS)** An application program usually residing on a computer that manages at least part of a network, including systems and applications. The NMS communicates with agents to monitor network statistics and resources, control network device configuration, and analyze network problems. *See also* agent.

**NMS** See network management system (NMS).

**object identifier (OID)** a unique identifier of a managed object in a MIB hierarchy. *See also* management information base (MIB).

**OID** See object identifier (OID).

**operating system (OS)** The program that manages all other programs (applications or application programs) on a computer. Provides the following services: determining the order in which each application runs and the time allotted for that application, managing the sharing of internal memory among multiple applications and handling input to and output from attached hardware devices.







**OS** See operating system (OS).

**packet** A logical unit of data routed between an origin and a destination on the Internet or any other packet-switched network. On the Internet, the Transmission Control Protocol (TCP) layer of TCP/IP divides a file into packets of manageable size for routing.

**packet-switched network** A communications network in which data is transferred in small units called packets. Individual packets for a file may travel different routes. When all packets for a file reach their destination, the file is reassembled.

**packet-switching** A networking technology in which network nodes share bandwidth by sending packets. The same data path can be shared by many users in the network. Packet-switching is widely used throughout the Internet.

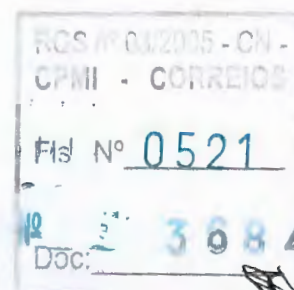
**page** In computers that utilize virtual memory, a unit of data storage. Systems transfer pages of data from disk storage to memory and back again.

On the World Wide Web, a file written using Hypertext Markup Language (HTML) that specifies how text, images, and other multimedia will be presented to the user. A Web site delivers information to the user one page at a time.

**paging** The process by which a computer moves portions of programs between random access memory and auxiliary storage (on disk).

**partition** A logical division of a hard disk on a PC that is created so that each partition can have a different operating system or can be used for different purposes (for example, file management or multiple users).

**performance threshold** The upper limit of acceptable response time.





**ping** An Internet echo message used to confirm the reachability of a network device. An abbreviation for Packet Internet or Inter-Network Groper.

**process** Typically, an instance of a program or application that is running on a server. Applications can have one or more associated processes.

**protocol** The set of rules by which the endpoints in a telecommunication connection communicate. The protocol defines the packet format of the transmitted information. On the Internet, common protocols are TCP, IP, HTTP and FTP.

**queue** In a system, a set of jobs awaiting resources. In a network device such as a router, a collection of packets waiting to be processed or forwarded. Insufficient central processing unit (CPU) speed, memory, or interface speeds can contribute to long queues, and therefore, to delay on the network.

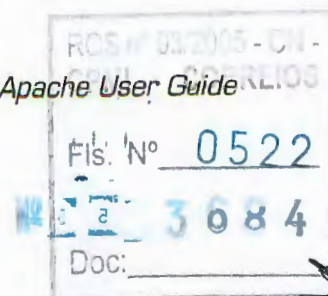
**real-time** A level of computer responsiveness that an end user would deem as immediate or fast enough to show incremental changes of an external process (for example, to present visualizations of the weather as it constantly changes).

**Request For Comments (RFC)** The name of the document series regarding Internet design. Most RFCs define protocol specifications such as Telnet and FTP. RFCs are widely available online.

**RFC** See Request For Comments (RFC).

**server** A program that provides services to other programs in the same and other computers.

Also a computer that performs file storage and application hosting as well as provides computing services to other devices and users on the network. Typically has one or more central processing units (CPUs), disks, interfaces, and storage partitions.







**Simple Network Management Protocol (SNMP)** The network management protocol used almost exclusively in data networks. A method for monitoring and controlling network devices, as well as managing configurations, statistics collection, performance, and security.

**SNMP** See Simple Network Management Protocol (SNMP).

**SNMP agent** A program such as the SystemEDGE agent that conforms to a management information base (MIB) specification to collect information about managed devices and to take corrective action (using SNMP traps) when appropriate.

**SystemEDGE agent** Concord's SNMP agent that autonomously monitors system configuration, status, performance, users, applications, file systems, and other critical resources.

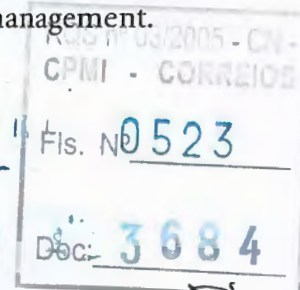
**Systems Management MIB** A set of MIB (management information base) objects that extends the capabilities of the Host Resources MIB. It provides greater visibility into systems and specific information about Windows NT and UNIX systems.

**TCP/IP** See Transmission Control Protocol (TCP) and "Internet Protocol (IP).

**threshold** See performance threshold.

**Transmission Control Protocol (TCP)** A connection-based protocol used along with the Internet Protocol (IP) to send data in the form of message units between computers over the Internet. While IP is responsible for the actual delivery of the data, TCP is responsible for dividing data into packets at the sending system and constructing the data message from individual packets at the receiving system.

**trap** A message sent by an SNMP agent to a console or network management system (NMS) to indicate that a threshold has been reached or another user-defined condition has occurred. The SystemEDGE agent defines a number of traps for system and application management.





**UDP** See User Datagram Protocol (UDP).

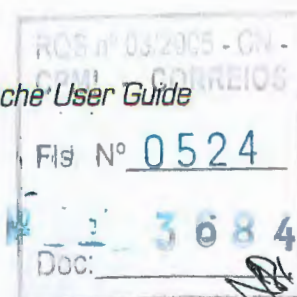
**User Datagram Protocol (UDP)** A communications protocol that uses Internet Protocol (IP) to send and receive data and is similar to Transmission Control Protocol (TCP), but provides fewer packet management services.

**variable** A performance metric for an element. A characteristic or behavior upon which eHealth gathers data and evaluates the performance of the element. SystemEDGE agents can also monitor local variables to reduce network polls and increase scalability.

**Web** See World Wide Web (WWW, Web).

**workstation** A powerful computer that is equipped with a fast processor, a large amount of random access memory, and other features such as high-speed graphical rendering that make it suitable for business users such as engineers, graphic designers, and architects.

**World Wide Web (WWW, Web)** All of the resources on the Internet that use Hypertext Transfer Protocol (HTTP). Users of the Web access information through browser software.







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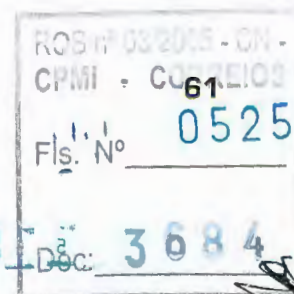
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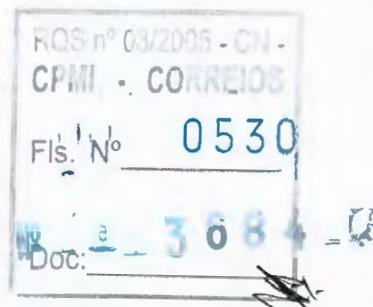
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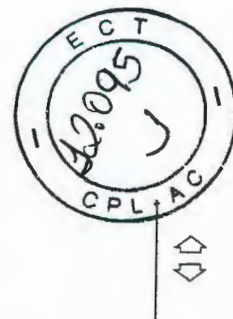
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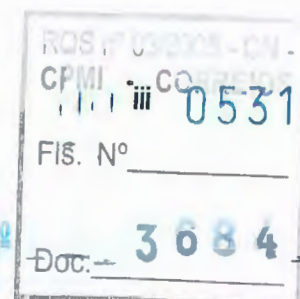
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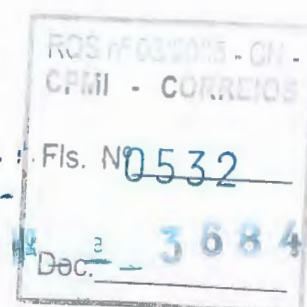


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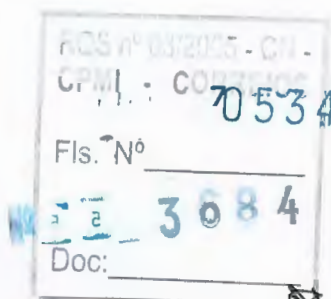
## About This Guide

This guide describes how to install and use the *eHealth* application insight module (AIM) for Oracle. It is intended for the person responsible for installing and configuring *eHealth* AIM for Oracle. This guide supports *eHealth* AIM for Oracle Release 1.3 Patchlevel 1 or later, and *eHealth* SystemEDGE Release 4.0, Patchlevel 3 or later. *eHealth* AIM for Oracle supports the following operating systems:

- Sun Solaris (SPARC) Release 2.6 or later in *32-bit mode* and one of the following versions of Oracle in *32-bit mode*:
  - Oracle 8.0.4, 8.0.5, 8.0.6
  - Oracle 8i (8.1.5, 8.1.6, or 8.1.7)
- AIX Releases 4.2 and 4.3 on Oracle 8i
- HP-UX Releases 11.0 and 11.1 on Oracle 8i

## Audience

This guide is intended for the person who is installing and using *eHealth* AIM for Oracle. To use *eHealth* AIM for Oracle, you should have a basic understanding of the Oracle database, *eHealth* SystemEDGE, and your host's operating system environment. For more information, refer to Oracle documentation (<http://www.oracle.com>) and the *eHealth* SystemEDGE User Guide.







## About This Guide

This section describes the changes and enhancements that have been made since the last release of this guide. It also includes the documentation conventions used in this guide.

### Revision Information

This guide describes information that is specific to *eHealth AIM* for Oracle 1.0 Patchlevel 2. The following is new in this version of the guide:

- Installation instructions for the AIX and HP-UX versions of *eHealth AIM* for Oracle
- Licensing through AdvantEDGE View Event Processing and Host Administration
- Glossary

### Documentation Conventions

Table 1 lists the conventions used in this document.

Table 1. Documentation Conventions (Page 1 of 2)

Convention	Description
File or Directory Name	File or directory names.
<code>code</code>	System, code, or operating system command line examples.
<i>emphasis</i>	Emphasis and guide titles.
<b>enter</b>	Text that you must type exactly as shown.
<b>Name</b>	Text that defines menus, fields in dialog boxes, or keyboard keys.
New Term	A new term, that is, one that is being introduced.
<i>Variable</i>	Variable values that you substitute.

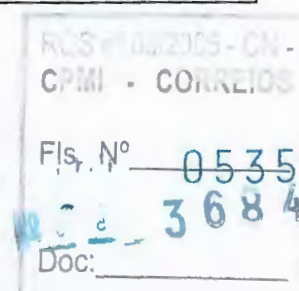




Table 1. Documentation Conventions (Page 2 of 2)

Convention	Description
→	A sequence of menus or menu options. For example, <b>File</b> → <b>Exit</b> means "Choose <b>Exit</b> from the <b>File</b> menu."
<b>NOTE</b> _____ _____	Important information, tips, or other noteworthy details.
<b>CAUTION</b> _____ _____	Information that helps you avoid data corruption or system failures.
<b>WARNING</b> _____ _____	Information that helps you avoid physical danger.

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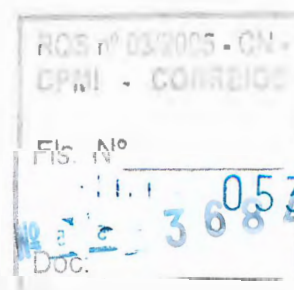




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# Introduction

This chapter provides an overview of *eHealth AIM* for Oracle.

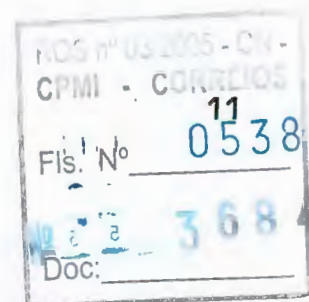
## Introducing *eHealth AIM* for Oracle

*eHealth AIM* for Oracle is a plug-in for the SystemEDGE agent that enables information technology (IT) operators to monitor the health and availability of Oracle databases and servers. You can configure this plug-in to monitor the Oracle processes and features that are relevant to your organization. You can also configure *eHealth AIM* for Oracle to alert you to any potential issues with the application or the system on which it is running before those issues become problems.

To use *eHealth AIM* for Oracle, you must install it on every Oracle system that you want to monitor. For more information, refer to Chapter 2, "Installing *eHealth AIM* for Oracle."

### NOTE

This guide is not intended to describe how to install, administer, or use Oracle databases. For help with Oracle, refer to your Oracle documentation.







## Features

*eHealth AIM for Oracle* monitors the following:

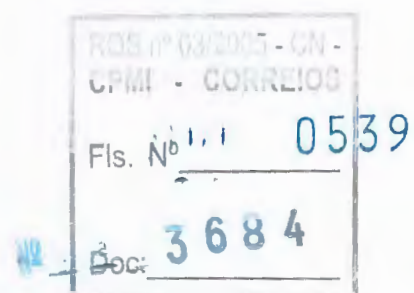
- Oracle database configuration
- Oracle log files (including alert, redo, database, and configuration logs)
- Performance metrics
- Database response and availability

*eHealth AIM for Oracle* monitors database process attributes. For example, it monitors whether each process is alive; and it can restart processes, if necessary. In addition, it monitors memory use, log sizes, number of transactions, and efficiency of the library and the data dictionary.

Because the Oracle application records error information in alert log files, *eHealth AIM for Oracle* can use the log-file monitoring capability of the SystemEDGE agent to scan the logs and forward certain events as SNMP traps when appropriate.

For more information about the management information base (MIB) objects that you can monitor with *eHealth AIM for Oracle*, refer to Chapter 3, “Using the *eHealth AIM for Oracle* MIB.” For more information about configuring the SystemEDGE agent to monitor these MIB objects, refer to Chapter 4, “Using *eHealth AIM for Oracle*.”

*eHealth AIM for Oracle* is designed to monitor one or more Oracle databases of the same Oracle release that are running on a single system. To support multiple databases, the data in the *eHealth AIM for Oracle* MIB is organized into tables that are indexed by database session identification (SID) number. Each table includes an entry for the SID. For more information, refer to Chapter 3, “Using the *eHealth AIM for Oracle* MIB.”





## Using eHealth AIM for Oracle

1

eHealth AIM for Oracle provides important information about Oracle to management software through the SystemEDGE agent and Simple Network Management Protocol (SNMP). This AIM works with the SystemEDGE agent to closely manage the Oracle application, providing real-time fault detection and automatically correcting problems, if necessary.

You can use eHealth AIM for Oracle with any SNMP-compliant management software, including Concord's eHealth suite of products, AdvantEDGE View, HP OpenView, and others. eHealth AIM for Oracle and the SystemEDGE agent can provide you with the following types of information:

- Number and type of users connected to the database
- Amount of work that each transaction performs
- Database workload per transaction
- Number of client and database requests per transaction
- Rate at which application systems reference the database
- Effectiveness of the database buffer cache and library cache
- Number of changes to the database
- Amount of memory allocated to sessions
- Sort statistics and efficiency percentages
- Server statistics

### Using eHealth AIM for Oracle with AdvantEDGE View

You can use eHealth AIM for Oracle with AdvantEDGE View to run queries for monitoring the performance, configuration, availability, and health of the Oracle application.

**To run an AdvantEDGE View Application query for Oracle:**

1. Select the target system or group from the **System** or **Group** list.
2. Select **Oracle** from the **Applications** list.

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3. Click the **Applications** icon.

AdvantEDGE View runs the query for the specified application on the system or group you selected.

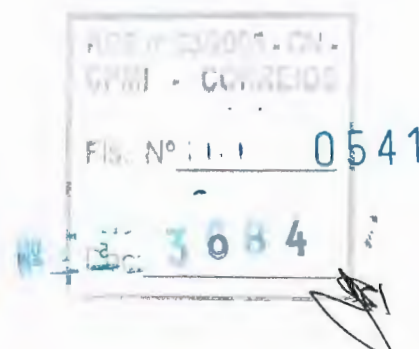
**NOTE**

If you run a query for a group of systems, AdvantEDGE View may request additional information before running the query. For more information, refer to the AdvantEDGE View Web Help.

Figure 1 shows the image map that AdvantEDGE View displays when you run an Application query for Oracle. Click the area for which you want to display information.



Figure 1. AdvantEDGE View Image Map for Oracle Queries





For example, if you click the **Metrics** area, AdvantEDGE View displays the Oracle metrics. Figure 2 shows a sample Metrics query for the Oracle application.

1

Oracle Metrics	
<u>Instance</u> : 15	<u>Block Changes Per Transaction</u> : 25,664
<u>Block Get Rate</u> : 4	<u>Block Visits Per Transaction</u> : 90,653
<u>Cache Hit Ratio</u> : 233	<u>Call Rate</u> : 90,653
<u>Calls Per Transaction</u> : 158,886	<u>Changed Blocks</u> : 44,981
<u>Consistent Change Ratio</u> : 0	<u>Continued Row Ratio</u> : 0
<u>Library Cache Miss Ratio</u> : 99	<u>Recursive To User Call Ratio</u> : 18,666
<u>Redo Log Space Wait Ratio</u> : 0	<u>Row Source Ratio</u> : 1,608,212,080
<u>Row Source Ratio</u> : 3	<u>Transaction Rate Ratio</u> : 15
<u>User Call Rate Ratio</u> : 23,833	<u>Users Calls Per Parse</u> : 59
<u>User Rollback Ratio</u> : 72	<u>Library Cache Efficiency</u> : 98
<u>Data Dict. Cache Efficiency</u> : 0	<u>Reads and Writes</u> : 336978
<u>Block Changes</u> : 6,116,597	<u>Block Gets</u> : 556
<u>Consistent Gets</u> : 336,722	<u>Physical Reads</u> : 279
<u>Disk Sorts</u> : 6,982	<u>Memory Sorts</u> : 0
<u>Free Block Wait</u> : 0	<u>Multi-threaded Queue Wait</u> : 341,612
<u>Highwater Session Memory</u> : 344,548	<u>Maximum Session Memory</u> : 3
<u>Highwater Number of Sessions</u> : 1	<u>Sessions Current</u> : 15
<u>User Commits</u> : 39	<u>User Rollbacks</u> : 23,833
<u>Transactions</u> : 0	<u>Physical Writes</u> : 16,082,075
<u>Rows Table Scan</u> : 0	<u>Rowid Rows fetched</u> : 135
<u>Continued Row Fetch</u> : 4,448,746	<u>Recursive Calls</u> : 0
<u>Consistent Changes</u> : 39,833	<u>Parses</u> : 4
<u>CPU Time</u> : 230,087	<u>Redo Log File Switches</u> : 0

Figure 2. Sample AdvantEDGE View Oracle Metrics Query

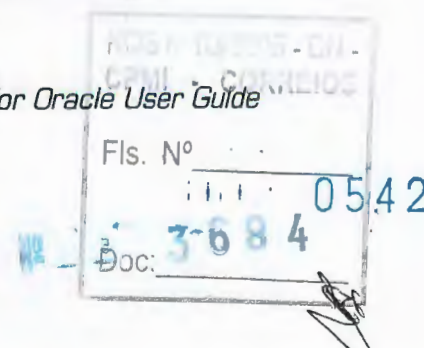
## Using eHealth AIM for Oracle with eHealth

In previous releases, eHealth – Application Insight was called eHealth – Application Assessment.

You can use eHealth AIM for Oracle and the SystemEDGE agent with the eHealth product suite to provide the historical data for long-term trending analysis and capacity planning. With eHealth – Application Insight, you can run At-a-Glance, Trend, Top N, and MyHealth reports for the following types of variables:

- Amount of Central Processing Unit (CPU), memory, and disk space that the Oracle application is using
- Size of the Oracle configuration and database logs

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- Number of transactions that the Oracle application is performing each second
- Amount of CPU used, disk input/output, work performed, and user calls for each transaction
- Ratio of transaction rollbacks and failures in writing to the redo logs
- Frequency with which the Oracle application uses the database cache to redisplay information

For more information about the variables that you can monitor and reports that you can run when you integrate *eHealth AIM* for Oracle with *eHealth*, refer to the *eHealth Web Help*.

### Using *eHealth AIM* for Oracle with Live Health

You can also use *eHealth AIM* for Oracle and the SystemEDGE agent with Live Health for real-time detection of potential problems. Live Health applies intelligent algorithms to the data, resulting in precise assessments of application health and performance. For more information about how Live Health can detect “brownouts” and service delays across applications, systems, and networks, refer to the Live Health Web Help.

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## Installing eHealth AIM for Oracle

This chapter explains how to install, configure, and license eHealth AIM for Oracle.

### NOTE

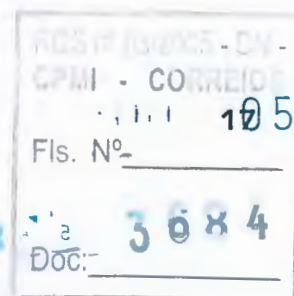
For the most current information about installing this AIM, refer to the `relnotes.txt` file on the eHealth AIM for Oracle installation CD-ROM.

## Installation Requirements

Before you install eHealth AIM for Oracle, you must first install, configure, and license the SystemEDGE agent Release 4.0, Patchlevel 3 or later. For more information, refer to the *eHealth SystemEDGE User Guide*.

To use eHealth AIM for Oracle, your system must be running one of the following:

- Sun Solaris (SPARC) Release 2.6 or later in *32-bit mode* and one of the following versions of Oracle in *32-bit mode*:
  - Oracle 8.0.4, 8.0.5, 8.0.6
  - Oracle 8i (8.1.5, 8.1.6, or 8.1.7)
- AIX Releases 4.2 and 4.3 and Oracle 8i
- HP-UX Releases 11.0 and 11.1 and Oracle 8i







**NOTE**

If you are using the Solaris operating system, you *must* run both Solaris and Oracle in 32-bit mode only.

## Installing the Software

eHealth AIM for Oracle is distributed as a tape archive (tar) file. The name of the tar file varies for each operating system, as follows:

- oramod\_1.3p1\_sol.tar for Solaris systems
- oramod\_1.3p1\_aix.tar for AIX systems
- oramod\_1.3p1\_hpx.tar for HP-UX systems

**To install eHealth AIM for Oracle:**

1. Locate the Oracle database that you need to monitor.
2. Log on to that system as the root user.
3. Copy the tar file for your system from the CD-ROM to the /tmp directory.
4. Change directory to the SystemEDGE agent directory on your system by entering one of the following commands.

For Solaris and HP-UX systems, enter the following:

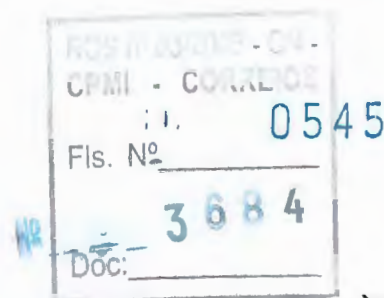
```
cd /opt/EMPSysedge
```

For AIX systems, enter the following:

```
cd /usr/lpp/EMPSysedge
```

5. Create the plugins directory, if it is not already present, by entering the following:

```
mkdir plugins
```





6. Change directory to the `plugins` directory by entering the following:

```
cd plugins
```

7. Enter one of the following commands to launch the installation, depending on your operating system.

For Solaris systems, enter the following:

```
tar xvf /tmp/oramod_1.3p1_sol.tar
```

For AIX systems, enter the following:

```
tar xvf /tmp/oramod_1.3p1_aix.tar
```

For HP-UX systems, enter the following:

```
tar xvf /tmp/oramod_1.3p1_hpux.tar
```

The installation creates files in the `plugins/oramod` directory.

8. Edit the `sysedge.cf` file as described in “Editing the `sysedge.cf` File” on page 21. After you install the files, you must edit the `sysedge.cf` file to specify the correct shared library for your version of Oracle.
9. Edit the `oramod.cf` file to indicate which databases, SIDs, and Oracle home directories to use, as described in “Editing the `oramod.cf` File” on page 22.
10. Edit the SystemEDGE startup file to include Oracle environment variables so that the agent and AIM can find the Oracle home and lib directories, as described in “Editing the SystemEDGE Startup File” on page 24.
11. Start the SystemEDGE agent, using one of the following commands.

For Solaris systems, enter the following:

```
/etc/rc2.d/S99sysedge start
```

For AIX systems, enter the following:

```
bin/sysedge -b
```

2





For HP-UX systems, enter the following:

```
/sbin/rc2.d/S990sysedge start
```

12. License the AIM, as described in “Licensing eHealth AIM for Oracle” on page 27.
13. Restart the SystemEDGE agent.

## eHealth AIM for Oracle Files

Table 2 describes the files created by the eHealth AIM for Oracle installation procedure.

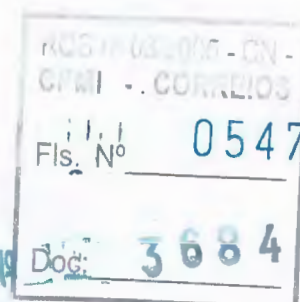
Table 2. Files Installed by eHealth AIM for Oracle

File Name	Description
oramod.asn1	eHealth AIM for Oracle MIB specification
oramod.cf	eHealth AIM for Oracle configuration file
oramod.pdf	<i>eHealth AIM for Oracle User Guide</i>
oramod8.so	eHealth AIM for Oracle shared library for Oracle 8.0.4, 8.0.5, and 8.0.6
oramod8i.so	eHealth AIM for Oracle shared library for Oracle 8i (versions 8.1.5, 8.1.6, and 8.1.7)
relnotes.txt	Release notes for the eHealth AIM for Oracle module

## Configuring eHealth AIM for Oracle

After you install eHealth AIM for Oracle, you must configure it by editing the following files:

- `sysedge.cf` (page 21)
- `oramod.cf` (page 22)
- SystemEDGE startup file (page 24)





## Editing the sysedge.cf File

You must edit the `sysedge.cf` file to use the correct shared library file for your system and to enable the SystemEDGE agent to load eHealth AIM for Oracle. You can use the `sysedge_plugin` keyword in the `sysedge.cf` configuration file to specify which eHealth AIMs the SystemEDGE agent will load at system initialization. By default, the SystemEDGE agent does not load any AIMs at initialization, but you can edit the `sysedge.cf` file to configure the agent to load any eHealth AIMs that you have installed.

The `sysedge.cf` file is located in your system directory by default; for example, it is located in the `/etc/sysedge.cf` directory on UNIX systems. For more information about the `sysedge.cf` file, refer to the *eHealth SystemEDGE User Guide*.

### NOTE

To configure the SystemEDGE agent to start eHealth AIM for Oracle, you must provide the complete pathname to the shared library file for your version of Oracle.

## Enabling eHealth AIM for Oracle for Oracle 8.0.4, 8.0.5, or 8.0.6 (Solaris)

To enable the eHealth AIM for Oracle module in the SystemEDGE agent for Oracle 8.0.4, 8.0.5, or 8.0.6 on Solaris systems, add the following line to `/etc/sysedge.cf`:

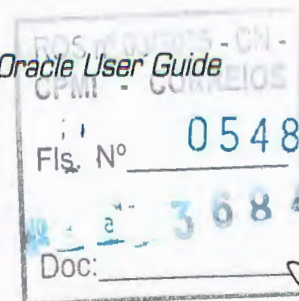
```
sysedge_plugin /opt/EMPSysedge/plugins/oramod/oramod8.so
```

## Enabling eHealth AIM for Oracle for Oracle 8i (Solaris and HP-UX)

To enable the eHealth AIM for Oracle module in the SystemEDGE agent for Oracle 8i (versions 8.1.5, 8.1.6, or 8.1.7) on Solaris and HP-UX systems, add the following line to `/etc/sysedge.cf`:

```
sysedge_plugin /opt/EMPSysedge/plugins/oramod/oramod8i.so
```

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## Enabling eHealth AIM for Oracle for Oracle 8i (AIX)

To enable the eHealth AIM for Oracle module in the SystemEDGE agent for Oracle 8i for AIX systems, add the following line to `/etc/sysedge.cf`:

```
sysedge_plugin /usr/lpp/EMPSysedge/plugins/oramod/oramod8i.so
```

### Editing the oramod.cf File

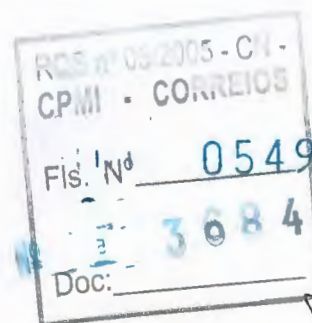
The `oramod.cf` file describes the eHealth AIM for Oracle configuration. You can edit the `oramod.cf` file to indicate the following:

- User name and password.
- Name (SID) of the database that you are monitoring. This value is contained in the `oramodDbCfgSID` MIB object.

#### NOTE

If you are using Transparent Network Substrate (TNS) names, use the TNS name that matches your database name in the `oramod.cf` file.

- SID index. This value is also the value of the `oramodDbCfgSIDINDEX` MIB object. This value is user-configurable. You can set it to any integer greater than zero. Each instance must have a unique index for the platform.
- SID-home. Installation directory for Oracle, or `ORACLE_HOME`. This value is also the value of the `oramodDbCfgHOME` MIB object.
- SID-base. Base directory for Oracle, or `ORACLE_BASE`. This value is also the value of the `oramodDbCfgBASE` MIB object.
- File Check Interval. This value is the interval for checking files, in seconds.
- Tablespace Check Interval. This value is the interval for checking tablespaces.





To use eHealth AIM for Oracle, you must have a user ID that has either DBA privileges or SELECT\_CATALOG\_ROLE permissions for Oracle Version 8i and later. For earlier versions of Oracle, the SELECT\_ANY\_TABLE permissions should suffice.

**2**

eHealth AIM for Oracle can monitor different versions of Oracle databases on the same platform *only* if you are running multiple versions of the SystemEDGE agent on different ports. Otherwise, eHealth AIM for Oracle can simultaneously monitor *only* instances of Oracle that are the *same Oracle version*.

### Sample oramod.cf File

The following is a sample oramod.cf file.

```
# oramod.cf
# Configuration file for the eHealth AIM for Oracle Module
# Concord Communications, Copyright 2001
#
# For each Oracle database running on your system, specify the following:
#
# oramod username passwd sid sid-index sid-home sid-base
# file-check-interval table-space-check-interval
#
oramod fred elTsdm VIS 15 /u01/app/oracle/8.0.5 /u01/app/oracle 60 60
```

#### NOTE

After you make any changes to the oramod.cf file, you must restart the SystemEDGE agent to ensure that the changes take effect.

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## Editing the SystemEDGE Startup File

The SystemEDGE startup file is the shell script for starting and stopping the SystemEDGE agent. This file was installed with the SystemEDGE agent. You must edit the file for your system to match your Oracle installation environment.

For Solaris, edit the following file:

`/etc/rc2.d/S99sysedge`

For HP-UX, edit the following file:

`/sbin/rc2.d/S990sysedge`

For AIX, edit the following file:

`/etc/rc.tcpip`

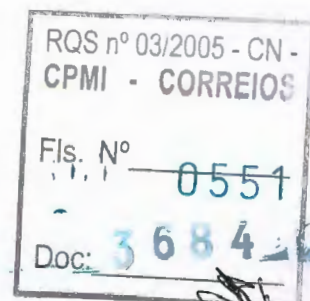
You must set the following environment variables in the SystemEDGE startup file to export the environment variables that Oracle requires:

- `ORACLE_BASE=/oracle; export ORACLE_BASE`
- `ORACLE_SID=NHTD; export ORACLE_SID`
- `ORACLE_HOME=/oracle/product/8.1.5; export ORACLE_HOME`
- `LD_LIBRARY_PATH=$ORACLE_HOME/lib; export LD_LIBRARY_PATH`

For more information, refer to the following sections.

### NOTE

The eHealth AIM for Oracle installation includes a sample SystemEDGE startup file. Do *not* install this sample file in place of your existing file. Use the sample file only as an example to help you edit the existing startup file to export the Oracle environment variables.





## Setting Environment Variables for Solaris Systems

Before you start SystemEDGE, add the following to your site's /etc/rc2.d/S99sysedge to customize directory locations for your Oracle installation for Solaris systems:

2

```
ORACLE_BASE=/export/ahab3/oracle/oracle.8.1.7
export ORACLE_BASE
ORACLE_SID=EH55
export ORACLE_SID
ORACLE_HOME=$ORACLE_BASE
export ORACLE_HOME
LD_LIBRARY_PATH=$ORACLE_HOME/lib:$ORACLE_HOME/jdbc/lib:/usr/dt/lib
export LD_LIBRARY_PATH
```

## Setting Environment Variables for AIX Systems

Before you start SystemEDGE, add the following to your site's /etc/rc.tcpip file to customize directory locations for your Oracle installation for AIX systems:

```
ORACLE_BASE=/oracle/u01/app/oracle
export ORACLE_BASE
ORACLE_SID=POS1
export ORACLE_SID
ORACLE_HOME=$ORACLE_BASE/8i
export ORACLE_HOME
LD_LIBRARY_PATH=$ORACLE_HOME/lib
export LD_LIBRARY_PATH
```

## Setting Environment Variables for HP-UX Systems

Before you start SystemEDGE, add the following to your site's /etc/rc2.d/S990sysedge file to customize directory locations for your Oracle installation:

```
ORACLE_BASE=/export/ahab3/oracle/oracle.8.1.7
```

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```
export ORACLE_BASE
ORACLE_SID=EH55
export ORACLE_SID
ORACLE_HOME=$ORACLE_BASE
export ORACLE_HOME
LD_LIBRARY_PATH=$ORACLE_HOME/lib:$ORACLE_HOME/jdbc/lib:/usr/dt/lib
export LD_LIBRARY_PATH
SHLIB_PATH=$ORACLE_HOME/lib:$ORACLE_HOME/jdbc/lib:/usr/dt/lib
export SHLIB_PATH
LD_PRELOAD=/usr/lib/libpthread.sl:/usr/lib/libcl.sl:/export/ahab3/
oracle/oracle.8.1.7/JRE/lib/PA_RISC/native_threads/libjava.sl
export LD_PRELOAD
```

### Verifying that the Startup File is Set Up Correctly

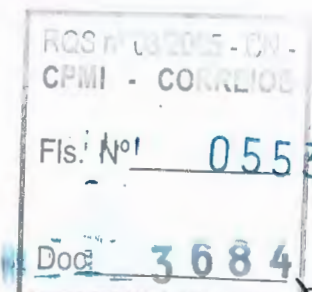
If your SystemEDGE startup file is not set up correctly, you will receive an error message similar to the following:

```
brahma# ../../bin/sysedge
SystemEDGE Version 4.0 Patchlevel 3
Copyright 2001 by Concord Communications, Inc.
load_plugin: dlopen of /opt/EMPSysedge/plugins/oramod/oramod8.so failed, 9,
ld.so.1: ../../bin/sysedge: fatal: libcintsh.so.1.0: open failed: No such file
or directory
sysedge: load plugin /opt/EMPSysedge/plugins/oramod/oramod8.so failed
sysedge: using port 161, config file /etc/sysedge.cf
```

If you receive an error message, verify that you have set up the SystemEDGE startup file correctly and that you have loaded the correct shared library file for your version of Oracle.

## Licensing eHealth AIM for Oracle

Like the SystemEDGE agent, eHealth AIM for Oracle utilizes a host-based license method. Copies of eHealth AIM for Oracle can run only on systems that possess a valid license key. This license key is separate from the one used for the SystemEDGE agent.





The first time that you attempt to start the SystemEDGE agent after installing eHealth AIM for Oracle, the agent displays a message stating that it could not find a valid license for eHealth AIM for Oracle. It then provides you with a **public key** that is used to generate a permanent license key for your host machine.

2

A license key is composed of four space-separated, 8-character sequences, totaling 32 characters. The `sysedge.lic` file contains the eHealth AIM for Oracle license, as well as the SystemEDGE agent license and other eHealth AIM licenses. For an example, refer to the sample license file in "Sample License File" on page 33.

## Obtaining a License

To obtain a license, you can do any of the following:

- Run the Concord-supplied `licenseutil.pl` script.
- Run the `licenseme.exe` license utility.
- Use AdvantEDGE View to receive an SNMP license trap or to query and license the plug-in without a trap. For more information, refer to "Generating a License through AdvantEDGE View Event Processing" on page 30 or "Generating a License through AdvantEDGE View Host Administration" on page 32.
- Send an e-mail request to [licenses@concord.com](mailto:licenses@concord.com) and place the returned license key in the appropriate license file.
- Complete the online license form through the Internet, as described in the next section, "Generating the License through the Web-based License Form."

For more information, refer to the *eHealth SystemEDGE User Guide* and the *Automating the Licensing of SystemEDGE and AdvantEDGE Point Plug-in Modules* white paper.

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## Generating the License through the Web-based License Form

This section describes how to generate the license using the Web-based license form.

### NOTE

If you are using an evaluation copy of eHealth AIM for Oracle, you must request a temporary license that will enable it to operate during the evaluation period.

### To generate a license for eHealth AIM for Oracle:

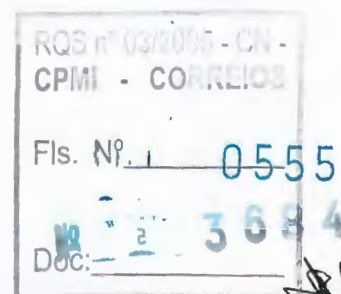
1. Start the SystemEDGE agent as follows:
  - a. Log in as **root**.
  - b. Change directory (cd) to **/opt/EMPsysedge**.
  - c. Enter the following:

```
./bin/sysedge -b
```

The SystemEDGE agent displays a message indicating that you need a license for the eHealth AIM for Oracle module on this host machine. It displays a message similar to the following:

```
SystemEDGE Version 4.1 Patchlevel 1
Copyright 2001 by Concord Communications, Inc.
Please contact Concord Communications, Inc. to obtain a license
http://www.concord.com/support, Email: licenses@concord.com
Provide this: sysedge neptune sol2 5.8 346561363366b19c 1.3 Patchlevel 1
```

2. Using a Web browser, go to the licensing Web site at <http://license.concord.com>, and select the **Create License** option that matches your use of the agent:
  - **Create SystemEDGE/AdvantEDGE Eval License** (if you are evaluating the AIM or are a Concord partner or reseller)
  - **Create SystemEDGE Outsource License** (if you are outsourcing the AIM)





- **Create SystemEDGE/AdvantEDGE License** (if you have purchased the AIM)

**NOTE**

You must supply a user name and password to access the license form.

2

If you do not have Web access, fill out the license request form, /config/license.txt (available as part of the eHealth AIM for Oracle installation), with the complete string generated by the SystemEDGE agent, and e-mail the completed form to [licenses@concord.com](mailto:licenses@concord.com).

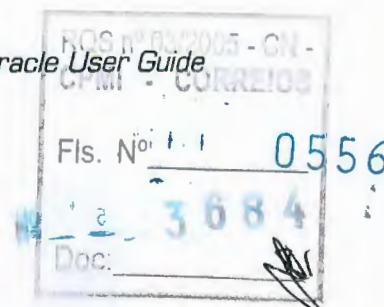
3. Fill out the license form, entering the information that was printed by the SystemEDGE agent. You must supply the following information:

- Name
- E-mail address
- Software version number (1.3 in the example on page 28)
- Patchlevel (1 in the example on page 28)
- System name (neptune in the example on page 28)
- Operating system name (sol2 in the example on page 28)
- Operating system version (5.8 in the example on page 28)
- System identifier (346561363366b19c in the example on page 28)

**NOTE**

Select the option for eHealth AIM for Oracle from the product list on the licensing form.

After you submit the license request form, the Concord Web server generates a license, displays it on your Web browser, and e-mails it to the contact person in your organization.







4. Copy the license into `/etc/sysedge.lic`, and save that file.
5. Restart the SystemEDGE agent as root by entering the following:

```
./bin/sysedge -b
```

## Generating a License through AdvantEDGE View Event Processing

In order to use AdvantEDGE View event processing to license eHealth AIM for Oracle, your system must meet the following requirements:

- You must be using SystemEDGE Release 4.0 Patchlevel 3 or later with AdvantEDGE View.
- You must configure the SystemEDGE agent to send SNMP traps to AdvantEDGE View. For more information, refer to the section on configuring the SystemEDGE agent in the *eHealth SystemEDGE User Guide*.
- You must configure the SystemEDGE agent with a read-write community so that AdvantEDGE View can issue an SNMP Set to transmit the license key to it. For more information, refer to the section on configuring the SystemEDGE agent in the *eHealth SystemEDGE User Guide*.
- Your AdvantEDGE View system must have access to the Internet, either directly or through a Web proxy.
- The AdvantEDGE View user who is generating the license must have either write or admin permissions.

### To generate a license through AdvantEDGE View:

1. Start the SystemEDGE agent with eHealth AIM for Oracle in unlicensed mode. SystemEDGE sends a license trap to AdvantEDGE View for that module.



2. Start AdvantEDGE View, and click the **Events** icon to display the Event Processing screen.



AdvantEDGE View displays a license trap for the system that requires a license.





3. Click the index number for that system to view the Trap Details form for **License Software** to display the AdvantEDGE View Software Licensing form.
4. Complete the licensing form, and click **Get License**.

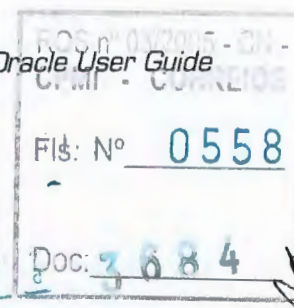
2

Software Licensing, System <i>SystemName</i>	
<b>License Account Info:</b>	
Username	<input type="text" value="user"/>
Password	<input type="password"/>
Name	<input type="text" value="AdvantEDGE View User"/>
Company	<input type="text" value="Company"/>
Email	<input type="text" value="user@company.com"/>
Phone	<input type="text" value="555.555.5555"/>
CustomerID	<input type="text" value="666"/>
License Type	<input type="text" value="Permanent"/>
License Duration	<input type="text" value="N/A"/> <input type="text" value="3 months"/> <input type="text" value="6 months"/> <input type="text" value="9 months"/> <input type="text" value="12 months"/> (Only applicable if leasing license)
End-user Company	<input type="text"/> (Only applicable if leasing license)
<input type="button" value="Get License"/> <input type="button" value="Clear"/>	

#### NOTE

If you have configured AdvantEDGE View preferences, AdvantEDGE View fills in all of the information (except password) on this form.

AdvantEDGE View contacts the Web-based license server, obtains a license for eHealth AIM for Oracle, and issues an SNMP Set to the target SystemEDGE agent to inform it of the new software license key.







## Generating a License through AdvantEDGE View Host Administration

You can also license systems through AdvantEDGE View Host Administration.

To access Host Administration:



1. Start AdvantEDGE View, and click the **Administration** icon. AdvantEDGE View displays the Administration page.

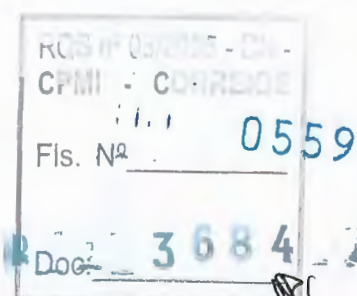


2. Click the **Host Administration** icon. AdvantEDGE View displays the host list.

SystemEDGE Host Configuration

System Name	Community	Read/Write Community	Port	Timeout	Retries
aviewdemo	public		181	2	2
mailserver	public		161	6	3
nethealth	public		161	3	3
ntclient	public		161	6	3
ntserver	public		161	3	2
unixclient	public		161	6	3
unixserver	public		161	3	3
win2kclient	public		161	5	3
www	public		161	6	3

Add New Host





- Click the name of the system that you want to license from the **System Name** column. AdvantEDGE View displays the Modify Host form.

**Modify Host view:**

<b>Community:</b>	<input type="text" value="public"/>	Read community string for use with this host
<b>Read/Write Community:</b>	<input type="text"/>	Read/Write community string for use with this host
<b>Port:</b>	<input type="text" value="161"/>	UDP Port to use with this host (e.g. 161 or 1691)
<b>Timeout:</b>	<input type="text" value="5"/>	Timeout value (in seconds) to use with this host (e.g. 3)
<b>Retries:</b>	<input type="text" value="3"/>	Number of times to retry an operation on this host (e.g. 3)

2

- Click **License Host/Software** to display the licensing form.
- Select the option for eHealth AIM for Oracle from the **Product** list, and then click **License Software**.

AdvantEDGE View contacts the Web-based license server, obtains a license for the software, and issues an SNMP Set to the target SystemEDGE agent, informing it of the new software license key.

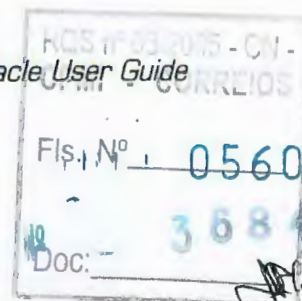
## Sample License File

The following is a sample SystemEDGE agent license file. A pound character (#) in column 1 indicates that the entire line is a comment.

```
# license file for SystemEDGE Agent
# Concord Communications, Inc.
# http://www.concord.com
# file /etc/sysedge.lic or %SystemRoot%\system32\sysedge.lic
# A valid license key has four parts of 8 characters per part
# parts are separated by space(s) with one license key per line

# sysedge jupiter sol2 5.8 807cb1da007cb1da 4.1 PL 1
e13311d3 0F2a7cb1 abc512dc fF8C923a

# oramod jupiter sol2 5.8 807cb1da007cb1da 1.3 PL 1
a7943fde 098a87ij a4kiuf39 afafEkj4
```







## Using the eHealth AIM for Oracle MIB

This chapter explains the organization and content of the Concord Communications MIB for the Oracle application. The MIB specification (oramod.asn1) defines a collection of objects for monitoring and managing Oracle. You must configure the SystemEDGE agent to monitor the eHealth AIM for Oracle MIB objects that are relevant for your configuration. For more information, refer to Chapter 4, "Using eHealth AIM for Oracle." Figure 3 shows part of the eHealth AIM for Oracle MIB.

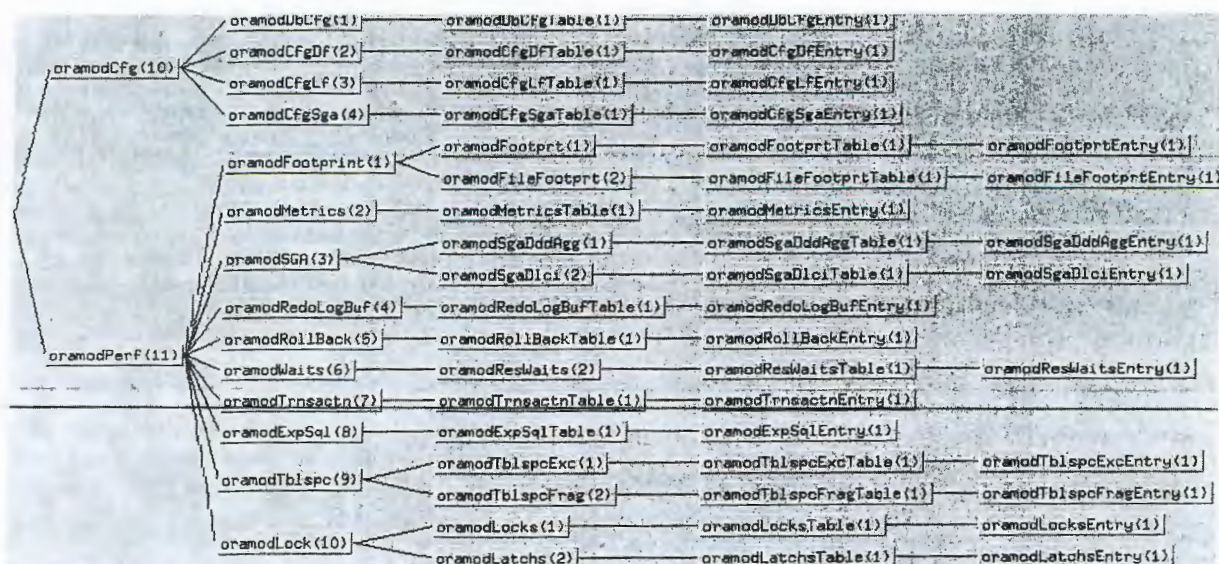
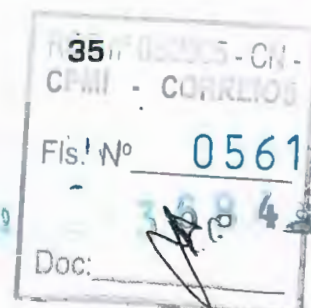


Figure 3. eHealth AIM for Oracle MIB





The eHealth AIM for Oracle MIB is organized into sections for database configuration and performance. Within the performance section, a footprint section defines MIB objects that show how much of the underlying system's resources Oracle is consuming. The following sections describe the eHealth AIM for Oracle MIB. For the most current list of MIB objects, refer to the eHealth AIM for Oracle MIB specification (oramod.asn1).

## Configuration Section

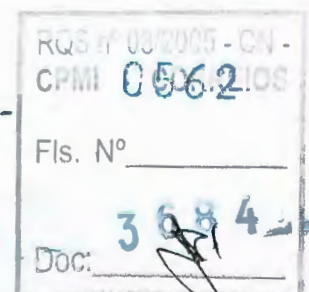
The Configuration section of the eHealth AIM for Oracle MIB contains configuration parameters and settings that are important for monitoring the health and performance of the Oracle database. The Configuration section includes groups for database, database files, redo logs, and the System Global Area (SGA).

### Database Configuration Group

The Database Configuration group contains instance names, index numbers, and initial startup information. Table 3 defines the Database Configuration parameters.

**Table 3. MIB Objects – Oracle Database Configuration Group**  
(Page 1 of 3)

MIB Object	Description
oramodDbCfgSIDINDEX	Specifies the SID index number.
oramodDbCfgSID	Specifies the database name.
oramodDbCfgVERSION	Provides the description and version of this Oracle installation.
oramodDbCfgHOME	Specifies the installation directory for Oracle.
oramodDbCfgBASE	Specifies the base directory for Oracle, or ORACLEBASE.







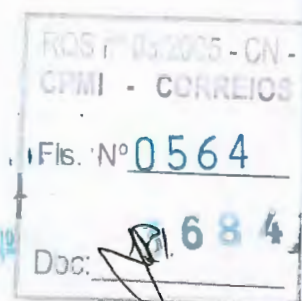
**Table 3. MIB Objects – Oracle Database Configuration Group**  
(Page 2 of 3)

MIB Object	Description
oramodDbCfgID	Specifies the database ID that was calculated when the database was created; this value is stored in all file headers.
oramodDbCfgCRTDT	Specifies the original creation date and time of the database.
oramodDbCfgLOGMODE	Specifies the archive log mode: NOARCHIVELOG or ARCHIVELOG.
oramodDbCfgCTRLFILETYPE	Specifies the control file type: CURRENT, STANDBY, CLONE, BACKUP, or CREATED.
oramodDbCfgOPENMODE	Indicates whether the database is set to READ WRITE or READ ONLY mode.
oramodDbCfgMAXPROCESS	Specifies the maximum number of user processes that can simultaneously connect to an Oracle server for a multi-process operation.
oramodDbCfgMAXSESSION	Specifies the maximum number of user and system sessions.
oramodDbCfgTIMEDSTATISTICS	Specifies whether timing is on. Set this variable to FALSE for optimum performance.
oramodDbCfgCPUCNT	Specifies the maximum number of CPUs for this instance.
oramodDbCfgSHAREDPOOLSIZE	Specifies the shared pool size in KB. This variable controls the size of the memory area that is used for parsing and executing SQL statements.
oramodDbCfgSHAREDPOOLRSSIZE	Specifies the shared pool reserved size in KB.
oramodDbCfgLARGEPOOLSIZE	Specifies the large pool reserved size in KB.

**3**

**Table 3. MIB Objects – Oracle Database Configuration Group**  
(Page 3 of 3)

MIB Object	Description
oramodDbCfgCPUJAVAPOOLSIZE	Specifies the Java pool size in KB. The default value is 20,000 KB.
oramodDbCfgCPUCNTRLFILES	Specifies the name and path of the control files.
oramodDbCfgCPUDBLKBUFF	Specifies the number of database block buffers in blocks.
oramodDbCfgBLKSIZE	Specifies the size of the database blocks.
oramodDbCfgCKPTINTRVL	Specifies the redo log checkpoint interval.
oramodDBCfgDBFILES	Specifies the maximum number of database files.
oramodDbCfgSORTAREASIZE	Specifies the maximum sort area size. This object controls the amount of memory allocated to each process in the Process Global Area for any sorting activity.
oramodDBCfgOPENCURSORS	Specifies the maximum number of simultaneous open cursors that a single-user process can have.
oramodDBCfgTRNSACTNS	Specifies the maximum number of simultaneous, concurrent transactions.
oramodDBCfgTRNSACTNSPERSEG	Specifies the maximum number of concurrent transactions per segment.
oramodDBCfgMAXROLLSEG	Specifies the maximum number of rollback segments.







## Database File Configuration Group

The Database File Configuration group describes the Oracle database files. Table 4 defines the Database File Configuration parameters.

Table 4. MIB Objects – Oracle Database File Configuration Group  
(Page 1 of 2)

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MIB Object	Description
oramodCfgDfFILENUM	Specifies the file identification number.
oramodCfgDfSTATUS	Specifies the type of file (system or user) and its status. The value can be OFFLINE, ONLINE, SYSTEM, RECOVER, or SYSOFF.
oramodCfgDfENABLED	Describes how accessible a file is from SQL. The value can be DISABLED, READ ONLY, READ WRITE, or UNKNOWN.
oramodCfgDfUNRCVRBLECHG	Specifies the last unrecoverable change number that was made to this data file.
oramodCfgDfUNRCVRBLETIME	Specifies the last unrecoverable change time that was made to this data file.
oramodCfgDfKBYTES	Specifies the current size of the file in kilobytes (KB).
oramodCfgDfCRTKBYTES	Specifies the size of the data file when it was created.
oramodCfgDfFNAME	Specifies the file name.
oramodCfgDfCRTTIME	Specifies the time at which the data file was created.
oramodCfgDfTBLSPACENUM	Specifies the tablespace number.
oramodCfgDfTBLESPACERFILENUM	Specifies the tablespace relative data file number.
oramodCfgDfBLOCKS	Specifies the current size of the data file in blocks.

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**Table 4. MIB Objects – Oracle Database File Configuration Group**  
(Page 2 of 2)

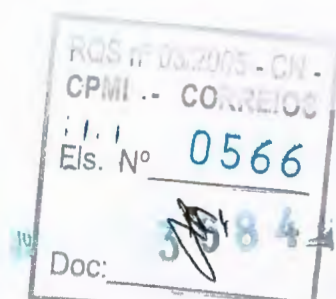
MIB Object	Description
oramodCfgDfBLOCKSIZE	Specifies the block size of the data file.
oramodCfgDfERROR	Indicates whether the datafile header read an error. If so, a restore is required. A value of NULL indicates success.
oramodCfgDfRECOVER	Indicates whether the file needs media recovery. The value can be YES or NO.
oramodCfgDfRSTLOGSCHGNUM	Specifies the reset log change number.
oramodCfgDfRSTLOGSTIME	Specifies the reset log timestamp.

### Redo Log File Configuration Group

The Redo Log File Configuration group describes the redo log file locations and status for each Oracle installation. Table 5 defines the Redo Log File Configuration parameters.

**Table 5. MIB Objects – Oracle Redo Log File Configuration Group**

MIB Object	Description
oramodCfgLfMEMBERINDX	Specifies the log file member index.
oramodCfgLfGROUPNUM	Specifies the log file group number.
oramodCfgLfSTATUS	Specifies the log file status.
oramodCfgLfMEMBER	Specifies the log file name and path.







## System Global Area Configuration Group

The System Global Area (SGA) Configuration group summarizes the Oracle system global area. Table 6 defines the SGA Configuration parameters.

Table 6. MIB Objects – Oracle SGA Configuration Group

MIB Object	Description
oramodCfgSgaTOTALMEMALLOC	Specifies the total real memory allocated.
oramodCfgSgaFIXEDSGA	Specifies the fixed memory allocated in KB.
oramodCfgSgaVARIABLE	Specifies the variable memory that is allocated in the SGA.
oramodCfgSgaDBBUFF	Specifies the database buffers allocated in KB. The typical range is from 4 KB to 2 GB.
oramodCfgSgaREDOBUFF	Specifies the redo buffers allocated in KB.

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## Performance Section

The Performance section of the eHealth AIM for Oracle MIB contains performance data that is necessary for capacity planning and trend analysis, as well as real-time performance and availability monitoring. The Performance group is divided into subgroups for footprint data, metrics, the SGA, redo logs, rollback segments, waits, expensive SQL, tablespaces, and locks.

### Oracle Footprint Group

The Footprint group provides information about the Oracle CPU, memory, data flow, and disk-resource consumption, more commonly called the **footprint**. Long-term trending analysis of footprint information is useful for anticipating and avoiding problems due to resource exhaustion. You can also monitor footprint information in real time to detect and correct temporary resource exhaustion due to viruses, security incidents, and hardware failures. The Footprint group includes subgroups for footprint and file footprint.



## Footprint Group

The Footprint group describes the performance footprint for each Oracle service. Table 7 defines the Oracle Footprint parameters.

Table 7. MIB Objects – Oracle Footprint Group (Page 1 of 2)

MIB Object	Description
oramodFootprtCPUTIME	Specifies the CPU time in seconds accumulated by Oracle. This time includes all core components and the database instance.
oramodFootprtPERCENTCPU	Specifies the percentage of CPU utilization by Oracle over the last sample interval. This value is reported as the percentage multiplied by 100. It is the sum of the CPU utilization of all Oracle core services and components, and provides a good indication of the CPU resource consumption by the entire Oracle application. Do not use this variable as a counter.
oramodFootprtMEMSIZE	Specifies the combined size of all Oracle text, data, and stack segments in KB. This value is the sum of all process sizes for all core Oracle services and optional connectors.
oramodFootprtRSS	Specifies the total real memory (resident size set [RSS]) of Oracle in KB. This value is the sum of process RSS for all core Oracle services and optional connectors.
oramodFootprtPERCENTMEM	Specifies the percentage (0-100) of real memory used by Oracle, including core services and optional connectors.
oramodFootprtTHREADS	Specifies the total number of threads operating within the respective Oracle components as seen by the operating system.
oramodFootprtINBLKS	Specifies the number of blocks of data input by the processes.
oramodFootprtOUTBLKS	Specifies the number of blocks of data output by the processes.
oramodFootprtMSGSENT	Specifies the number of messages sent by the processes.

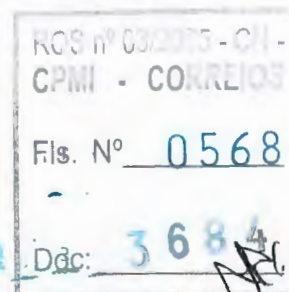






Table 7. MIB Objects – Oracle Footprint Group (Page 2 of 2)

MIB Object	Description
oramodFootprtMSGRCVD	Specifies the number of messages received by the processes.
oramodFootprtSYSCALLS	Specifies the number of system calls invoked by the processes.
oramodFootprtMINORPGFLT	Specifies the number of minor page faults incurred by the process.
oramodFootprtMAJORPGFLT	Specifies the number of major page faults incurred by the process.
oramodFootprtNUMSWAPS	Specifies the number of times the processes have been swapped.
oramodFootprtVOLCNTX	Specifies the number of voluntary context switches incurred by the processes.
oramodFootprtINVOLCNTX	Specifies the number of involuntary context switches incurred by the processes.
oramodFootprtHOMESIZE	Specifies the size in KB of the Oracle root directory and all files beneath it.
oramodFootprtDBDISKSIZE	Specifies the size in KB of all Oracle database disk storage areas. This value is a sum of all database files.
oramodFootprtSTARTUPTIME	Specifies the date and time that the Oracle instance was started.
oramodFootprtSTATUS	Specifies the status of the instance: STARTED, MOUNTED, or OPEN.
oramodFootprtDATABASESTATUS	Specifies the database status of the instance.
oramodFootprtSHUTDOWNPENDING	Specifies whether the database is about to be shut down: YES or NO.

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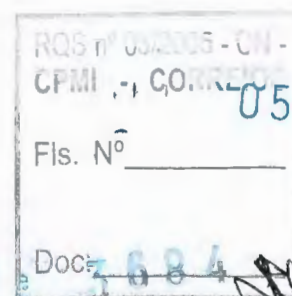


### File Footprint Group

The File Footprint group describes the Oracle file footprint. Table 7 defines the Oracle File Footprint parameters.

**Table 8. MIB Objects – Oracle File Footprint Group**

MIB Object	Description
oramodFFootprtFILEINDX	Specifies the file index number.
oramodFFootprtFILETYPE	Specifies the file type.
oramodFFootprtFILENAME	Specifies the file name.
oramodFFootprtCRTTS	Specifies the timestamp of the last update.
oramodFFootprtCRTKBYTES	Specifies the file creation size in KB.
oramodFFootprtKBYTES	Specifies the file size in KB.
oramodFFootprtBLOCKS	Specifies the file blocks.
oramodFFootprtSTATUS	Specifies the file status.
oramodFFootprtRECOVER	Indicates whether the file needs recovering.
oramodFFootprtAVGIOTIM	Specifies the average input/output time for the file.







## Metrics Group

The Metrics Group describes the Oracle database metrics.  
Table 9 defines the Oracle Metrics parameters.

Table 9. MIB Objects – Oracle Metrics Group (Page 1 of 4)

MIB Object	Description
oramodMetricsBCPT	Block Changes Per Transaction (scaled by 100). Measures the amount of data manipulation language (DML) work that each transaction performs.
oramodMetricsBGR	Block Get Rate per second (scaled by 100). Measures the rate at which application systems reference the database.
oramodMetricsBVPT	Block Visits Per Transaction (scaled by 100). Measures the database load imposed for each transaction.
oramodMetricsCHR	Cache Hit Ratio (scaled by 100). Measures the effectiveness of the hits against the buffer cache.
oramodMetricsCR	Call Rate (user and recursive) over time. Measures the work demand rate that all work sources are placing on the database instance.
oramodMetricsCPT	Calls Per Transaction (scaled by 100). Indicates the number of database requests per committed transaction.
oramodMetricsCBR	Changed Blocks (scaled by 100). Measures the balance between queries and DML and can indicate changes in application use or indexes.
oramodMetricsCCR	Consistent Change Ratio (scaled by 100). Measures consistent database changes and gets, or the extent to which applications are exercising the read-consistency mechanism.
oramodMetricsCRR	Continued Row Ratio (scaled by 100). Measures the space usage of data blocks.
oramodMetricsLCM	Library Cache Miss Ratio (scaled by 100). Measures the missed requests and reloads to access library-cached objects since instance startup. Monitor the library cache to help determine whether you should resize the shared pool.

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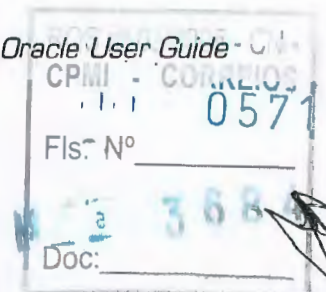




Table 9. MIB Objects – Oracle Metrics Group (Page 2 of 4)

MIB Object	Description
oramodMetricsRTUC	Recursive To User Call Ratio (scaled by 100). Measures the ratio of recursive and user to application calls.
oramodMetricsRLSW	Redo Log Space Wait Ratio (scaled by 100). Shows the rate at which failures are occurring in writing to the redo log space. It can measure memory allocation.
oramodMetricsRSR	Row Source Ratio (scaled by 100). Specifies the percentage of total rows retrieved from full table scans.
oramodMetricsSOR	Sort Overflow Ratio (scaled by 100). Indicates the number of sorts that are using temporary segments.
oramodMetricsTRR	Transaction Rate Ratio (scaled by 100). Indicates the rate at which users or applications are committing transactions.
oramodMetricsUCR	User Call Rate Ratio (scaled by 100). Indicates the rate at which client users or applications are requesting SQL statements.
oramodMetricsUCPP	User Calls Per Parse Ratio (scaled by 100). Specifies the ratio of user calls to parses in the shared SQL area. This value indicates how well the application is managing its context area.
oramodMetricsURR	User Rollback Ratio (scaled by 100). Indicates the rate at which application transactions are failing.
oramodMetricsSGALCE	Library Cache Efficiency Percentage (scaled by 100). Specifies the percentage of times that an SQL statement did not need to be reloaded because it was already in the library cache.
oramodMetricsSGADDCE	Data Dictionary Cache Efficiency Percentage (scaled by 100). Shows the ratio of gets to misses within the shared pool.
oramodMetricsDBTOTALRW	Specifies the total number of physical reads and writes since the instance started.
oramodMetricsDBBLKCHG	Specifies the total number of database block changes.

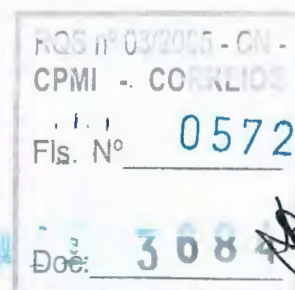






Table 9. MIB Objects – Oracle Metrics Group (Page 3 of 4)

MIB Object	Description
oramodMetricsDBBLKGET	Specifies the total number of database block gets since the instance started.
oramodMetricsDBCNSTGET	Specifies the total number of consistent gets since the instance started.
oramodMetricsDBPHYSREAD	Specifies the total number of physical reads since the instance started.
oramodMetricsDBSORTDISK	Specifies the total number of database disk sorts since the instance started.
oramodMetricsDBSORTMEM	Specifies the total number of database memory sorts since the instance started.
oramodMetricsBLKFREWAIT	Specifies the percentage of times that a request resulted in a wait for a free block.
oramodMetricsMTHRDQUEUEWAIT	Specifies the number of seconds that a request waited in the queue for multi-threaded servers.
oramodMetricsSESSHIWTRMEM	Specifies the maximum high-water amount of session memory that has been used.
oramodMetricsSESSCURRMEM	Specifies the current maximum amount of session memory that has been used.
oramodMetricsSESSHIWTR	Specifies the high-water mark for the number of sessions.
oramodMetricsSESSCURRENT	Specifies the current number of sessions.
oramodMetricsUSERCOMMITTS	Specifies the number of successfully completed and aborted database transactions.
oramodMetricsUSERROLLBACK	Specifies the number of transactions that have been rolled back since the instance started.
oramodMetricsUSERCALLS	Specifies the number of transactions that have been started since the instance started.
oramodMetricsDBPHYSWRTS	Specifies the total number of physical writes since the instance started.

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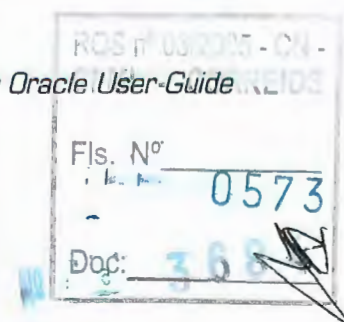


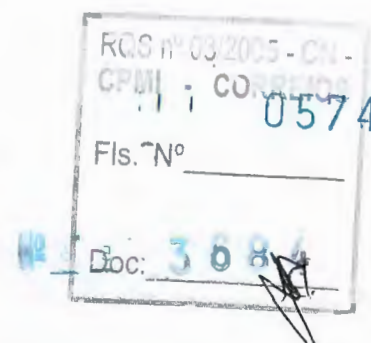


Table 9. MIB Objects – Oracle Metrics Group (Page 4 of 4)

MIB Object	Description
oramodMetricsTBLSCANROWS	Specifies the number of rows that were retrieved through table scans since the instance started.
oramodMetricsTBLFTCHROWID	Specifies the number of rows that were retrieved through table fetches by row ID since the instance started.
oramodMetricsTBLFTCHCROW	Specifies the number of rows that were retrieved through table fetches by row since the instance started.
oramodMetricsRECRSVCALLS	Specifies the number of recursive calls since the instance started.
oramodMetricsCNSTCHGS	Specifies the number of consistence changes since the instance started.
oramodMetricsPARSECNT	Specifies the number of parses since the instance started.
oramodMetricsCPUTM	Specifies the amount of time that was taken to work requests.
oramodMetricsLOGFILESWTCH	Specifies the number of redo log file switches.

### SGA Group

The SGA area of the Oracle MIB stores aggregate information about the performance of the dictionary cache. Each user and data request that connects to the database references this data dictionary. Retaining as much of the data dictionary information as possible in memory contributes to database efficiency. The SGA Group includes subgroups for Data Dictionary Aggregate (DDA) and Detailed Library Cache Information (DLCI).





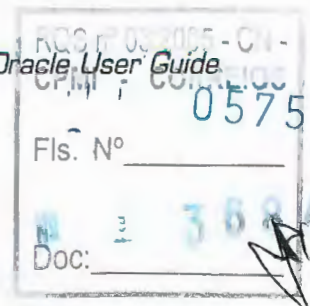


## SGA DDA Group

The SGA DDA group describes the data dictionary aggregates. Table 10 defines the Oracle SGA DDA parameters.

Table 10. MIB Objects – Oracle SGA DDA Group

MIB Object	Description
oramodSGAAGGCNT	Specifies the total number of entries in the data dictionary cache since the instance started.
oramodSGAAGGUSGE	Specifies the total number of cache entries with valid data since the instance started.
oramodSGAAGGFIX	Specifies the total number of fixed entries in the data dictionary cache since the instance started.
oramodSGAAGGGET	Specifies the total number of information requests since the instance started.
oramodSGAAGGGETMISS	Specifies the total number of information requests that resulted in cache misses since the instance started.
oramodSGAAGGSCAN	Specifies the total number of scan requests since the instance started.
oramodSGAAGGSCANMISS	Specifies the total number of scan requests that resulted in misses since the instance started.
oramodSGAAGGSCANCPLT	Specifies the total number of times that the list was scanned completely since the instance started.
oramodSGAAGGMODS	Specifies the total number of insertions, updates, and deletions since the instance started.
oramodSGAAGGFLUSH	Specifies the total number of times the data was flushed to disk since the instance started.

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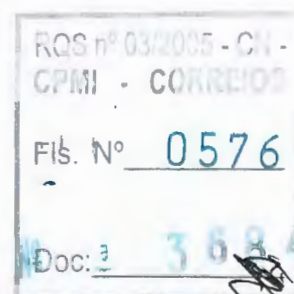


### SGA DLCI Group

The SGA DLCI group describes the detailed library cache information. Table 11 defines the Oracle SGA DLCI parameters.

Table 11. MIB Objects – Oracle SGA DLCI Group

MIB Object	Description
oramodSGADLCINAME	Specifies the Library Cache Namespace: SQL AREA, TABLE/PROCEDURE, BODY, TRIGGER, INDEX, CLUSTER, OBJECT, or PIPE.
oramodSGADLCIGET	Specifies the total number of request handles to the library namespace since instance startup.
oramodSGADLCIGETHIT	Specifies the total number of times that handles were already allocated in the cache.
oramodSGADLCIGETHITRT	Specifies the Get/Hit ratio that indicates the percentage of parse calls that find a cursor to share.
oramodSGADLCIPIN	Specifies the number of pin requests for objects in the cache since the instance started.
oramodSGADLCIPINHIT	Specifies the number of pin hits or executions of objects that are already allocated and initiated in the cache.
oramodSGADLCIPINHITRT	Specifies the ratio of pin hits to pins.
oramodSGADLCIRELOAD	Specifies the number of times a statement had to be reparsed in order to be executed.
oramodSGADLCIINVALID	Specifies the number of times that non-persistent library objects have been invalidated.







## Redo Logs Group

Oracle stores data that is being changed by transactions in redo logs. The application can later use these redo logs to perform database recoveries, if necessary. Table 12 defines the Oracle Redo Log parameters.

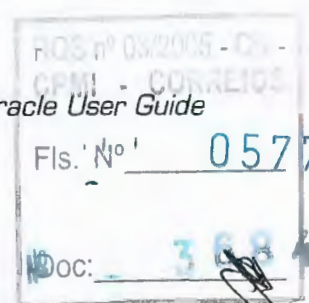
Table 12. MIB Objects – Oracle Redo Log Group

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MIB Object	Description
oramodREDOBLKWRT	Specifies the total number of redo blocks written since instance startup.
oramodREDOENTRIES	Specifies the total number of redo entries in the redo log since instance startup.
oramodREDOSIZE	Specifies the size of the redo log.
oramodREDOSPACERQST	Specifies the number of redo log space requests. If this value is not close to zero, the buffer is too small.
oramodREDOSPACEWAIT	Specifies the total number of redo log space wait times since the instance started.
oramodREDOSYNCHWRT	Specifies the total number of redo synch writes since the instance started.
oramodREDOSSYNCHTM	Specifies the total amount of redo synch time.
oramodREDOWASTAGE	Specifies the total amount of redo log waste.
oramodREDORETRIES	Specifies the total number of redo retries.

## Rollback Segment Group

The Rollback Segment section of the Oracle MIB records cumulative statistics about the use of all rollback segments since the database was last started. These segments contain records of data that have not yet been modified in a transaction. The database can use these segments to remove changes that were performed for a transaction that was canceled. That is, they can return the record to the state it was in before any changes were





made. For best performance, try to size the rollback segment so that each of its extents is large enough to support a typical transaction. Table 13 defines the Oracle Rollback Segment parameters.

Table 13. MIB Objects – Oracle Rollback Segment Group (Page 1 of 2)

MIB Object	Description
oramodRollBackSEGNAME	Specifies the rollback segment name.
oramodRollBackEXTENTS	Specifies the total number of rollback segment extents since the instance started.
oramodRollBackRSSIZE	Specifies the size of the rollback segment.
oramodRollBackWRITES	Specifies the total number of segment Writes since the instance started.
oramodRollBackGETS	Specifies the total number of rollback segment Gets since the instance started.
oramodRollBackWAITS	Specifies the total number of rollback segment Waits since the instance started.
oramodRollBackOPTSIZE	Specifies the optimal size of the rollback segment. Base this value on application use to minimize space management issues.
oramodRollBackSHRINKS	Specifies the total number of rollback segment shrinks (return to normal size after an extend) since the instance started.
oramodRollBackWRAPS	Specifies the total number of rollback segment wraps since instance startup. If this value is not equal to zero, recreate the rollback segments with larger extent sizes.
oramodRollBackEXTENDS	Specifies the number of rollback segments extends (extensions for handling larger transactions that what the segment was designed to handle).

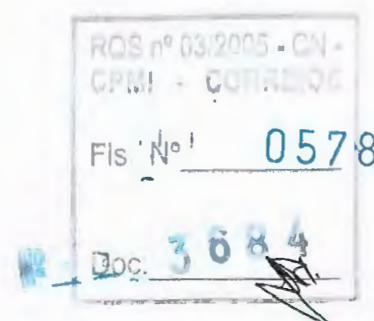






Table 13. MIB Objects – Oracle Rollback Segment Group (Page 2 of 2)

MIB Object	Description
oramodRollBackAVESHRINK	Specifies the average shrink size of this rollback segment since the instance started.
oramodRollBackAVEACTIVE	Specifies the average activity for this rollback segment since the instance started.
oramodRollBackSTATUS	Specifies the rollback segment status.

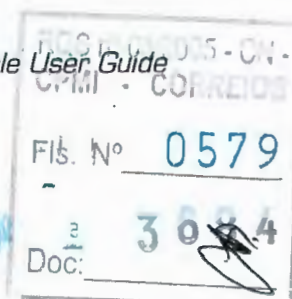
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## Waits Group

Wait time contributes most significantly to total response time. The Waits table identifies the events that are contributing to the longest wait times. Table 14 defines the Oracle Waits parameters.

Table 14. MIB Objects – Oracle Waits Group

MIB Object	Description
oramodWaitsEVENT	Specifies the name of the resource that is experiencing waits.
oramodWaitsTOTALWAITS	Specifies the total number of waits for the resource.
oramodWaitsTOTALTIMEOUT	Specifies the total number of timeouts for the resource.
oramodWaitsTIMEWAITED	Specifies the total time the resource waited.
oramodWaitsAVGWAIT	Specifies the average time the resource waited.



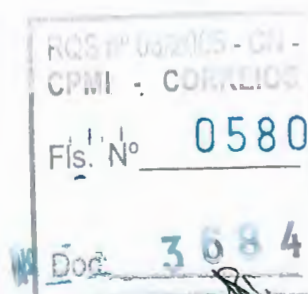


## Expensive SQL Group

SQL queries that are not optimized can significantly reduce the overall performance of a system. The Expensive SQL table identifies statements that require too many disk reads or parses. Table 15 defines the Oracle Expensive SQL parameters.

**Table 15. MIB Objects – Oracle Expensive SQL Group**

MIB Object	Description
oramodExpSqlEXECUTION	Specifies the number of executions of expensive SQL.
oramodExpSqlDISKREAD	Specifies the number of disk reads.
oramodExpSqlPARSECNT	Specifies the number of parses. A large number of hard parses requires more memory for the shared pool.
oramodExpSqlBUFFGETS	Specifies the number of Buffer Gets.
oramodExpSqlSORTS	Specifies the number of Sorts.
oramodExpSqlSQL	Specifies the SQL statement.







## Tablespace Group

The Tablespace group identifies the fragmentation within each database tablespace. For best performance, you must have enough free block space to fill database requests. The Tablespace table describes the amount of space left in a tablespace after the next largest extent of any table in the tablespace is allocated. Table 16 defines the Oracle Tablespace parameters.

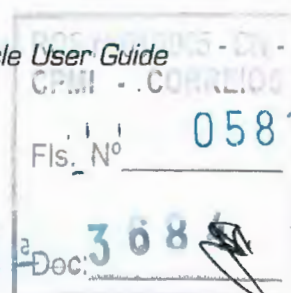
**3**

**Table 16. MIB Objects – Oracle Tablespace Group**

MIB Object	Description
oramodTblspTBLSPINDX	Specifies the tablespace index number.
oramodTblspTBLSPNAME	Specifies the tablespace name.
oramodTblspKBYTESLEFT	Specifies the number of KB that are left after the next largest extent is allocated.
oramodTblspFILNAME	Specifies the tablespace file name.
oramodTblspEXTENTS	Specifies the number of extents.
oramodTblspLRGEXTENT	Specifies the size in bytes of the largest extent.
oramodTblspSMEXTENT	Specifies the size in bytes of the smallest extent.
oramodTblspINCREMENTBY	Specifies the size in bytes of the next extent increment.
oramodTblspBYTESCOALSD	Specifies the number of free bytes that were coalesced.
oramodTblspBYTESFREE	Specifies the number of free bytes that are available.

## Lock Group

Locks are access restrictions in a multi-user environment. They can maintain security and protect the integrity of the data by remaining in place until a commit (which saves all changes to a database since the start of a transaction) or rollback (which removes updates performed by a partially completed transaction) takes place. The Lock Group includes subgroups for locks and latches.





## Locks Group

The Locks table identifies lock holders and requestors. Table 17 defines the Oracle Locks parameters.

Table 17. MIB Objects – Oracle Locks Group

MIB Object	Description
oramodLockUSERINDX	Specifies the user's index number.
oramodLockUSERNAME	Specifies the name of the user who is holding the lock.
oramodLockOBJECT	Specifies the name of the locked object.
oramodLockTYPE	Specifies the object type of the locked object.
oramodLockMODE	Specifies the type of lock mode that is being held: Null, Row share, Row exclusive, Share, Share row exclusive, or Exclusive.
oramodLockCTIME	Specifies the amount of time since the current mode was granted.
oramodLockBLOCK	Indicates whether the lock is blocking another lock.

## Latches Group

Latches are subsets of locks that can prevent access to Oracle internal memory structures while a process is accessing them. If the database spends too much time waiting for latches, it can affect performance. The Latch table identifies latches held per instance. Table 18 defines the Oracle Latch parameters.

Table 18. MIB Objects – Oracle Latch Group (Page 1 of 2)

MIB Object	Description
oramodLatchLATCHNUM	Specifies the latch number.
oramodLatchLATCHNAME	Specifies the latch name.
oramodLatchGETS	Specifies the number of times that Oracle satisfied requests for latches without waiting.

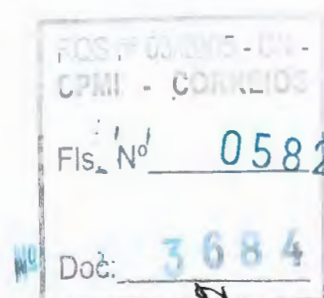






Table 18. MIB Objects – Oracle Latch Group (Page 2 of 2)

MIB Object	Description
oramodLatchMISSES	Specifies the number of times that Oracle did not satisfy latch requests.
oramodLatchSLEEPS	Specifies the number of latch sleeps.
oramodLatchIMDGETS	Specifies the number of latch immediate gets.
oramodLatchIMDMISSES	Specifies the number of latch immediate misses.
oramodLatchWAITSHOLDING	Specifies the number of latch waits that are holding.
oramodLatchSPINGETS	Specifies the number of latch spin gets.

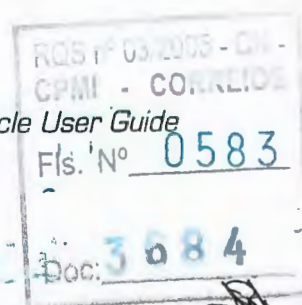
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## Backup Group

The Backup group provides physical backup information. Table 19 defines the Backup parameters.

Table 19. MIB Objects – Oracle Backup Group

MIB Object	Description
oramodBackupFILENUM	Specifies the backup file index number.
oramodBackupSTATUS	Specifies the status of the backup.
oramodBackupCHANGENUM	Specifies the change number of the backup file.
oramodBackupDATE	Specifies the date of the backup.



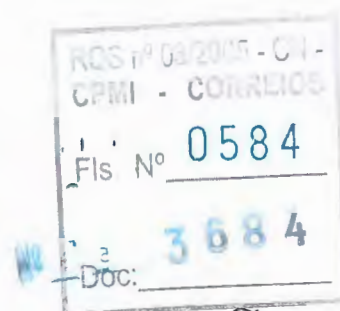


## Archive Group

The Archive group provides physical backup information. Table 20 defines the Backup parameters.

Table 20. MIB Objects – Oracle Archive Group

MIB Object	Description
oramodArcDestARCMODE	Specifies the mode of the archive log.
oramodArcDestSTATUS	Specifies the status of the archive log file.
oramodArcDestDEST	Specifies the archive log file destination.



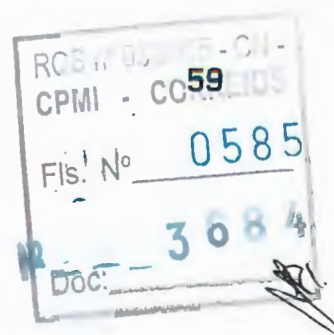


## Using eHealth AIM for Oracle

This chapter describes how to configure and use eHealth AIM for Oracle. This module is implemented as a SystemEDGE agent plug-in. After you enable this plug-in in the `sysedge.cf` file and obtain a license for it, SystemEDGE will load it automatically at startup. For more information, refer to “Editing the `sysedge.cf` File” on page 21 and “Licensing eHealth AIM for Oracle” on page 26.

eHealth AIM for Oracle implements additional MIB objects that provide advanced information about the health and availability of Oracle databases. It can operate with any SNMP-compliant management software such as Concord’s eHealth suite of products, AdvantEDGE View, HP OpenView, and others. If you are using eHealth AIM for Oracle with eHealth, refer to the eHealth Web Help for more information about the reports that you can generate.

The default configuration settings of the eHealth AIM for Oracle plug-in enable you to use the advanced self-monitoring capabilities of the SystemEDGE agent in conjunction with eHealth AIM for Oracle.





## eHealth AIM for Oracle MIB Branch

You can use AdvantEDGE View or another SNMP tool to edit the SystemEDGE configuration file to utilize the eHealth AIM for Oracle MIB objects with the process-monitoring, threshold-monitoring, and history-collection features of the SystemEDGE agent. All MIB objects that are related to eHealth AIM for Oracle exist at object identifier (OID) branch 1.3.6.1.4.1.546.16.4 in the Concord Systems Management MIB. The MIB is defined in the `oramod.asn1` file, which is available in the eHealth AIM for Oracle product installation.

## Assigning Entry Rows in the SystemEDGE Self-Monitoring Tables

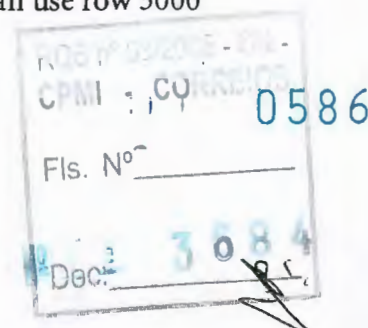
All SystemEDGE self-monitoring tables (including log monitoring, process/service monitoring, threshold monitoring, and history collection) require the use of unique row numbers. Each table contains an **Index** column which acts as a **key field** to distinguish rows in the table. This section describes the benefits of reserving a block of rows (in the range of 11 to the maximum number of rows in your table) for use by the system or application administrator.

### Setting Local Policy

You may choose, as a matter of local policy, to reserve a block of rows for system administration. This policy allows you to define entries within a reserved block of rows without being concerned that the row might already be taken by another user's entry. In compliance with the local policy, all other users should use row indices that are outside the reserved range when they define user-configured entries.

### Reserving Blocks of Rows

By reserving a block of rows, you can define a consistent set of conditions (row entries) to be monitored across all machines such that the same condition is defined in the same row number on each machine. For example, you can use row 3000







in each table to define entries monitoring the MIB object for total number of SQL disk reads (oramodExpSqlDISKREAD). You can then distribute this configuration to every host so that every system that is running Oracle uses row 3000 for monitoring the number of SQL disk reads, for each SystemEDGE self-monitoring table.

**To reserve a block of rows for monitoring Oracle:**

1. Decide which block of rows you want to reserve for use with monitoring Oracle.
2. Use that block of rows to define a set of row entries for each SystemEDGE self-monitoring table. For more information, refer to the chapter on self-monitoring in the *eHealth SystemEDGE User Guide*.
3. Distribute configuration file entries to all hosts that are running Oracle and eHealth AIM for Oracle. For more information, refer to the *Automating the Deployment of SystemEDGE and the AdvantEDGE Point Plug-in Modules* white paper.

4

**NOTE**

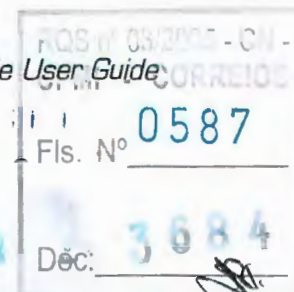
As an alternative, you can use this row-number assignment policy with AdvantEDGE View for group-configuration operations.

4. Require end users to avoid your block of rows when defining their own self-monitoring table entries.

## Using the SystemEDGE Self-Monitoring Features

This section provides examples of how to use SystemEDGE process, threshold, and history monitoring to monitor the Oracle application. Add these commands to the `sysedge.cf` file to enable monitoring of the MIB objects that they specify. Modify these examples as necessary to monitor the MIB objects that are relevant for your configuration.

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The examples in this section use row numbers in the 5000 range; use a row number for your configuration that conforms to local policies. For more information on row assignment, refer to “Assigning Entry Rows in the SystemEDGE Self-Monitoring Tables” on page 60.

The following command, for example, instructs the SystemEDGE agent to monitor the RSS of the Oracle database every 60 seconds for values that are greater than 50,000 and to store the data in row 5001 of the Threshold Monitoring table:

```
monitor oid oramodFootprtrRSS 5001 0x0 60 absolute > 50000 'Total  
Resident Memory' ''
```

For more information about the syntax for the commands in this section, refer to the *eHealth SystemEDGE User Guide*. For more information about eHealth AIM for Oracle MIB objects, refer to Chapter 3, “Using the eHealth AIM for Oracle MIB,” or to the MIB specification (*oramod.asn1*).

#### NOTE

*Enter the commands throughout this chapter on one line. Do not use a carriage return to match the formatting shown here.*

## Using SystemEDGE Process Monitoring

This section provides an example of how to use the SystemEDGE agent to monitor the availability of a critical Oracle process. For more information, refer to the chapter on process monitoring in the *eHealth SystemEDGE User Guide*.

### Monitoring the Oracle database

To ensure that the Oracle database is running, enter the following command in the *sysedge.cf* file:

```
watch process procAlive 'oracle' 5000 30 'Oracle Database' ''
```







## Using SystemEDGE Threshold Monitoring

This section provides examples of how to use the SystemEDGE agent to monitor important Oracle metrics. Add the commands that are provided in the following sections to the `sysedge.cf` file to monitor thresholds for these MIB objects. For more information, refer to the chapter on threshold monitoring in the *eHealth SystemEDGE User Guide*.

### NOTE

The thresholds used in this section may not be appropriate for your Oracle application; select thresholds that are appropriate for your environment.

4

### Monitoring Total Resident Memory Size of an Oracle Service

To monitor the total resident memory size of an Oracle service, enter the following:

```
monitor oid oramodFootprtRSS 5001 0x0 60 absolute > 50000 'Total  
Resident Memory' ''
```

### Monitoring Combined Size of Oracle Text, Data, and Stack Segments

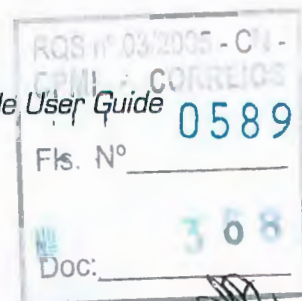
To monitor the total size of the Oracle text, data, and stack segments, enter the following:

```
monitor oid oramodFootprtMEMSIZE 5002 0x0 60 absolute > 1000000 'Total  
Memory Size' ''
```

### Monitoring Total Size of Oracle Redo Log File

To monitor the total size of the Oracle redo log file, enter the following:

```
monitor oid oramodREDOSIZE 5003 0x0 60 absolute > 500000 'Total Redo  
Log Size' ''
```





## Monitoring Total Number of Database Disk Sorts

To monitor the total number of database disk sorts, enter the following:

```
monitor oid oramodMetricsDBSORTDISK 5004 0x0 60 absolute > 50000 'Total  
Number Database Disk Sorts' ''
```

## Using SystemEDGE History Collection

This section provides examples of how to use SystemEDGE history capabilities to track the value of important Oracle metrics over time. Add the commands that are provided in the following sections to the `sysedge.cf` file to collect history for these MIB objects. For more information about history collection, refer to the chapter on history collection in the *eHealth SystemEDGE User Guide*.

### NOTE

The number of samples and the interval between samples used in this section may not be appropriate for your Oracle system; select values that are suitable for your environment.

## Collecting History on Number of Hits to the Database

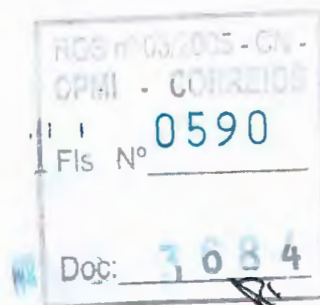
To collect history on the number hits to the database, enter the following:

```
emphistory 5000 60 oramodMetricsCHR 300 'Total Hits To Oracle Database'
```

## Collecting History on Block Changes Per Transaction

To collect history on the number of block changes per transaction for the Oracle database, enter the following:

```
emphistory 5001 60 oramodMetricsBCPT 300 'Oracle Database Block Changes  
Per Transaction'
```







## Collecting History on the Number of Transactions Started

To collect history on the number of transactions started since the last instance startup, enter the following:

```
emphistory 5002 60 oramodMetricsUSERCALLS 300 'Total Transactions  
Started Since Instance Startup'
```

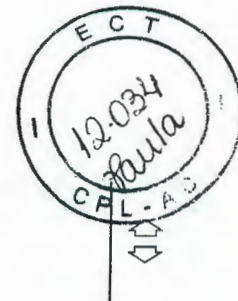
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# Glossary

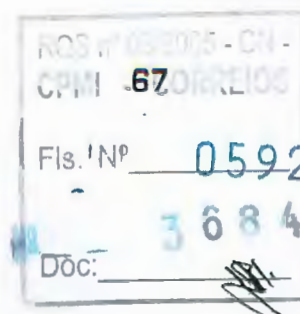
**Abstract Notation One (ASN.1)** A language that describes data types independent of computer structures and representations. For more information refer to ISO International Standard 8824.

**AdvantEDGE View** A Web-based management interface for use with the SystemEDGE agent that enables an administrator to use a Web browser to manage systems and applications.

**agent** In network management, a program that provides information from a management information base (MIB) for SNMP agents. *eHealth* or a network management system (NMS) use the information about managed devices and take corrective action when appropriate.

**American Standard Code for Information Interchange (ASCII)** The most common format for character representation in computers and the Internet. Characters fit into a single byte. It was developed by the American National Standards Institute (ANSI).

**application** A program that performs a specific function for one or more users or for another application program. Types of applications include communication programs, management programs, word processors, databases, and drawing programs.







**ASCII** See American Standard Code for Information Interchange (ASCII).

**ASN.1** See Abstract Notation One (ASN.1).

**baseline** A level of performance that is considered normal, average, or typical over a period of time such as a day, week, or month. Compare current performance metrics against baseline data to identify trends in performance levels and service delivery.

**buffer** A temporary storage area for data. Often implemented as holding areas between the backplane and an interface; data remains in the buffer until it can be transmitted on the interface or processed by the central processing unit (CPU).

**capacity** A measurement of the volume that an element can support. For interfaces, this is the bandwidth that can be carried. For hard disks, this is the disk size or the amount of information that can be stored on the disks. See also traffic.

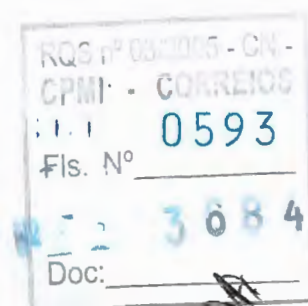
**central processing unit (CPU)** The component within a device that performs the instruction execution for the applications and programs that run on the device. Also referred to as a processor or microprocessor.

**client** A computer system, usually a desktop computer or laptop, that presents data directly to a user and accepts input. They drive the computing process, supporting local processing and accessing remote servers as needed for data access and analysis.

Also refers to the application software residing on a machine that is used by an end user.

**congestion** A condition in which the network traffic is greater than the amount that the network can carry. Often causes performance problems and delays on a network.

**CPU** See central processing unit (CPU).





**Database Management System (DBMS)** A program such as Oracle, Microsoft SQL Server, or Sybase for creating and providing access to one or more databases.

**delay** The time required for a packet or frame to travel from the sending station (source) to the receiving station (destination).

**disk thrashing** A condition that results when a server performs high disk input/output (I/O) operations—reads and writes to the disk—without producing actual work. Often occurs when a server performs excessive paging and swapping due to physical memory limitations.

**DNS** See domain name system (DNS).

**domain name system (DNS)** The system that locates and translates Internet domain names such as concord.com into Internet Protocol (IP) addresses. A DNS server is typically a device that translates domain names to IP addresses within your network.

**eHealth AIM** See eHealth application insight module.

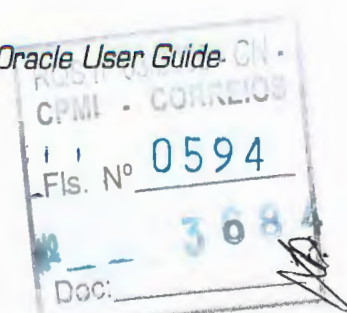
**eHealth application insight module** A plug-in (supplementary program) that extends the functionality of the SystemEDGE agent. AIMS add the capability to manage application-specific events, processes, thresholds, and health.

**event** An occurrence on a system that typically results in a message, such as an SNMP trap, being sent to a configured management system. Common events include system failures, system reboots, exceeded thresholds, or any user-configurable situation that the user wants to identify.

**File Transfer Protocol (FTP)** A means for uploading and downloading files on the Internet (the oldest Internet protocol for retrieving files). You can use an FTP client application to request files from or transfer files to an FTP server.

**FTP** See File Transfer Protocol (FTP).

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**Host Resources MIB** A MIB (management information base) that defines a set of objects that are useful for the management of host computers. For example, it defines host storage areas, devices, and file systems. This MIB is defined in RFC 1514.

**hostname** The name for an individual IP (Internet Protocol) address on a computer. While many computers have only one hostname, some machines, such as network servers have multiple hostnames.

**HTML** See Hypertext Markup Language (HTML).

**HTTP** See Hypertext Transfer Protocol (HTTP).

**Hypertext Markup Language (HTML)** A programmatic language used for controlling the way that text and images appear when a file is displayed on the World Wide Web.

**Hypertext Transfer Protocol (HTTP)** An application protocol that defines the set of rules for exchanging files (text, graphics, multimedia, and other files) on the World Wide Web.

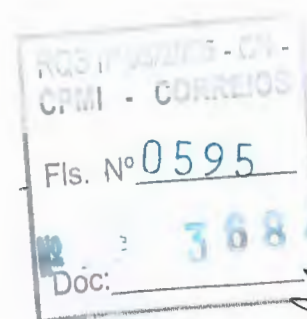
**Hertz (Hz)** A unit of frequency of one cycle per second that measures the change in the state of an alternating current, sound wave, or other cyclical wave form.

**I/O** See input/output (I/O).

**Information Technology (IT)** A widely-used term to describe all of the technologies used for creating, exchanging, managing, and using information in various forms.

**input/output (I/O)** Any operation, program, or device that transfers data to or from a computer.

**internet infrastructure** The applications, systems, and networks that a company uses to run its business, for both internal use and for interfaces to the outside world.





**Internet Protocol (IP)** The method (or protocol) by which packets of information are sent across the Internet. IP defines addressing, error handling, routing, and option codes for data transmission. IP requires no continuing connection between the endpoints that are communicating.

**IP** See Internet Protocol (IP).

**IT** See Information Technology (IT).

**KB** Kilobytes.

**latency** A measure of delay, often network delay. Depending on the type of element, eHealth reports can show two types of latency: round-trip latency, which is the length of time in milliseconds for a ping packet to travel from the eHealth system to a polled element and back. Alternate latency, which is the length of time in milliseconds for a ping packet to travel from a network resource (the alternate latency source) such as a router to other critical network resources such as routers and servers (the alternate latency partner).

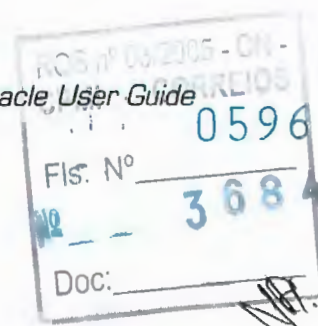
**management information base (MIB)** A formal description of a set of network objects that can be managed using Simple Network Management Protocol (SNMP).

**MB** Megabytes.

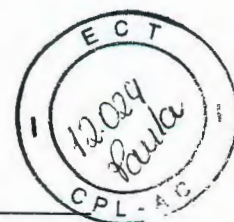
**MIB** See management information base (MIB).

**network** A collection of computers, printers, routers, switches, and other devices that are able to communicate using a common transmission media such as TCP/IP.

**network management system (NMS)** An application program usually residing on a computer that manages at least part of a network, including systems and applications. The NMS communicates with agents to monitor network statistics and resources, control network device configuration, and analyze network problems. *See also* agent.







**NMS** See network management system (NMS).

**object identifier (OID)** a unique identifier of a managed object in a MIB hierarchy. See also management information base (MIB).

**OID** See object identifier (OID).

**operating system (OS)** The program that manages all other programs (applications or application programs) on a computer. Provides the following services: determining the order in which each application runs and the time allotted for that application, managing the sharing of internal memory among multiple applications and handling input to and output from attached hardware devices.

**OS** See operating system (OS).

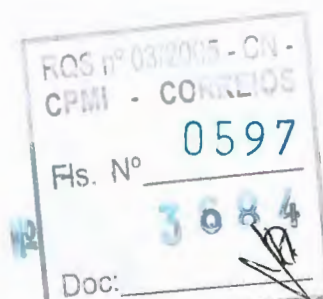
**packet** A logical unit of data routed between an origin and a destination on the Internet or any other packet-switched network. On the Internet, the Transmission Control Protocol (TCP) layer of TCP/IP divides a file into packets of manageable size for routing.

**page** In computers that utilize virtual memory, a unit of data storage. Systems transfer pages of data from disk storage to memory and back again.

On the World Wide Web, a file written using Hypertext Markup Language (HTML) that specifies how text, images, and other multimedia will be presented to the user. A Web site delivers information to the user one page at a time.

**paging** The process by which a computer moves portions of programs between random access memory and auxiliary storage (on disk).

**partition** A logical division of a hard disk on a PC that is created so that each partition can have a different operating system or can be used for different purposes (for example, file management or multiple users).





**path** In networking, a path is a route from one location to another in a network. In an Asynchronous Transfer Mode (ATM) network, a path is a virtual pipe that can carry a number of channels.

**PC** See personal computer (PC).

**performance threshold** The upper limit of acceptable response time.

**personal computer (PC)** A computer designed for individual use. Prior to the PC, computers were designed to be used by many individuals and system resources were shared by all. A PC often refers to a computer with an Intel microprocessor architecture and an operating system such as Microsoft DOS or Windows.

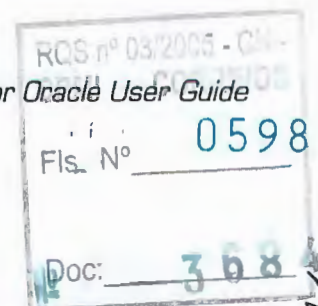
**ping** An Internet echo message used to confirm the reachability of a network device. An abbreviation for Packet Internet or Inter-Network Groper.

**port** The physical (hardware) connection on a device that connects the device to a network.

**process** Typically, an instance of a program or application that is running on a server. Applications can have one or more associated processes. *See also* Database Management System (DBMS).

**process set** A collection of one or more processes that relate to a specific application. Using eHealth – System At-a-Glance reports, you can obtain information about the impact and performance of process sets running on systems that have Concord SystemEDGE agents.

**protocol** The set of rules by which the endpoints in a telecommunication connection communicate. The protocol defines the packet format of the transmitted information. On the Internet, common protocols are TCP, IP, HTTP and FTP.







**queue** In a system, a set of jobs awaiting resources. In a network device such as a router, a collection of packets waiting to be processed or forwarded. Insufficient central processing unit (CPU) speed, memory, or interface speeds can contribute to long queues, and therefore, to delay on the network.

**real-time** A level of computer responsiveness that an end user would deem as immediate or fast enough to show incremental changes of an external process (for example, to present visualizations of the weather as it constantly changes).

**Request For Comments (RFC)** The name of the document series regarding Internet design. Most RFCs define protocol specifications such as Telnet and FTP. RFCs are widely available online.

**RFC** See Request For Comments (RFC).

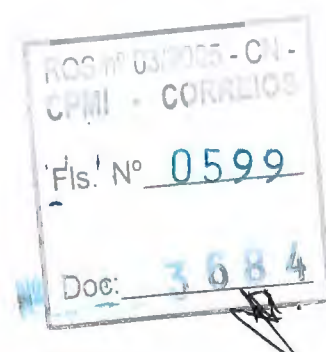
**server** A program that provides services to other programs in the same and other computers.

Also a computer that performs file storage and application hosting as well as provides computing services to other devices and users on the network. Typically has one or more central processing units (CPUs), disks, interfaces, and storage partitions.

**server process** A server-side part of a distributed application.

**Simple Network Management Protocol (SNMP)** The network management protocol used almost exclusively in data networks. A method for monitoring and controlling network devices, as well as managing configurations, statistics collection, performance, and security.

**SNMP** See Simple Network Management Protocol (SNMP).





**SNMP agent** A program such as the SystemEDGE agent that conforms to a management information base (MIB) specification to collect information about managed devices and to take corrective action (using SNMP traps) when appropriate.

**speed** The capacity (bandwidth) of an interface in bits per second (bps).

**swapping** The process in which a computer moves entire programs in and out of random access memory to and from auxiliary storage (swap partition or pagefile).

**SystemEDGE agent** Concord's SNMP agent that autonomously monitors system configuration, status, performance, users, applications, file systems, and other critical resources.

**Systems Management MIB** A set of MIB (management information base) objects that extends the capabilities of the Host Resources MIB. It provides greater visibility into systems and specific information about Windows NT and UNIX systems.

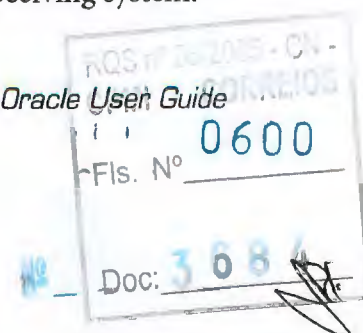
**TCP/IP** See Transmission Control Protocol (TCP) and "Internet Protocol (IP).

**threshold** See performance threshold.

**throughput** The rate of data transfer on an interface over time. At each poll, eHealth calculates throughput by dividing the total number of bits for an interface by the elapsed time in seconds since the previous poll.

**traffic** The data that travels over a network.

**Transmission Control Protocol (TCP)** A connection-based protocol used along with the Internet Protocol (IP) to send data in the form of message units between computers over the Internet. While IP is responsible for the actual delivery of the data, TCP is responsible for dividing data into packets at the sending system and constructing the data message from individual packets at the receiving system.







**trap** A message sent by an SNMP agent to a console or network management system (NMS) to indicate that a threshold has been reached or another user-defined condition has occurred. The SystemEDGE agent defines a number of traps for system and application management.

**UDP** See User Datagram Protocol (UDP).

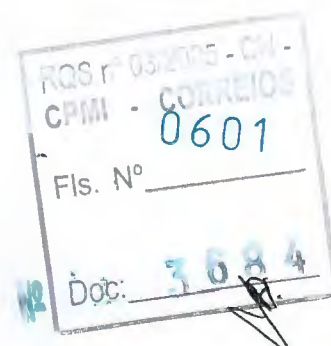
**User Datagram Protocol (UDP)** A communications protocol that uses Internet Protocol (IP) to send and receive data and is similar to Transmission Control Protocol (TCP), but provides fewer packet management services.

**variable** A performance metric for an element. A characteristic or behavior upon which eHealth gathers data and evaluates the performance of the element. SystemEDGE agents can also monitor local variables to reduce network polls and increase scalability.

**Web** See World Wide Web (WWW, Web).

**workstation** A powerful computer that is equipped with a fast processor, a large amount of random access memory, and other features such as high-speed graphical rendering that make it suitable for business users such as engineers, graphic designers, and architects.

**World Wide Web (WWW, Web)** All of the resources on the Internet that use Hypertext Transfer Protocol (HTTP). Users of the Web access information through browser software.





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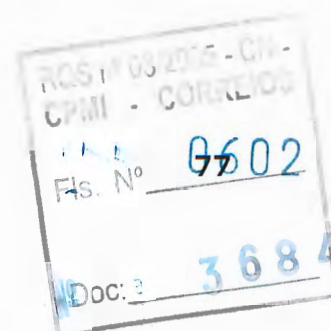
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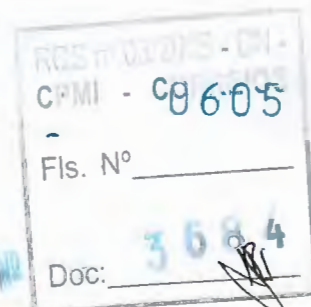
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## **ANEXO 3**

# **CATÁLOGOS, MANUAIS E OUTROS DOCUMENTOS TÉCNICOS**

## **VOLUME 5**

**CONTEÚDO:**

**MANUAL 15**



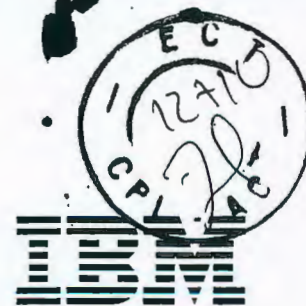
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**Note**

Before using this information and the product it supports, read the information in Appendix B, "Notices", on page 327.

**Second Edition (May 2003)**

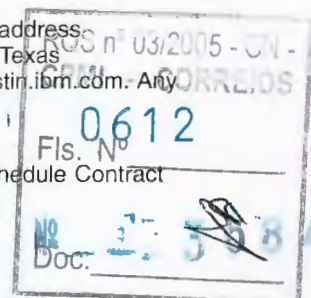
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This edition replaces SC23-4113 and SC23-4374.

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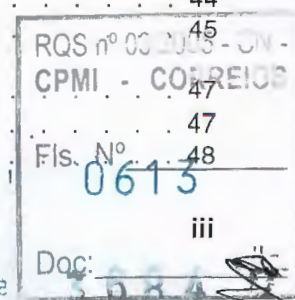






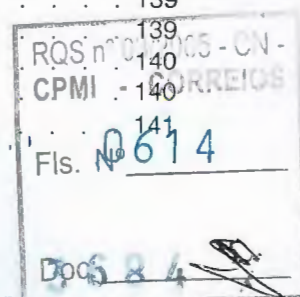
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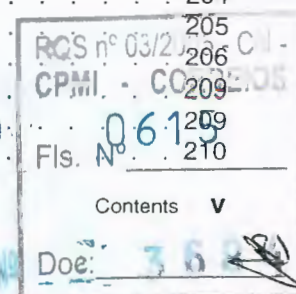
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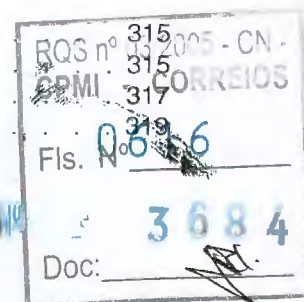
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## About This Book

This book provides system administrators with complete information about how to perform such tasks as installing and maintaining the AIX operating system and optional software on standalone systems and on client systems from a resource server using the Network Install Management (NIM) interface. It also includes information on how to migrate a system, manage system backups, install AIX updates, use alternate disk installation, and troubleshoot problems with installation. This publication is available on the documentation CD that is shipped with the operating system.

Beginning with the AIX 5.2 documentation library, all information regarding AIX system security, or any security-related topic, has moved. For all security-related information, see the *AIX 5L Version 5.2 Security Guide*.

This edition supports the release of AIX 5L Version 5.2 with the 5200-01 Recommended Maintenance package. Any specific references to this maintenance package are indicated as *AIX 5.2 with 5200-01*.

## Who Should Use This Book

This book is intended for system administrators who are installing AIX 5.2 on standalone systems or networked systems.

## Highlighting

The following highlighting conventions are used in this book:

<b>Bold</b>	Identifies commands, subroutines, keywords, files, structures, directories, and other items whose names are predefined by the system. Also identifies graphical objects such as buttons, labels, and icons that the user selects.
<i>Italics</i>	Identifies parameters whose actual names or values are to be supplied by the user.
Monospace	Identifies examples of specific data values, examples of text similar to what you might see displayed, examples of portions of program code similar to what you might write as a programmer, messages from the system, or information you should actually type.

## Viewing Readme Files

The Base Operating System (BOS) includes a readme file that contains information not included in other documentation. Each software product may also have its own readme file with new information specific to that product. After you install BOS, view these files to learn important changes before using your system.

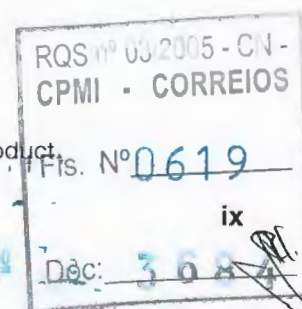
Use the following procedure to view the readme files for Base Operating System (BOS) software and optional software products:

1. Log in as root user if you have not already done so.
2. Enter the following command at the system prompt:  
`cd /usr/lpp`
3. Type:  
`ls */*README*`

The system lists readme files for each software product installed on your system.

4. To view a readme file for a specific software product, use the following command:  
`pg xxx/README`

In this example, xxx is the directory name associated with a particular software product.





Press Enter when the copyright screen appears. Press the following keys or key combinations to scroll through the readme file:

**To page down**

Press Enter key.

**To page up**

Type the minus (-) key, then press the Enter key.

**To move forward x pages**

Type the plus (+) key and number of pages, then press the Enter key.

For example, to move forward five pages, type +5 and press the Enter key.

**To move backward x pages**

Type the minus (-) key and number of pages, then press the Enter key.

For example, to move backward five pages, type -5 and press Enter.

Type q at the : (colon) prompt to exit the readme file.

---

## Case-Sensitivity in AIX

Everything in the AIX operating system is case-sensitive, which means that it distinguishes between uppercase and lowercase letters. For example, you can use the **ls** command to list files. If you type **LS**, the system responds that the command is "not found." Likewise, **FILEA**, **FiLea**, and **filea** are three distinct file names, even if they reside in the same directory. To avoid causing undesirable actions to be performed, always ensure that you use the correct case.

---

## ISO 9000

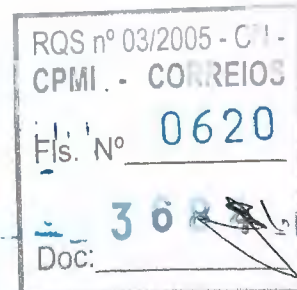
ISO 9000 registered quality systems were used in the development and manufacturing of this product.

---

## Related Publications

The following publications contain additional information related to the installation and management of AIX 5.2:

- *AIX 5L Version 5.2 Operating System Installation: Getting Started*
- *AIX 5L Version 5.2 System Management Guide: Operating System and Devices*
- *AIX 5L Version 5.2 System Management Guide: Communications and Networks*
- *AIX 5L Version 5.2 Commands Reference*
- *AIX 5L Version 5.2 Files Reference*
- *AIX 5L Version 5.2 General Programming Concepts: Writing and Debugging Programs*
- *AIX 5L Version 5.2 System User's Guide: Operating System and Devices*
- *AIX 5L Version 5.2 System User's Guide: Communications and Networks*
- *AIX 5L Version 5.2 Security Guide*

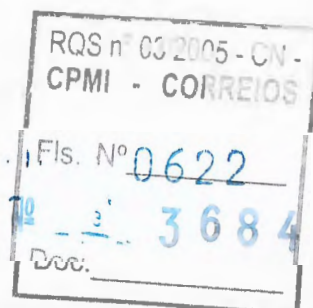




## Part 1. How-To's for AIX Installation Tasks

Part 1 contains how-to instructions for performing installation tasks.







## Chapter 1. How-To's for Base Operating System Installation Tasks

This chapter provides the following how-to instructions for performing common installation tasks:

- "Perform a New and Complete Overwrite Base Operating System Installation from CD"
- "Perform a Migration Base Operating System Installation from CD" on page 7
- "Perform a Non-Prompted New and Complete Overwrite Base Operating System Installation from CD" on page 10
- "Create and Install a Software Bundle" on page 12
- "Add Open Source Applications to Your AIX System" on page 15
- "Clone a rootvg Using Alternate Disk Installation" on page 17
- "Configure NIM Using EZNIM" on page 20
- "Install a Client Using NIM" on page 21
- "Create a System Backup to Tape" on page 23
- "Clone a System Using a System Backup Tape" on page 25
- "Clean Up a Failed Software Installation" on page 26

### Perform a New and Complete Overwrite Base Operating System Installation from CD

Using this scenario, you can install the AIX operating system for the first time or overwrite an existing version of the operating system. In this scenario, you will do the following:

- Boot from the AIX product CD
- Set BOS Installation Settings
  - Perform a new and complete overwrite installation of AIX onto hdisk0
  - Use English as the primary language
  - Use the default options in the More Options menu
- Start the BOS Installation and Configure the System

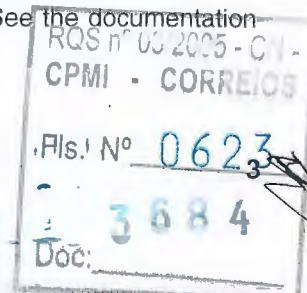
If you are overwriting an existing system, gather the TCP/IP information from the system before you begin this scenario.

**Attention:** This procedure requires shutting down and reinstalling the base operating system. Whenever you reinstall any operating system, schedule your downtime when it least impacts your workload to protect yourself from a possible loss of data or functionality. Before you perform a new and complete overwrite installation, ensure you have reliable backups of your data and any customized applications or volume groups. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.

The following steps show you how to use the system's built-in CD-ROM device to perform a new and complete overwrite base operating system installation.

### Step 1. Prepare Your System

- There must be adequate disk space and memory available. AIX 5.2 requires 128 MB of memory and 2.2 GB of physical disk space. For additional release information, see the *AIX 5.2 Release Notes*.
- Make sure your hardware installation is complete, including all external devices. See the documentation provided with your system unit for installation instructions.







- If your system needs to communicate with other systems and access their resources, make sure you have the information in the following worksheet before proceeding with installation:

Table 1. Network Configuration Information Worksheet

Network Attribute	Value
Network Interface	(For example: en0, et0)
Host Name	
IP Address	_____
Network Mask	_____
Nameserver	_____
Domain Name	
Gateway	_____

## Step 2. Boot from the AIX Product CD

1. Insert the *AIX Volume 1* CD into the CD-ROM device.
2. Make sure all external devices attached to the system (such as CD-ROM drives, tape drives, DVD drives, and terminals) are turned on. Only the CD-ROM drive from which you will install AIX should contain the installation media.
3. Power on the system.
4. When the system beeps twice, press F5 on the keyboard (or 5 on an ASCII terminal). If you have a graphics display, you will see the keyboard icon on the screen when the beeps occur. If you have an ASCII terminal (also called a tty terminal), you will see the word keyboard when the beeps occur.

**Note:** If your system does not boot using the F5 key (or the 5 key on an ASCII terminal), refer to your hardware documentation for information about how to boot your system from an AIX product CD.

5. Select the system console by pressing F1 (or 1 on an ASCII terminal) and press Enter.
6. Select the English language for the base operating system (BOS) Installation menus by typing a 1 in the **Choice** field. Press Enter to open the Welcome to Base Operating System Installation and Maintenance screen.
7. Type 2 to select **2 Change/Show Installation Settings and Install** in the **Choice** field and press Enter.

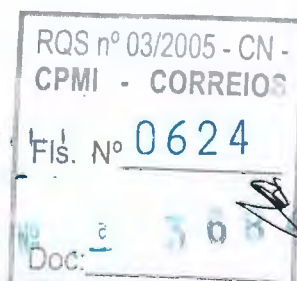
```

Welcome to Base Operating System
Installation and Maintenance

Type the number of your choice and press Enter. Choice is indicated by >>>.

1 Start Install Now with Default Settings
2 Change/Show Installation Settings and Install
3 Start Maintenance Mode for System Recovery

88 Help ?
99 Previous Menu
>>> Choice [1]: 2
```





### Step 3. Set and Verify BOS Installation Settings

1. In the Installation and Settings screen, verify the installation settings are correct by checking the method of installation (new and complete overwrite), the disk or disks you want to install, the primary language environment settings, and the advanced options.

If the default choices are correct, type 0 and press Enter to begin the BOS installation. The system automatically reboots after installation is complete. Go to "Step 4. Configure the System after Installation" on page 6.

Otherwise, go to sub-step 2.

2. To change the System Settings, which includes the method of installation and disk where you want to install, type 1 in the **Choice** field and press Enter.

Installation and Settings

Either type 0 and press Enter to install with current settings, or type the number of the setting you want to change and press Enter.

**1 System Settings:**  
Method of Installation.....New and Complete Overwrite  
Disk Where You Want to Install.....hdisk0

>>> Choice [0]: 1

3. Type 1 for New and Complete Overwrite in the **Choice** field and press Enter. The Change Disk(s) Where You Want to Install screen now displays.

Change Disk(s) Where You Want to Install

Type one or more numbers for the disk(s) to be used for installation and press Enter. To cancel a choice, type the corresponding number and Press Enter.  
At least one bootable disk must be selected. The current choice is indicated by >>>.

	Name	Location Code	Size(MB)	VG Status	Bootable
1	hdisk0	04-B0-00-2,0	4296	none	Yes
2	hdisk1	04-B0-00-5,0	4296	none	Yes
3	hdisk2	04-B0-00-6,0	12288	none	Yes

>>> 0 Continue with choices indicated above

66 Disks not known to Base Operating System Installation  
77 Display More Disk Information  
88 Help ?  
99 Previous Menu

>>> Choice [0]:

4. In the Change Disk(s) Where You Want to Install screen:
  - a. Select hdisk0 by typing a 1 in the **Choice** field and press Enter. The disk will now be selected as indicated by >>>. To unselect the destination disk, type the number again and press Enter.
  - b. To finish selecting disks, type a 0 in the **Choice** field and press Enter. The Installation and Settings screen displays with the selected disks listed under System Settings.
5. Change the Primary Language Environment Settings to English (United States). Use the following steps to change the Cultural Convention, Language, and Keyboard to English.
  - a. Type 2 in the **Choice** field on the Installation and Settings screen to select the **Primary Language Environment Settings** option.
  - b. Type the number corresponding to English (United States) as the Cultural Convention in the **Choice** field and press Enter.
  - c. Select the appropriate keyboard and language options.

RDS 03/2005 - CN -  
CPMI - CORREIOS  
0625  
Fls. N°  
Doc 3684





You do not need to select the **More Options** selection, because you are using the default options in this scenario. For more information about the installation options available in AIX 5.2, see Chapter 4, "Installation Options", on page 37.

6. Verify that the selections are correct in the Overwrite Installation Summary screen, as follows:

```
Overwrite Installation Summary

Disks: hdisk0
Cultural Convention: en_US
Language: en_US
Keyboard: en_US
64 Bit Kernel Enabled: No
JFS2 File Systems Created: No
Desktop: CDE
Enable System Backups to install any system: Yes

Optional Software being installed:

>>> 1 Continue with Install
      88 Help ?
      99 Previous Menu

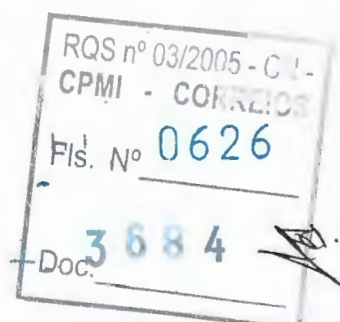
>>> Choice [1]:
```

7. Press Enter to begin the BOS installation. The system automatically reboots after installation is complete.

#### Step 4. Configure the System after Installation

1. On systems with a graphics display, after a new and complete overwrite installation, the Configuration Assistant opens. On systems with an ASCII display, after a new and complete overwrite installation, the Installation Assistant opens.
2. Select the **Accept Licenses** option to accept the electronic licenses for the operating system.
3. Set the date and time, set the password for the administrator (root user), and configure network communications (TCP/IP).  
Use any other options at this time. You can return to the Configuration Assistant or the Installation Assistant by typing **configassist** or **smitty assist** at the command line.
4. Select **Exit the Configuration Assistant** and select **Next**. Or, press F10 (or ESC+0) to exit the Installation Assistant.
5. If you are in the Configuration Assistant, select **Finish now, and do not start Configuration Assistant when restarting AIX** and select **Finish**.

At this point, the BOS Installation is complete, and the initial configuration of the system is complete.







## Perform a Migration Base Operating System Installation from CD

Using this scenario, you can migrate a system from AIX 4.3.3 (or earlier) to AIX 5.2. In this scenario, you will do the following:

- Perform a migration installation of AIX 4.3.3 to AIX 5.2
- Use English as the primary language
- Use the default options in the Advanced Options menu

If you are overwriting an existing system, gather the TCP/IP information before you begin this scenario.

**Attention:** This procedure requires shutting down and reinstalling the base operating system. Whenever you reinstall any operating system, schedule your downtime when it least impacts your workload to protect yourself from a possible loss of data or functionality. Before you perform a migration installation, ensure you have reliable backups of your data and any customized applications or volume groups. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.

The following steps show you how to use the system's built-in CD-ROM device to perform a migration base operating system installation.

### Step 1. Prepare for the Migration

Before starting the migration, complete the following prerequisites:

- Ensure that the root user has a primary authentication method of SYSTEM. You can check this condition by typing the following command:  

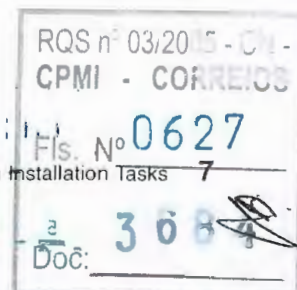
```
# lsuser -a auth1 root
```

  
If needed, change the value by typing the following command:  

```
# chuser auth1=SYSTEM root
```
- Before you begin the installation, other users who have access to your system must be logged off.
- Verify that your applications will run on AIX 5.2. Also, check if your applications are binary-compatible with AIX 5.2. If your system is an application server, verify that there are no licensing issues. Refer to your application documentation or provider to verify on which levels of AIX your applications are supported and licensed. You can also check the *AIX application availability guide* at the following Web address: <http://www-1.ibm.com/servers/aix/products/ibmsw/list/>
- Verify that all currently installed software is correctly entered in the Software Vital Product Database (SWVPD), by using the **lppchk** command. To verify that all filesets have all required requisites and are completely installed, type the following:  

```
# lppchk -v
```
- Check that your hardware microcode is up-to-date.
- All requisite hardware, including any external devices (such as tape drives or CD/DVD-ROM drives), must be physically connected and powered on. If you need further information, refer to the hardware documentation that accompanied your system.
- Use the **errpt** command to generate an error report from entries in the system error log. To display a complete detailed report, type the following:  

```
# errpt -a
```
- There must be adequate disk space and memory available. AIX 5.2 requires 128 MB of memory and 2.2 GB of physical disk space. For additional release information, see the *AIX 5.2 Release Notes*.
- Make a backup copy of your system software and data. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.





## Step 2. Boot from the AIX Product CD

1. If they are not already on, turn on your attached devices.
2. Insert the *AIX Volume 1* CD into the CD-ROM device.
3. Reboot the system by typing the following command:  
# shutdown -r
4. When the system beeps twice, press F5 on the keyboard (or 5 on an ASCII terminal). If you have a graphics display, you will see the keyboard icon on the screen when the beeps occur. If you have an ASCII terminal (also called a tty terminal), you will see the word keyboard when the beeps occur.

**Note:** If your system does not boot using the F5 key (or the 5 key on an ASCII terminal), refer to your hardware documentation for information about how to boot your system from an AIX product CD.

5. Select the system console by pressing F1 (or 1 on an ASCII terminal) and press Enter.
6. Select the English language for the BOS Installation menus by typing a 1 at the **Choice** field and press Enter. The Welcome to Base Operating System Installation and Maintenance menu opens.
7. Type 2 to select **2 Change/Show Installation Settings and Install** in the **Choice** field and press Enter.

```
                Welcome to Base Operating System
                Installation and Maintenance

Type the number of your choice and press Enter. Choice is indicated by >>>.

  1 Start Install Now with Default Settings

  2 Change/Show Installation Settings and Install

  3 Start Maintenance Mode for System Recovery

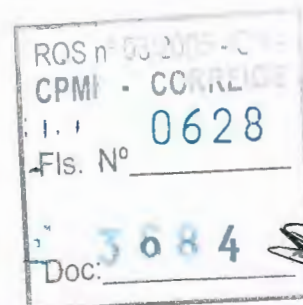
88 Help ?
99 Previous Menu
>>> Choice [1]: 2
```

## Step 3. Verify Migration Installation Settings and Begin Installation

1. Verify that migration is the method of installation. If migration is not the method of installation, select it now. Select the disk or disks you want to install.

```
1 System Settings:
  Method of Installation.....Migration
  Disk Where You Want to Install.....hdisk0
```

2. Select **Primary Language Environment Settings (AFTER Install)**.
3. Type 3 and press Enter to select **More Options**. To use the Help menu to learn more about the options available during a migration installation, type 88 and press Enter in the Installation Options menu. For more information about the installation options available in AIX 5.2, see Chapter 4, "Installation Options", on page 37.
4. Verify the selections in the Migration Installation Summary screen and press Enter.
5. When the Migration Confirmation menu displays, follow the menu instructions to list system information or continue with the migration by typing 0 and pressing Enter.







#### Migration Confirmation

Either type 0 and press Enter to continue the installation, or type the number of your choice and press Enter.

- 1 List the saved Base System configuration files which will not be merged into the system. These files are saved in /tmp/bos.
- 2 List the filesets which will be removed and not replaced.
- 3 List directories which will have all current contents removed.
- 4 Reboot without migrating.

Acceptance of license agreements is required before using system.  
You will be prompted to accept after the system reboots.

>>> 0 Continue with the migration.  
88 Help ?

+-----+  
WARNING: Selected files, directories, and filesets (installable options)  
from the Base System will be removed. Choose 2 or 3 for more information.

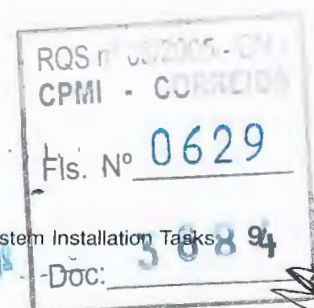
>>> Choice[0]:

### Step 4. Verify System Configuration after Installation

After the migration is complete, the system will reboot. Verify the system configuration, as follows:

1. On systems with a graphics display, after a migration installation, the Configuration Assistant opens.  
On systems with an ASCII display, after a migration installation, the Installation Assistant opens.  
For more information on the Configuration Assistant or the Installation Assistant, see Chapter 7, "Configuring the Operating System", on page 53.
2. Select the **Accept Licenses** option to accept the electronic licenses for the operating system.
3. Verify the administrator (root user) password and network communications (TCP/IP) information.  
Use any other options at this time. You can return to the Configuration Assistant or the Installation Assistant by typing **configassist** or **smitty assist** at the command line.
4. Select **Exit the Configuration Assistant** and select **Next**. Or, press F10 (or ESC+0) to exit the Installation Assistant.
5. If you are in the Configuration Assistant, select **Finish now, and do not start Configuration Assistant when restarting AIX** and select **Finish**.

When the login prompt displays, log in as the root user to perform system administration tasks.







## Perform a Non-Prompted New and Complete Overwrite Base Operating System Installation from CD

Using this scenario, you can perform a non-prompted new and complete overwrite base operating system installation from CD. The first time you install, the base operating system (BOS) installation program presents menus from which you must choose setup options.

For subsequent installations, you can change many aspects of the default BOS installation program by editing the **bosinst.data** file. The **bosinst.data** file directs the actions of the BOS installation program. The file resides in the **/var/adm/ras** directory on the installed machine only, and it is not accessible on the commercial tape or the CD on which you received AIX 5.2.

Also, the **bosinst.data** file can be used to replicate one set of installation settings on other machines. For example, system administrators can create a **bosinst.data** file with settings that can be used to install all the machines they support that have the same configuration.

In this scenario, you will create a **bosinst.data** file that will not prompt the user during the BOS installation menus.

In this scenario, you will do the following:

- Create a customized **bosinst.data** file
- Create a supplementary diskette
- Boot from the AIX product CD

If you are overwriting an existing system, gather the TCP/IP information from the system before you begin this scenario.

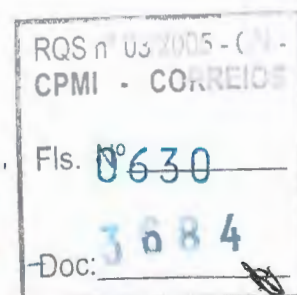
**Attention:** This procedure requires shutting down and reinstalling the base operating system. Whenever you reinstall any operating system, schedule your downtime when it least impacts your workload to protect yourself from a possible loss of data or functionality. Before you perform a new and complete overwrite installation, ensure you have reliable backups of your data and any customized applications or volume groups. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.

### Create a Customized **bosinst.data** File

1. Use the **cd** command to change your directory to the **/var/adm/ras** directory.
2. Copy the **/var/adm/ras/bosinst.data** file to a new name, such as **bosinst.data.orig**. This step preserves the original **bosinst.data** file.
3. Edit the **bosinst.data** file with an ASCII editor as follows:

**Note:** The following example includes automatic acceptance of Software License Agreements.

```
control_flow:
  CONSOLE = /dev/lft0
  INSTALL_METHOD = overwrite
  PROMPT = no
  EXISTING_SYSTEM_OVERWRITE = yes
  INSTALL_X_IF_ADAPTER = yes
  RUN_STARTUP = yes
  RM_INST_ROOTS = no
  ERROR_EXIT =
  CUSTOMIZATION_FILE =
  TCB =
  INSTALL_TYPE = full
  BUNDLES =
  SWITCH_TO_PRODUCT_TAPE = no
  RECOVER_DEVICES = yes
```





```
BOSINST_DEBUG = no
ACCEPT_LICENSES = yes
INSTALL_64BIT_KERNEL =
INSTALL_CONFIGURATION =
DESKTOP = CDE
```

```
target_disk_data:
  LOCATION =
  SIZE_MB =
  HDISKNAME = hdisk0
```

```
locale
  BOSINST_LANG = en_US
  CULTURAL_CONVENTION = en_US
  MESSAGES = C
  KEYBOARD = en_US
```

4. Verify the contents of the edited **bosinst.data** file using the **bicheck** command:  
`/usr/lpp/bosinst/bicheck bosinst.data`
5. Copy the edited file to the root directory:  
`cp /var/adm/ras/bosinst.data /bosinst.data`

## Create a Supplementary Diskette

1. Create an ASCII file consisting of one word:  
`data`
2. Save the new ASCII file, naming it **signature**.
3. Copy the **signature** file to the root directory.
4. Create the supplementary diskette and use it for installation:  
Back up the edited **bosinst.data** file and the new **signature** file to the diskette with the following command:  
`ls ./bosinst.data ./signature | backup -iqv`

**Note:** Make sure you back up the files to the diskette relative to the root path.

## Boot from the AIX Product CD

1. Insert the diskette in the diskette drive of the target machine you are installing.
2. Insert the **AIX Volume 1** CD in the CD-ROM drive.
3. Boot the system.

The BOS installation program uses the customized **bosinst.data** file on the diskette, rather than the default **bosinst.data** file shipped with the installation media to answer the questions in the BOS menus. If you filled in the values correctly in the **bosinst.data** file, the BOS installation will begin. If the BOS installation program detects an error with a value in the **bosinst.data** file, the BOS menus will display with a message explaining what information needs to be corrected.

RQS n 072075 - 001
CPMI - CONSTRUCTION
Fls. N° 0631
3684
Doc: _____





## Create and Install a Software Bundle

Using this scenario, you can create a user-defined software bundle and install its contents. A user-defined software bundle is a text file ending in **.bnd** that is located in the **/usr/sys/inst.data/user\_bundles** path. By creating the software bundle file in the **/usr/sys/inst.data/user\_bundles** path, SMIT (System Management Interface Tool) can locate the file and display it in the bundle selection screen.

In this scenario, you will do the following:

- Create a user-defined software bundle that contains Netscape Communicator - U.S. Version, the HTTP Server Base Run-Time, and the Web-based System Manager Security application, which are located on the Expansion Pack
- Install the software bundle
- Verify the installation of the software bundle was successful

It is recommended that you first perform a system backup to ensure safe system recovery. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.

The following procedure shows you how to create a software bundle and install its contents.

### Step 1. Create a User-Defined Software Bundle

1. Create a text file with the extension **.bnd** in the **/usr/sys/inst.data/user\_bundles** path by running the following:

```
# vi /usr/sys/inst.data/user_bundles/MyBundle.bnd
```

2. Add the software products, packages, or filesets to the bundle file with one entry per line. Add a format-type prefix to each entry. For this example, we are dealing with AIX installp packages, so the format-type prefix is **I:**. Type the following in the *MyBundle.bnd* file:

```
I:Netscape.communicator
I:http_server.base
I:sysmgmt.websm.security
```

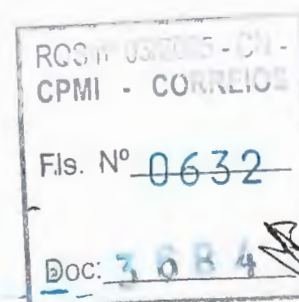
For more information on installation format types, see Chapter 14, "Software Product Packaging Concepts", on page 139.

3. Save the software bundle file and exit the text editor.

### Step 2. Install the Software Bundle

1. Type the following at the command line:  

```
# smitty easy_install
```
2. Enter the name of the installation device or directory.
3. From the selection screen, select the name of the user-defined software bundle, *MyBundle*, you created.





```

Install Software Bundle

Type or select a value for the entry field.
Press Enter AFTER making all desired changes.
+-----+
|               Select a Fileset Bundle               |
|Move cursor to desired item and press Enter.         |
|                                                       |
|App-Dev                                               |
|CDE                                                    |
|GNOME                                                  |
|KDE                                                    |
|Media-Defined                                         |
|MyBundle                                              |
|...                                                    |
|...                                                    |
|                                                       |
|F1=Help        F2=Refresh        F3=Cancel          |
|F8=Image       F10=Exit           Enter=Do           |
|/=Find         n=Find Next       |
+-----+

```

4. Change the values provided in the Install Software Bundle screen as appropriate to your situation. You can change the **PREVIEW only?** option to yes to preview the installation of your software bundle before you install it. You might also need to **accept new license agreements** if the software in your bundle has an electronic license.

```

                                Install Software Bundle

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* INPUT device / directory for software      /cdrom
* BUNDLE                                     MyBundle      +
* SOFTWARE to install                       [all]          +
  PREVIEW only? (install operation will NOT occur) no/yes      +
  COMMIT software updates?                  yes           +
  SAVE replaced files?                      no            +
  AUTOMATICALLY install requisite software? yes           +
  EXTEND file systems if space needed?      yes           +
  VERIFY install and check file sizes?      no            +
  Include corresponding LANGUAGE filesets?  yes           +
  DETAILED output?                          no            +
  Process multiple volumes?                 yes           +
  ACCEPT new license agreements?            no/yes          +
  Preview new LICENSE agreements?           no            +

F1=Help      F2=Refresh      F3=Cancel      F4=List
Esc+5=Reset  F6=Command      F7=Edit       F8=Image
F9=Shell     F10=Exit        Enter=Do

```

5. Press Enter to continue. Press Enter a second time to confirm your decision and begin the installation of your software bundle.
6. Check the installation summary at the end of the installation output by scrolling to the end of the output. The output indicates whether the installation of your user-defined software bundle was successful.

### Step 3. Verify the Installation of the Software Bundle

- Check the installation summary at the end of the installation output by scrolling to the end of the output. The output indicates whether the installation of your user-defined software bundle was successful, you may see output similar to the following:



Summaries:

Installation Summary

Name	Level	Part	Event	Result
sysmgt.websm.security	5.1.0.0	USR	APPLY	SUCCESS
sysmgt.websm.security	5.1.0.0	ROOT	APPLY	SUCCESS
http_server.base.source	1.3.12.2	USR	APPLY	SUCCESS
http_server.base.rte	1.3.12.2	USR	APPLY	SUCCESS
http_server.base.rte	1.3.12.2	ROOT	APPLY	SUCCESS
Netscape.communicator.com	4.7.6.1	USR	APPLY	SUCCESS
Netscape.communicator.us	4.7.6.1	USR	APPLY	SUCCESS
Netscape.communicator.com	4.7.6.1	ROOT	APPLY	SUCCESS
Netscape.msg.en_US.communic	4.7.6.1	USR	APPLY	SUCCESS

RQS n° 03 2005 - 01  
CPMI - CCN 00000000  
Fls. N° 0634

Doc: 3684





## Add Open Source Applications to Your AIX System

The *AIX Toolbox for Linux Applications* CD that is shipped with your base operating system software contains the most commonly used open source applications that you can use with the AIX operating system. Your options for installing from this CD include:

- Using the SMIT **install\_software** fast path to install **RPM** packages from the *AIX Toolbox for Linux Applications* CD.
- Using the **geninstall** command to install RPM packages from the *AIX Toolbox for Linux Applications* CD.
- Installing a bundle. Bundles group the applications you need for a basic Linux operating environment, basic desktop use, GNOME or KDE desktop use, or application development.
- Installing from a directory of packages classified by function. These directory groupings cover a broad range of applications, shell environments, network applications, development tools, application libraries, and so on.
- Installing a single package for a particular application.

The following procedures provide examples of installing RPM packages from *AIX Toolbox for Linux Applications* CD.

- To install the **cdrecord** and **mttools** RPM packages using SMIT, do the following:
  1. Run the SMIT **install\_software** fast path.
  2. Enter the device name for the *AIX Toolbox for Linux Applications* CD (for example, `/dev/cd0`), and press Enter.
  3. Use the F4 key to list the contents of the device.
  4. Select the **cdrecord** and **mttools** packages, and press Enter.
  5. Accept the default values for the rest of the Install Software menu fields, and press Enter.
  6. Confirm that you do want to install the software, and press Enter.

The software installation process begins at this point.

- To install the **cdrecord** and **mttools** RPM packages from the command line, type the following:  

```
# geninstall -d/dev/cd0 R:cdrecord R:mttools
```

The software installation process begins at this point.

- Use the **rpm** command, which is automatically installed with the base operating system for AIX 5.1 and later versions, to install the bundles required for the GNOME desktop and the **bc** application package. Complete instructions are available on the README file of the *AIX Toolbox for Linux Applications for POWER Systems* CD.

1. With your system powered on and AIX 5.1 or a later version running, insert the *AIX Toolbox for Linux Applications for POWER Systems* CD into the CD-ROM drive of your system.
2. With root authority, mount the CD-ROM drive using the following command:  

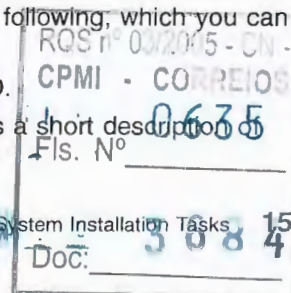
```
mount -v cdrfs -oro /dev/cd0 /mnt
```

The **-v** flag specifies the virtual file system type of **cdrfs**. The **-o** flag specifies the **ro** option, which means the mounted file is read-only. The device name is `/dev/cd0`. The directory in which you want to mount the CD-ROM is `/mnt`.

3. Change to the `/mnt` directory by using the following command:  

```
cd /mnt
```

4. Use the **ls** command to list the contents of the CD. The listing contains the following, which you can view or print:
  - The **readme** file contains complete instructions for installing from this CD.
  - The **CONTENTS** file lists all packages available on this CD and provides a short description of the purpose for each package.







5. In your Web browser, open the `/mnt/LICENSES/index.html` file to view software licensing information.
6. In your terminal window, change to the `ezinstall/ppc` directory by using the following command:  
`cd /mnt/ezinstall/ppc`

In the next step, you use the **rpm** program to install GNOME by installing four bundles (Base, Desktop Base, GNOME Base, and GNOME Apps). Alternatively, you can install all necessary packages using the **smit install\_bundle** fast path and selecting the GNOME bundle.

7. Install GNOME by using the following sequence of commands:

```
rpm -Uhv ezinstall/ppc/base/*
rpm -Uhv ezinstall/ppc/desktop.base/*
rpm -Uhv ezinstall/ppc/gnome.base/*
rpm -Uhv ezinstall/ppc/gnome.apps/*
```

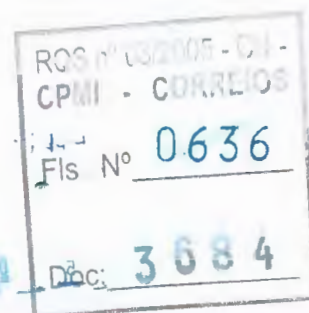
The **-U** flag updates any earlier versions of each package that you might have on your system. The **-h** flag prints hash marks (#) at timed intervals to indicate that the installation is progressing. The **-v** flag displays relevant informational or error messages that occur during the installation. Your result will look similar to the following:

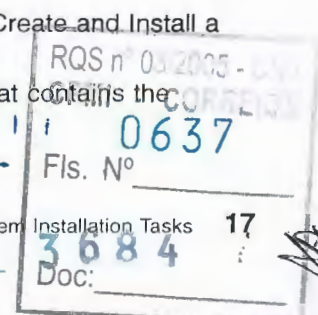
```
rpm -Uhv ezinstall/ppc/desktop.base/*
gdbm          #####
libjpeg       #####
libpng        #####
libtiff       #####
libungif      #####
readline      #####
zlib          #####
```

If your **rpm** command returns an error, it is probably caused by one of the following:

- Not enough space in your current file system. Resize the file system or change your mount point.
- Package is already installed. The **rpm** program discovered an existing package of the same name and version level, so it did not replace the package. A script on the CD installs only those packages from a directory that are not already installed on your system, as shown in the following example:  
`/mnt/contrib/installmissing.sh ezinstall/ppc/desktop.base/*`
- Failed dependencies. The packages listed in the error message must be installed before you can install this package or bundle.

8. Install the **bc** application package by using the following command:  
`rpm -Uhv RPMS/ppc/bc-*.rpm`









```
mkuser johndoe
touch /home/johndoe/abc.txt
touch /home/johndoe/xyz.txt
```

## Step 2. Perform the Alternate Disk Installation and Customization

1. To clone the **rootvg** to an alternate disk, type the following at the command line to open the SMIT menu :

```
# smit alt_clone
```

2. Select **hdisk1** in the **Target Disk to Install** field.
3. Select the **MyBundle** bundle in the **Bundle to Install** field.
4. Type **/dev/cd0** in the **Directory or Device with images** field.
5. Type **/home/scripts/AddUsers.sh** in the **Customization script** field.
6. Press Enter to start the alternate disk installation.
7. Check that the alternate disk was created, by running the following:

```
# lspv
```

Output similar to the following displays:

```
hdisk0      0009710fa9c79877    rootvg
hdisk1      0009710f0b90db93    altinst_rootvg
```

## Step 3. Boot from the Alternate Disk

1. By default, the alternate-disk-installation process changes the bootlist to the alternate disk. To check this run the following:

```
# bootlist -m normal -o
```

Output similar to the following displays:

```
hdisk1
```

2. Reboot the system. Type:

```
# shutdown -r
```

The system boots from the boot image on the alternate disk (hdisk1).

## Step 4. Verify the Operation

1. When the system reboots, it will be running off the alternate disk. To check this, type the following:

```
# lspv
```

Output similar to the following displays:

```
hdisk0      0009710fa9c79877    old_rootvg
hdisk1      0009710f0b90db93    rootvg
```

2. Verify that the customization script ran correctly, by typing the following:

```
# find /home/johndoe -print
```

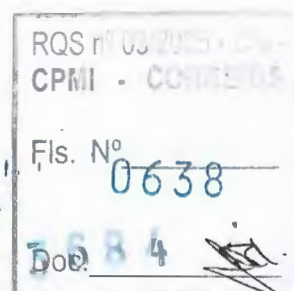
Output similar to the following displays:

```
/home/johndoe
/home/johndoe/.profile
/home/johndoe/abc.txt
/home/johndoe/xyz.txt
```

3. Verify that the contents of your software bundle was installed, by typing the following:

```
# lsipp -L bos.games bos.content_list
```

Output similar to the following displays:

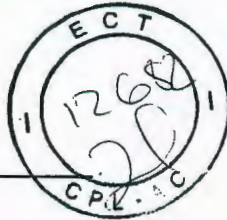






Fileset	Level	State	Description
bos.content_list	5.2.0.0	C	AIX Release Content List
bos.games	5.2.0.0	C	Games

RGS nº 05/2015 - CN -  
CPMI - CORREIOS  
Fls.º N° 0639  
Doc: 3684



## Configure NIM Using EZNIM

Using this scenario, you will use the SMIT EZNIM option to configure the NIM environment for the first time. The SMIT EZNIM option installs the **bos.sysmgt.nim.master** fileset and configures the NIM environment. The configuration involves creating the NIM database and populating it with several default entries. Several basic NIM resources will then be created and defined in the NIM database.

1. Type the following:  
# smitty eznim
2. Select **Configure as a NIM Master**, and press Enter.
3. Select **Setup the NIM Master Environment**, and press Enter.
4. Verify that the default selections for software source, volume group, and file system are correct for your environment. Change the selections, if needed.
5. Press Enter to begin configuring the NIM environment.
6. To display the NIM resources that have been created, do the following:
  - a. Use the SMIT **eznim\_master\_panel** fast path to open the EZNIM Master menu.
  - b. Select **Show the NIM environment**, and press Enter.

RCIS n° 01/2015
CPMI - COMISSÃO
Fls. N° 0640
3684
Doc.





## Install a Client Using NIM

Using this scenario, you can perform a new and complete BOS (base operating system) installation on a NIM client. It is assumed that you have already configured the NIM master, defined the basic NIM resources, and defined the NIM client you want to install.

For a guide on configuring the NIM environment and defining resources, see Chapter 18, "NIM Task Roadmap", on page 169.

In this scenario, you will do the following:

1. Perform an BOS (**rte**) installation.
2. Use a **bosinst\_data** resource to perform a nonprompted installation. For information on how to create a **bosinst.data** file for nonprompted installation, see "bosinst.data File Example" on page 68.
3. Use a **resolv\_conf** resource to configure the network nameserver and domain.

It is recommended that you first perform a system backup on the client to ensure safe system recovery. For instructions on how to create a system backup, see "Creating System Backups" on page 113.

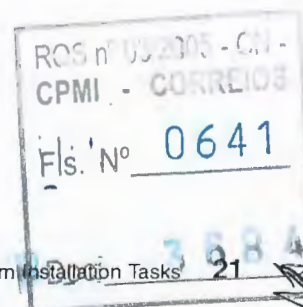
1. Type the following:  

```
# smit nim_bosinst
```
2. Select a target for the BOS installation operation.
3. Select **rte** installation for the installation type.
4. Select the **lpp\_source** resource for the BOS installation.
5. Select the **SPOT** resource for the BOS installation.
6. Select the **BOSINST\_DATA to use during installation** option, and select a **bosinst\_data** resource that is capable of performing a nonprompted BOS installation.
7. Select the **RESOLV\_CONF to use for network configuration** option, and select a **resolv\_conf** resource.
8. Select the **Accept New License Agreements** option, and select **Yes**.
9. Accept the default values for the remaining menu options.
10. Press Enter to confirm and begin the NIM client installation.
11. To check the status of the NIM client installation, type:  

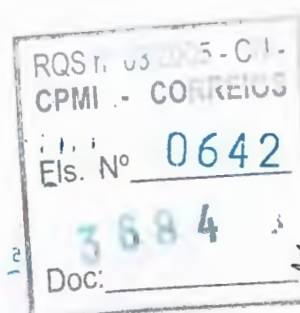
```
# lsnim -l va09
```

Output similar to the following displays:

```
va09:
class      = machines
type       = standalone
default_res = basic_res_grp
platform   = chrp
netboot_kernel = up
if1        = master_net va09 0
cable_type1 = bnc
Cstate     = Base Operating System installation is being performed
prev_state = BOS installation has been enabled
Mstate     = in the process of booting
info       = BOS install 7% complete : 0% of operations completed.
boot       = boot
bosinst_data = bid_tty_ow
lpp_source  = 520lpp_res
nim_script  = nim_script
resolv_conf = master_net_conf
```



spot = 520spot\_res  
cpuid = 0009710F4C00  
control = master  
Cstate\_result = success







## Create a System Backup to Tape

Using this scenario, you can create and verify a bootable system backup, also known as a *root volume group backup* or *mksysb image*.

### Step 1. Prepare for System Backup Creation

Before creating system backups, complete the following prerequisites:

- Be sure you are logged in as root user.
- If you plan to use a backup image for installing other differently configured target systems, you must create the image *before* configuring the source system, or set the RECOVER\_DEVICES variable to no in the **bosinst.data** file. For more information about the **bosinst.data** file, refer to The **bosinst.data** File in the *AIX 5L Version 5.2 Installation Guide and Reference*.
- Consider altering passwords and network addresses if you use a backup to make master copies of a source system. Copying passwords from the source to a target system can create security problems. Also, if network addresses are copied to a target system, duplicate addresses can disrupt network communications.
- Mount all file systems you want to back up. The **mksysb** command backs up only mounted JFS (journaled file systems) in the **rootvg**. To back up file systems, use the **mount** command.

**Note:** The **mksysb** command does not back up file systems mounted across an NFS network.

- Unmount any local directories that are mounted over another local directory.

**Note:** This backup procedure backs up files twice if a local directory is mounted over another local directory in the same file system. For example, if you mount **/tmp** over **/usr/tmp**, the files in the **/tmp** directory are then backed up twice. This duplication might exceed the number of files that a file system can hold, which can cause a future installation of the backup image to fail.

- Use the **/etc/exclude.rootvg** file to list files you do not want backed up.
- Make at least 8.8 MB of free disk space available in the **/tmp** directory. The **mksysb** command requires this working space for the duration of the backup.

Use the **df** command, which reports in units of 512-byte blocks, to determine the free space in the **/tmp** directory. Use the **chfs** command to change the size of the file system, if necessary.

For example, the following command adds 12 MB of disk space to the **/tmp** directory of a system with 4 MB partitions:

```
# chfs -a size=+24000 /tmp
```

- All hardware must already be installed, including external devices, such as tape and CD-ROM drives.
- The **bos.sysmgt.sysbr** fileset must be installed. The **bos.sysmgt.sysbr** fileset is automatically installed in AIX 5.2. To determine if the **bos.sysmgt.sysbr** fileset is installed on your system, type:

```
# ls1pp -l bos.sysmgt.sysbr
```

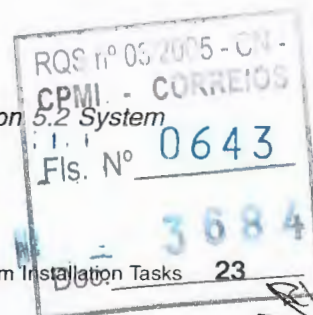
If the **ls1pp** command does not list the **bos.sysmgt.sysbr** fileset, install it before continuing with the backup procedure. Type the following:

```
# installp -agqXd /dev/cd0 bos.sysmgt.sysbr
```

### Step 2. Create a System Backup to Tape

1. Enter the **smit mksysb** fast path.
2. Select the tape device in the **Backup DEVICE** or **File** field.
3. If you want to create map files, select **yes** in the **Create Map Files?** field.

For more information, see Using Map Files for Precise Allocation in *AIX 5L Version 5.2 System Management Concepts: Operating System and Devices*.

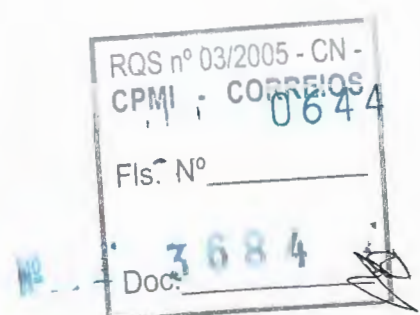




**Note:** If you plan to reinstall the backup to target systems other than the source system, or if the disk configuration of the source system might change before reinstalling the backup, do not create map files.

4. To exclude certain files from the backup, select **yes** in the **Exclude Files** field.  
For more information, see *Excluding Files in System Backups in AIX 5L Version 5.2 Installation Guide and Reference*.
5. Select **yes** in the **List files as they are backed up** field.
6. Use the default values for the rest of the menu options.
7. Press Enter to confirm and begin the system backup process.
8. The **COMMAND STATUS** screen displays, showing status messages while the system makes the backup image. When the backup process finishes, the **COMMAND:** field changes to **OK**.
9. To exit SMIT when the backup completes, press F10 (or Esc+0).
10. Remove the tape and label it. Write-protect the backup tape.
11. Record any backed-up root and user passwords. Remember that these passwords become active if you use the backup to either restore this system or install another system.

You have successfully created the backup of your **rootvg**. Because the system backup contains a boot image, you can use this tape to start your system if for some reason you cannot boot from hard disks.







## Clone a System Using a System Backup Tape

With a **mksysb** image, you can clone one system image onto multiple target systems. The target systems might not contain the same hardware devices or adapters, require the same kernel (uniprocessor or microprocessor), or be the same hardware platform as the source system.

Beginning in AIX 5.2, all devices and kernel support are installed by default during the base operating system (BOS) installation process. If the **Enable System Backups to install any system** selection in the Install Software menu is set to **yes**, you can create a **mksysb** image that boots and installs supported systems. Verify that your system is installed with all devices and kernel support, by typing the following:

```
# grep ALL_DEVICES_KERNELS /var/adm/ras/bosinst.data
```

Output similar to the following displays:

```
ALL_DEVICES_KERNELS = yes
```

Use this scenario if your system was not installed with all devices and kernel support during BOS installation. Be sure to boot from the appropriate product media for your system and at the same maintenance level of BOS (base operating system) as the installed source system on which the **mksysb** was made. For example, use BOS AIX 5.2 media with a **mksysb** from a BOS AIX 5.2 system. Use this how-to when installing a system backup tape to a different system.

In this scenario, you will do the following:

1. Boot the system with the *AIX Volume 1* CD in the CD-ROM drive and the system backup tape in the tape device.
2. Select **Start Maintenance Mode for System Recovery**.
3. Select **Install from a System Backup**.
4. Select the drive containing the backup tape, and press Enter.

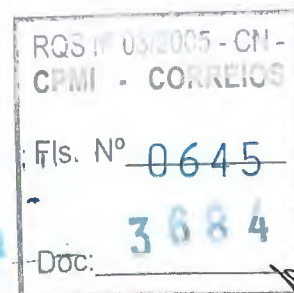
The system reads the media and begins the installation.

You are then prompted for the BOS installation language, and the Welcome screen displays. Continue with the Prompted Installation, because cloning is not supported in nonprompted installations.

If you are cloning from the product CD to restore a backup tape, do not remove the CD from the CD-ROM drive.

After the **mksysb** installation completes, the installation program automatically installs additional devices and the kernel (uniprocessor or microprocessor) on your system, using the original product media you booted from. Information is saved in BOS installation log files. To view BOS installation log files, type `cd /var/adm/ras` and view the **devinst.log** file in this directory.

If the source system does not have the correct passwords and network information, you can make modifications on the target system now. Also, some products (such as graPHIGS) ship device-specific files. If your graphics adapter is different on the target system, verify that the device-specific filesets for graphics-related LPPs are installed.





## Clean Up a Failed Software Installation

Using this scenario, you can clean up software products and service updates after an interrupted or failed installation. The cleanup procedure attempts to delete items that were partially installed or left in an incomplete state. This scenario applies only to the update or installation of optional software products. If your AIX 5.2 BOS installation was unsuccessful, see Chapter 15, "Troubleshooting Operating System and Optional Software Installation", on page 143.

**Note:** It is recommended that you first perform a system backup before installing software updates to ensure safe system recovery. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.

The cleanup procedure attempts to revert the update to its previous state. For example, when cleaning up an update that was interrupted in the **COMMITTING** state, the cleanup procedure attempts to return the update to its **APPLIED** state.

If an update installation is interrupted, run the **lsipp -l** command to see the current state of the update. For example, if you run **lsipp -l** on an interrupted update installation, it might report the update status as **APPLYING** rather than **APPLIED**.

If the interruption occurs during the initial state of an installation, then the cleanup procedure attempts to delete the installation entirely and restore the previous version of the product (if there is one). When the previous version is restored, it becomes the active version. When the previous version cannot be restored, the software is listed by the **lsipp -l** command as **BROKEN**.

When the product is deleted or **BROKEN**, you can attempt to reinstall the software. Any product in the **BROKEN** state cannot be cleaned up; it can only be reinstalled or removed.

### To initiate a cleanup procedure using SMIT:

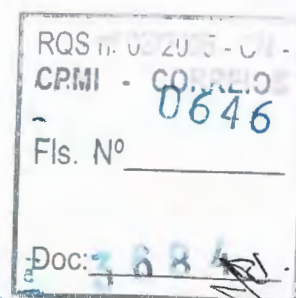
1. Type `smit maintain_software` on the command line.
2. Select **Clean Up After Failed or Interrupted Installation** and press Enter.

### To initiate a cleanup procedure from the command line:

Type `installp -C` on the command line and press Enter.

If prompted to reboot (restart) the system after running the cleanup procedure, then do so now.

If you get a message indicating that no products were found that could be cleaned up, you may have executed the cleanup procedure when it was not needed. Try your installation again.







## Part 2. Operating System and Optional Software Installation

Part 2 provides information about installing and configuring AIX on a standalone system, regardless of network connectivity. The chapters in this part describe the different base operating system installation methods, including new and complete overwrite installation, migration installation, and preservation installation.

RQS n° 05205-121 -
CPMI - CORRELOS
Fils. N° 0647
-Doc: 2527



RQS n° 03 - 05 - 01 -  
CPMI - CORREIOS  
Fls. N° 0648  
No 3684  
Doc:





## Chapter 2. What's New in Base Operating System Installation and Software Installation?

This chapter gives an overview of the new features in the base operating system (BOS) installation and software installation procedures for AIX 5.2.

### BOS Menus

Installation options are available for you to configure your system during a BOS installation process.

The installation options include the following:

- Desktop selection
- Trusted Computing Base
- Controlled Access Protection Profile (CAPP) and Evaluation Assurance Level 4+ (EAL4+)
- 64-bit kernel enablement
- Enhanced journaled file system (JFS2)
- Graphics software
- Documentation services software
- Installation of all device and kernel filesets

For information about the installation options, see Chapter 4, "Installation Options", on page 37.

### Software Maintenance and Utilities

The Copy Software Bundle to Hard Disk for Future Installation option is available in the SMIT Software Maintenance and Utilities menu.

For information about the SMIT Copy Software Bundle to Hard Disk for Future Installation option, see "Copy Software Bundle to Hard Disk for Future Installation" on page 77.

### Software Service Management

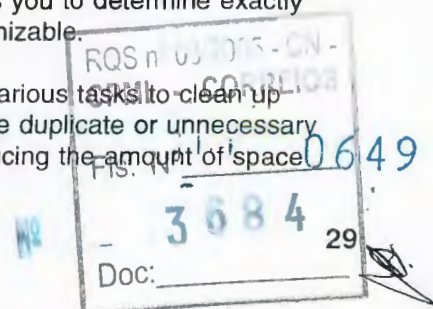
The SMIT Software Service Management menu allows you to manage how you update systems with fixes and preventive maintenance package levels. You can compare levels of different systems against a base system or a base set of fixes. Support is provided through the command line and SMIT to allow you to compare the filesets installed on your standalone system with the contents of an image repository or a service report that is downloaded from the IBM eServer pSeries support Web site.

This option also allows you clean up or rename software images in a repository. The following software maintenance options are available in the SMIT Software Service Management menu and the SMIT Software Maintenance and Utilities menu:

- Rename Software Images in Repository
- Clean Up Software Images in Repository

The Rename Software Images in Repository option allows you to rename software images with the PTF prefix to the fileset names generated by the **bffcreate** command. This allows you to determine exactly what updates are contained in a directory because the fileset name is recognizable.

The Clean Up Software Images in Repository option allows you to perform various tasks to clean up software image directories on standalone systems. This allows you to remove duplicate or unnecessary filesets from image repositories, easing management of the images and reducing the amount of space required to store them.





For information about the SMIT Software Service Management menu, see "Software Service Management" on page 79.

---

## Emergency Fix Management

The emergency fix (efix) management solution allows users to track and manage efixes on a system. The efix management solution consists of: the efix packager (**epkg**) command and the efix manager (**emgr**) command.

The **epkg** command creates efix packages that can be installed by the **emgr** command. The **emgr** command installs and removes efix packages created with the **epkg** command.

The efix management solution provides the following functions:

- Emergency fixes can be packaged in either interactive or template-based modes
- List all of the efixes on a given system
- Install efixes
- Remove efixes
- Force remove efixes
- Verify efixes
- Display efix package locks

For more information about efix management, see "Emergency Fix Management" on page 86.

---

## Alternate Disk Migration Installation

Alternate disk migration installation allows the user to create a copy of **rootvg** to a free disk (or disks) and simultaneously migrate it through Network Installation Management (NIM) to a new release level. Using alternate disk migration installation over a conventional migration provides several advantages:

- Less downtime (the migration is performed while the system is up normally, and there is no need to boot from any media).
- Quick recovery in case of migration failure.
- High degree of flexibility and customization.

For more information about alternate disk migration installation, see "Alternate Disk Migration Installation" on page 133.

---

## Universal Disk Format Support for DVD-RAM

The Universal Disk Format (UDF) allows you to manipulate files directly on the DVD-RAM media. The system backup image is an archived file composed of many files that cannot be manipulated. However, the installation packages and any files that are not contained in the backup image can be directly manipulated on the DVD-RAM. After the DVD is mounted, the files can be changed by using an editor, or new files can be copied to the DVD using the various copy and restore commands (such as the **cp**, **mv**, and **restore** commands).

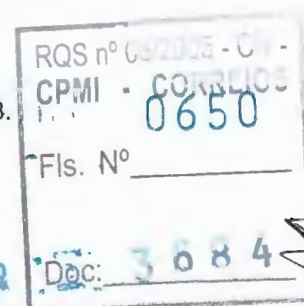
For information about the SMIT Software Service Management menu, see "DVD-RAM and Universal Disk Format" on page 120.

---

## Installation Commands

The following commands have been added to AIX:

- The **ismksysb** command. For further information, see "Backup Options" on page 123.







- The **install\_all\_updates** command. For further information, see "Update Installed Software to Latest Level from the Command Line" on page 74.
- The **lppmgr** command. For further information, see "Manage an Existing installp Image Source" on page 78.
- The **compare\_report** command. For further information, see "Comparison Reports" on page 79.

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## Chapter 3. Introduction to Base Operating System Installation

This chapter provides information about completing an installation of the AIX 5.2 base operating system (BOS).

The BOS installation program first restores the run-time **bos** image, then installs the appropriate filesets, depending on your selections. The installation program automatically installs required message filesets, according to the language you choose.

In the BOS menus, you can also configure the following options:

- Desktop selection
- Trusted Computing Base
- Controlled Access Protection Profile (CAPP) and Evaluation Assurance Level 4+ (EAL4+)
- 64-bit kernel enablement
- Enhanced journaled file system (JFS2)
- Graphics software
- Documentation services software
- Installation of all device and kernel filesets

For more information about the installation options, refer to Chapter 4, "Installation Options", on page 37.

The following installation methods are available on AIX:

### New and Complete Overwrite

This method installs AIX 5.2 on a new machine or completely overwrites any BOS version that exists on your system.

For instructions on installing AIX 5.2 on a new machine or to completely overwrite the BOS on an existing machine, refer to Chapter 5, "New and Complete Overwrite Installation / Preservation Installation", on page 41.

### Preservation

This method replaces an earlier version of the BOS but retains the root volume group, the user-created logical volumes, and the **/home** file system. The system file systems **/usr**, **/var**, **/tmp**, and **/** (root) are overwritten. Product (application) files and configuration data stored in these file systems will be lost. Information stored in other non-system file systems will be preserved.

For instructions on preserving the user-defined structure of an existing BOS, refer to Chapter 5, "New and Complete Overwrite Installation / Preservation Installation", on page 41.

### Migration

This method upgrades from AIX 4.3 or earlier versions of the BOS to AIX 5.2. The migration installation method is used to upgrade from an existing version or release of AIX to a later version or release of AIX. A migration installation preserves most file systems, including the root volume group, logical volumes, and system configuration files. It overwrites the **/tmp** file system.

For instructions on migrating an existing version or release of AIX to a later version or release of AIX, refer to Chapter 6, "Migration Installation", on page 47.

The following table shows the differences in the installation steps among the installation methods.

Table 2. AIX BOS Installation Methods

Installation Steps	New and Complete Overwrite	Preservation	Migration
Create <b>rootvg</b>	Yes	No	No
Create file system <b>/</b> , <b>/usr</b> , <b>/var</b>	Yes	Yes	Yes

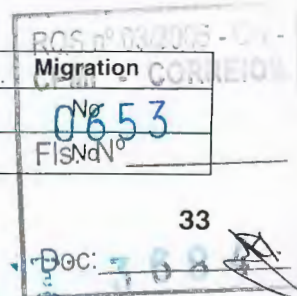




Table 2. AIX BOS Installation Methods (continued)

Installation Steps	New and Complete Overwrite	Preservation	Migration
Create file system /home	Yes	No	No
Save Configuration	No	No	Yes
Restore BOS	Yes	Yes	Yes
Install Additional Filesets	Yes	Yes	Yes
Restore Configuration	No	No	Yes

## BOS Menus

After you select the console and language to be used for the BOS menus, the Welcome to Base Operating System Installation and Maintenance screen displays, as follows:

```

Welcome to Base Operating System
Installation and Maintenance

Type the number of your choice and press Enter. Choice is indicated by >>>.

>>> 1 Start Install Now with Default Settings
    2 Change/Show Installation Settings and Install
    3 Start Maintenance Mode for System Recovery

    88 Help ?
    99 Previous Menu

>>> Choice [1]:
```

**Note:** To turn on the debug mode for the BOS installation process, type 911 in the **Choice** field and press Enter. The Welcome to Base Operating System Installation and Maintenance screen refreshes and the BOS installation process runs in debug mode when the installation occurs. Continue the procedure for selecting options and specifying data until the installation begins. Debug output is sent to the client's display as the installation proceeds.

If you select **Start Install Now with Default Settings**, the BOS command determines the default installation method to use based on your system's configuration. A summary screen displays, similar to the following, where you can confirm the installation method and installation options:

```

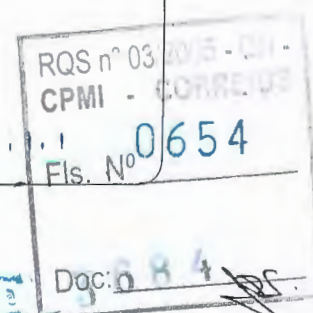
Overwrite Installation Summary

Disks: hdisk0
Cultural Convention: en_US
Language: en_US
Keyboard: en_US
64 Bit Kernel Enabled: No
JFS2 File Systems Created: No
Desktop:
Enable System Backups to install any system: Yes

Optional Software being installed:
HTTP_Server (Expansion Pack)
Kerberos_5 (Expansion Pack)

>>> 1 Continue with Install
    88 Help ?
    99 Previous Menu

>>> Choice [1]:
```







If the selections are correct, press Enter to begin the BOS installation.

However, if you would like to change the installation method or options, select **Change/Show Installation Settings and Install** at the BOS welcome screen. The Installation and Settings screen displays, as follows:

```

      Installation and Settings

Either type 0 and press Enter to install with current settings, or type the
number of the setting you want to change and press Enter.

  1 System Settings:
    Method of Installation.....New and Complete Overwrite
    Disk Where You Want to Install.....hdisk0

  2 Primary Language Environment Settings (AFTER Install):
    Cultural Convention.....English (United States)
    Language .....English (United States)
    Keyboard .....English (United States)
    Keyboard Type.....Default

  3 More Options (Desktop, Security, Kernel, Software, ...)

>>> 0 Install with the current settings listed above.

88 Help ?      +-----+
99 Previous Menu | WARNING: Base Operating System Installation will
                  | destroy or impair recovery of ALL data on the
                  | destination disk hdisk0.
>>> Choice [0]:
```

For more information on the BOS menu options, refer to the Help at any time by typing 88 in the **Choice** field. For conceptual information on the BOS installation procedures, refer to the following sections:

- Chapter 5, "New and Complete Overwrite Installation / Preservation Installation", on page 41
- Chapter 6, "Migration Installation", on page 47

For how-to instructions for performing BOS installations, refer to the following:

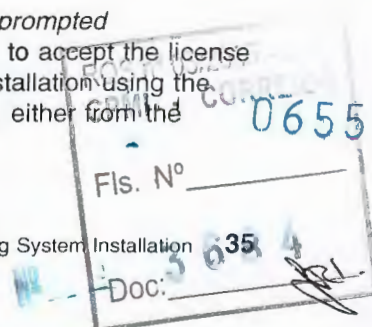
- "Perform a New and Complete Overwrite Base Operating System Installation from CD" on page 3
- "Perform a Migration Base Operating System Installation from CD" on page 7

## Electronic License Agreements

AIX 5.2 ships with software license agreements that can be viewed electronically. If a product has an electronic license agreement, it must be accepted before software installation can continue. In the case of initial BOS installation, you can view and accept or reject license agreements in a license agreement dialog after the installation has occurred, but before the system is available for use as part of Configuration Assistant (graphics consoles) or Installation Assistant (ASCII consoles).

The AIX BOS has a license agreement, but not all software packages do. When you agree to the license agreement for BOS installation, you are also accepting all license agreements for any software installed automatically with the BOS. Some software, such as the GNOME or KDE desktops, can be optionally installed during BOS installation; the appropriate licensing information for such software is displayed separately.

If a customized **bosinst.data** file is used (usually for unattended installations, or *nonprompted installations*), the **ACCEPT\_LICENSES** field in the **control\_flow** stanza can be used to accept the license agreements so users are not prompted at reboot time. When performing a "push" installation using the Network Installation Management (NIM) environment, the licenses must be accepted, either from the

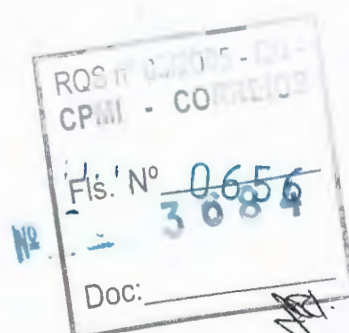




choices made when initializing the installation or in a customized **bosinst.data** file, before the installation can continue. For more information about the **bosinst.data** file, refer to Chapter 9, "The bosinst.data File", on page 61.

For additional software package installations, the installation cannot occur unless the appropriate license agreements are accepted. This option, as well as options to preview licenses, is offered in both the System Management Interface Tool (SMIT) and the Web-based System Manager installation interfaces. When using the **installp** command, use the **-Y** flag to accept licenses and the **-E** flag to view license agreement files on the media.

For more information about license manipulation, refer to the **inulag** command description in the *AIX 5L Version 5.2 Commands Reference*.







## Chapter 4. Installation Options

This chapter provides information about installation options for the AIX base operating system. The installation options are available by typing 3 in the **More Options** field in the Installation and Settings screen.

On 32-bit systems, the new and complete overwrite installation options are the following:

### Install Options

1. Desktop..... *NONE, CDE, GNOME, KDE*
2. Enable Trusted Computing Base..... No
3. Graphics Software..... Yes
4. Documentation Services Software..... Yes
5. Enable System Backups to install any system..... Yes  
(Installs all devices and kernels)

>>> 6. Install More Software

0 Install with the current settings listed above.

88 Help ?

99 Previous Menu

>>> Choice [6]:

On 64-bit systems, the new and complete overwrite installation options are the following:

### Install Options

1. Desktop..... *NONE, CDE, GNOME, KDE*
2. Enable Trusted Computing Base..... No
3. Enable CAPP and EAL4+ Technology..... No  
(English only, 64-bit kernel enablement, JFS2 file systems)
4. Enable 64-bit Kernel..... No
5. Create JFS2 File Systems..... No  
(Requires 64-bit Kernel Enabled)
6. Graphics Software..... Yes
7. Documentation Services Software..... Yes
8. Enable System Backups to install any system..... Yes  
(Installs all devices and kernels)

>>> 9. Install More Software

0 Install with the current settings listed above.

88 Help ?

99 Previous Menu

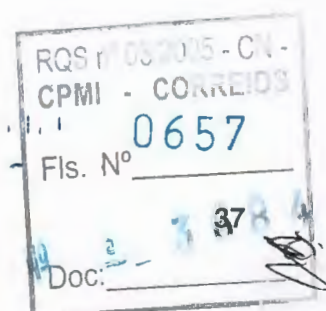
>>> Choice [9]:

On 64-bit systems, the preservation installation options are the following:

### Install Options

1. Desktop..... *NONE, CDE, GNOME, KDE*
2. Enable Trusted Computing Base..... No
3. Import User Volume Groups..... Yes
4. Graphics Software..... No
5. Documentation Services Software..... No
6. Enable System Backups to install any system..... Yes  
(Installs all devices and kernels)

>>> 7. Install More Software







0 Install with the current settings listed above.

88 Help ?

99 Previous Menu

>>> Choice [9]:

On 64-bit systems, the migration installation options are the following:

#### Install Options

- |   |     |
|---|-----|
| 1. Enable Trusted Computing Base.....   | No  |
| 2. Import User Volume Groups.....   | Yes |
| 3. Enable System Backups to install any system.....<br>(Installs all devices and kernels) | Yes |
| 4. Remove Java 1.1.8 Software.....  | No  |

>>> 0 Install with the current settings listed above.

88 Help ?

99 Previous Menu

>>> Choice [0]:

The following are the installation options available:

#### Desktop

The default is **CDE** for new and complete overwrite installations. If you select **NONE**, a minimal configuration is installed including X11, Java, perl, SMIT, and the Web-based System Manager (if **Graphics Software** is selected).

If you select **GNOME** or **KDE**, the BOS installation process prompts you for the *AIX Toolbox for Linux Applications CD*. If this CD is not available, you can type q to continue the installation without the *AIX Toolbox for Linux Applications CD*.

#### Enable Trusted Computing Base

The Trusted Computing Base (TCB) is the part of the system that is responsible for enforcing the information security policies of the system. All of the computer's hardware is included in the TCB, but a person administering the system should be concerned primarily with the software components of the TCB.

If you install the Trusted Computing Base option, you enable the trusted path, trusted shell, and system-integrity checking (**tcbck** command). These features can be enabled *only* during BOS installation.

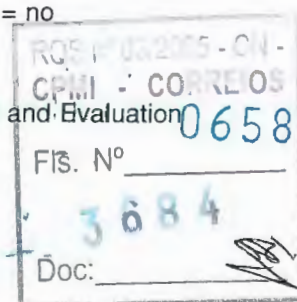
The choices are **yes** and **no**. To enable the Trusted Computing Base, type 2 and press Enter. The default is **no**.

#### Enable CAPP and EAL4+ Technology

Available in a new and complete overwrite installation. If you enable Controlled Access Protection Profile (CAPP) and Evaluation Assurance Level 4+ (EAL4+), other restrictions exist on installation choices, such as:

- Desktop = CDE or NONE
- TCB = yes
- 64-bit kernel = yes
- JFS2 = yes
- Enable System Backups to install any system (Installs all devices and kernels) = no
- Install more software options = no

For information about CAPP and EAL4+, see Controlled Access Protection Profile and Evaluation Assurance Level 4+ in the *AIX 5L Version 5.2 Security Guide*.





### Import User Volume Groups

*Available in migration installation and preservation installation.* You have the option to have user volume groups imported after the installation completes. These volume groups can be manually imported at a later time.

### Enable 64-bit Kernel

*Available only on 64-bit Common Hardware Reference Platform (CHRP) systems.*

To toggle the choice between **no** (the default) and **yes**, type 3 and press Enter. If you choose **no**, the 64-bit kernel is still installed, but it is not linked to the running **/unix**. If you choose **yes**, the 64-bit kernel is installed and begins running when your system reboots.

### Create JFS2 File Systems

*Available in new and complete overwrite installation, as well as preservation installation with 64-bit kernel enabled option.* Create enhanced journaled file systems during BOS installation.

### Graphics Software

*Available in new and complete overwrite installation, as well as preservation installation.* Install graphics software support.

### Documentation Services Software

*Available in new and complete overwrite installation, as well as preservation installation.* Install the documentation services software.

### Remove Java 1.1.8 Software

*Available in migration installation and preservation installation.* You have the option to have all Java version 1.1.8 software removed.

### Enable System Backups

If Enable System Backups to install any system is selected, all devices and kernels are installed, so that a system backup can be installed on a different system. For more information about installing a system backup to a different system, see "Cloning a System Backup" on page 126.

The **Install More Software** option is available in the new and complete overwrite installation method, as well as the preservation installation method. Select **Install More Software** to choose additional software to install after the BOS installation process finishes. A software bundle file corresponds to each selection that contains the required packages and filesets. The following software bundles are available:

#### Install More Software

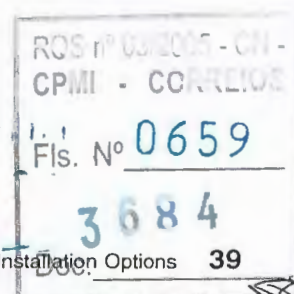
- |   |     |
|---|-----|
| 1. Netscape (Expansion Pack).....         | No  |
| 2. HTTP_Server (Expansion Pack).....      | Yes |
| 3. Kerberos_5 (Expansion Pack).....       | Yes |
| 4. Server (Volume 2).....                 | No  |
| 5. Alternate Disk Install (Volume 2)..... | No  |

>>> 0 Install with the current settings listed above.

88 Help ?

99 Previous Menu

>>> Choice [0]:





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## Chapter 5. New and Complete Overwrite Installation / Preservation Installation

This chapter provides information on the New and Complete Overwrite Installation operation and the Preservation Installation operation.

### Step 1. Complete the Prerequisites

Before starting the installation, complete the following prerequisites:

- There must be adequate disk space and memory available. AIX 5.2 requires 128 MB of memory and 2.2 GB of physical disk space. For additional release information, see the *AIX 5.2 Release Notes*.
- All requisite hardware, including any external devices (such as tape drives, CD-ROM or DVD-ROM drives), must be physically connected. If you need further information, refer to the hardware documentation that accompanied your system.
- The installation media must be loaded in the boot device.
- The system *must be* set to boot from the device in which the installation media is loaded. Refer to the hardware documentation that accompanied your system for instructions on setting the boot device.
- Before you begin the installation, other users who have access to your system must be logged off.
- If the system you are installing is currently running, create or locate a backup of the system. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.
- If your system needs to communicate with other systems and access their resources, make sure you have the information in the following worksheet before proceeding with installation:

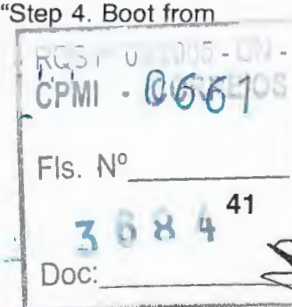
Table 3. Network Configuration Information Worksheet

Network Attribute	Value
Network Adapter	
Host Name	
IP Address	_____
Network Mask	_____
Nameserver	_____
Domain Name	
Gateway	_____

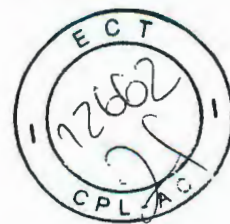
### Step 2. Prepare Your System for Installation

Prepare for a new and complete overwrite or preservation installation by doing the following:

1. Insert the *AIX Volume 1* CD into the CD-ROM device.
2. Shut down your system. If your machine is currently running, power it off now by following these steps:
  - a. Log in as the root user.
  - b. Type the following command:  
shutdown -F
  - c. If your system does not automatically power off, place the power switch in the Off (0) position.  
**Attention:** You *must not* turn on the system unit until instructed to do so in "Step 4. Boot from Your Installation Media" on page 43.
3. Turn on all attached external devices. These include the following:
  - Terminals







- CD-ROM or DVD-ROM drives
- Tape drives
- Monitors
- External disk drives

Turning on the external devices first is necessary so the system unit can identify each peripheral device during the startup (boot) process.

### Step 3. Set Up an ASCII Terminal

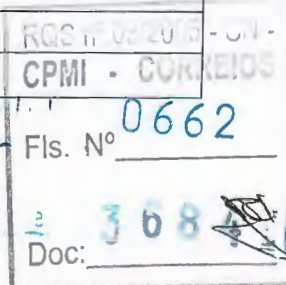
If you are using a graphics terminal, skip directly to "Step 4. Boot from Your Installation Media" on page 43.

If you are using an ASCII terminal, use the criteria listed below and your terminal reference documentation to set the communications, keyboard, and display options. The following settings are typical, but your terminal might have different option names and settings than those listed here.

**Note:** If your terminal is an IBM 3151, 3161, or 3164, press the Ctrl+Setup keys to display the Setup Menu and follow the on-screen instructions to set these options.

Communication Options	
Option	Setting
Line Speed (baud rate)	9600
Word Length (bits per character)	8
Parity	no (none)
Number of Stop Bits	1
Interface	RS-232C (or RS-422A)
Line Control	IPRTS

Keyboard and Display Options	
Option	Setting
Screen	normal
Row and Column	24x80
Scroll	jump
Auto LF (line feed)	off
Line Wrap	on
Forcing Insert	line (or both)
Tab	field
Operating Mode	echo
Turnaround Character	CR
Enter	return
Return	new line
New Line	CR
Send	page
Insert Character	space





## Step 4. Boot from Your Installation Media

1. Turn the system unit power switch from Off (0) to On (|).
2. When the system beeps twice, press F5 on the keyboard (or 5 on an ASCII terminal). If you have a graphics display, you will see the keyboard icon on the screen when the beeps occur. If you have an ASCII terminal (also called a tty terminal), you will see the word keyboard when the beeps occur.

**Note:** If your system does not boot using the F5 key (or the 5 key on an ASCII terminal), refer to your hardware documentation for information about how to boot your system from an AIX product CD.

The system begins booting from the installation media.

3. If you have more than one console, each might display a screen that directs you to press a key to identify your system console. A different key is specified for each console displaying this screen. If this screen displays, press the specified key *only* on the console you want to use for the installation. (The system console is the keyboard and display device used for installation and system administration.) A screen displays, asking you to select a language to be used during installation.
4. Select the language you prefer to use during installation.
5. When the Welcome to Base Operating System Installation and Maintenance screen displays, type 2 in the **Choice** field to select **Change/Show Installation Settings and Install** and press Enter. Go to "Step 5. Verify or Change the Installation Settings" for instructions on verifying or changing installation settings.

## Step 5. Verify or Change the Installation Settings

Verify the default installation settings from the Installation and Settings screen. If the installation and system settings are correct, type 0 in the **Choice** field and press Enter. Confirm that the selections on the installation summary screen are correct, and press Enter to begin the BOS installation. Go to "Step 6. Finish the BOS Installation" on page 44.

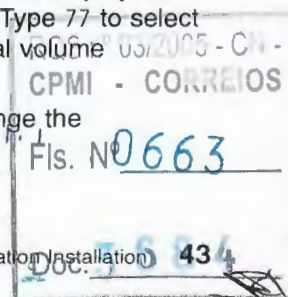
To change the installation settings, use the following procedure:

1. Select either **New and Complete Overwrite Installation** or **Preservation Installation**.
  - a. Type 1 in the **Choice** field to select the **System Settings** option.
  - b. When the Change Method of Installation screen displays, type the number corresponding to desired installation (either 1 for New and Complete Overwrite or 2 for Preservation) in the **Choice** field and press Enter.

**Note:** Available installation methods depend on whether your system has a previous version of AIX installed.

If you only want to install the next recommended maintenance level of AIX, see "Installing Optional Software Products and Service Updates" on page 71. You can also use the SMIT **update\_all** fast path or the **install\_all\_updates** command to update existing filesets to the next recommended maintenance level.

- c. When the Change Disk(s) screen displays, you can change the destination disk for the installation. If you selected the preservation installation, the screen lists only disks containing a **rootvg**. The disk name, the location, the size of the disk, and the root volume group status is displayed for each available disk. The Bootable column indicates whether the disk is bootable. Type 77 to select **Display More Disk Information** to view additional disk attributes such as physical volume identifier, device adapter connection location, or World Wide Port Name/Lun ID. If the default shown is correct, type 0 in the **Choice** field and press Enter. To change the destination disk, use the following procedure:







- 1) Type the number for each disk you choose in the **Choice** field and press Enter. *Do not* press Enter a final time until you have finished selecting all disks. If you need to deselect a disk, type its number a second time and press Enter.
  - You can specify a supplemental disk by typing 66 and pressing the Enter key for the **Disks not known to Base Operating System Installation** option. This option opens a new menu that prompts for a device support media for the supplemental disk. The device-support media is only needed when the device cannot configure with the generic SCSI or bus-attached device drivers. BOS installation configures the system for the disk and then returns to the Change Disk screen.
- 2) When you have finished selecting the disks, type 0 in the **Choice** field and press Enter. The Installation and Settings screen displays with the selected disks listed under System Settings.
2. Change the primary language environment, if needed. Use the following steps to change the primary language used by this installation.

**Note:** Changes to the primary language environment do not take effect until after BOS is installed and your system is rebooted.

  - a. Type 2 in the **Choice** field on the Installation and Settings screen to select the **Primary Language Environment Settings** option.
  - b. Select the appropriate set of cultural convention, language, and keyboard options. Most of the options are a predefined combination, however, you can define your own combination of options.
    - To select a predefined Primary Language Environment, type that number in the **Choice** field and press Enter.
    - To configure your own primary language environment:
      - 1) Select **MORE CHOICES**.
      - 2) Page through the choices and select the **Create Your Own Combination** option.
      - 3) When the Set Primary Cultural Convention screen displays, type the number in the **Choice** field that corresponds to the cultural convention of your choice and press Enter.
      - 4) When the Set Primary Language screen displays, type the number in the **Choice** field that corresponds to your choice for the primary language and press Enter.
      - 5) When the Set Keyboard screen displays, type the number in the **Choice** field that corresponds to the keyboard attached to the system and press Enter.
3. Change the installation options by typing 3 to select **More Options** and press Enter. For more information on the installation options, see Chapter 4, "Installation Options", on page 37.
4. Verify your selections in the installation summary screen and press Enter to begin the BOS installation process.

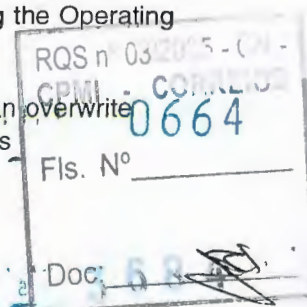
Your system automatically reboots after installation is complete. Go to "Step 6. Finish the BOS Installation".

## Step 6. Finish the BOS Installation

1. The Installing Base Operating System screen displays the status of your installation.

After the base run-time environment is installed, status information displays about other software that is being installed.
2. The system automatically reboots.
3. After the system has restarted, you are prompted to configure your installation. For information on configuring your system after a BOS installation process, refer to Chapter 7, "Configuring the Operating System", on page 53.

**Note:** If the system being installed has 4 GB or more of memory and you have performed an overwrite installation, then a dedicated dump device is created for you. If so, the device name is `/dev/lg_dumplv`, and its size is based on the following formula:

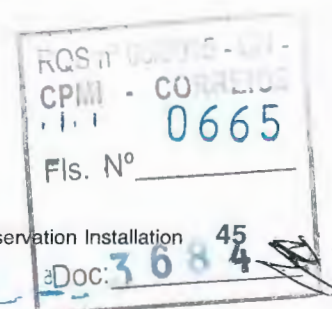




4>= RAM < 12	size of dump device= 1 GB
12>= RAM < 24	size of dump device= 2 GB
24>= RAM < 48	size of dump device= 3 GB
RAM >= 48	size of dump device= 4 GB

## Related Information

- For additional release information, see the *AIX 5.2 Release Notes*.
- For late-breaking information, which might include information on the configuration process and installed software, refer to readme files. For information on how to view readme files, see "Viewing Readme Files" on page ix.
- For information about installing optional software, refer to "Installing Optional Software Products and Service Updates" on page 71.







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## Chapter 6. Migration Installation

*Migration* is the default installation method to move from AIX 4.2 and later to AIX 5.2.

**Note:** If you only want to install the next recommended maintenance level of the operating system, use the **SMIT update\_all** fast path or the **install\_all\_updates** command to update the filesets currently installed. For more information about updating to the next recommended maintenance level of AIX, see Chapter 10, "Optional Software Products and Service Updates", on page 69.

During a migration, the installation process determines which optional software products are installed on the existing version of the operating system. Components from previous releases that have been replaced by new software in AIX 5.2 are installed at the AIX 5.2 level.

Migration attempts to preserve all user configuration, while moving the operating system to a new level of software. The following steps are taken to achieve this objective:

- Save configuration files
- Prepare and remove old files
- Restore new files
- Remove unsupported or unnecessary filesets
- Migrate configuration data wherever possible
- Prepare VPD for install
- Update additional filesets

When performing a migration, the following occurs:

- All files in the **/usr/lib/drivers**, **/usr/lib/microcode**, **/usr/lib/methods** and **/dev** directories are removed from the system, so software support for device drivers must be reinstalled. Non-device software products and applications remain on the system, and work correctly if they are among those files described in "Binary Compatibility Between Earlier Versions and AIX 5.2".
- The following software products are removed from the system:
  - AIXwindows Interface Composer
  - Remote Customer Services
  - AIXwindows Development Environment
  - Display PostScript functionality from AIXwindows Run-Time Environment Extensions
  - Performance Tools functionality from Extended Commands
  - OpenGL and graPHIGS
  - Xstation Manager

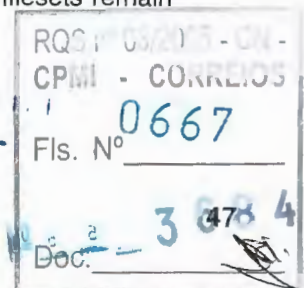
In most cases, user-configuration files from the previous version of a product are saved when the new version is installed during a migration installation.

### Binary Compatibility Between Earlier Versions and AIX 5.2

After a migration installation, you might notice filesets on the system in the **OBSOLETE** state. Obsolete filesets were installed by earlier versions of the operating system, but they remain on the current system because the migration only replaced some, but not all, of the files they contain. These filesets remain necessary for systems running mixed levels of the operating system.

During a migration installation, the following filesets are automatically included:

- Base operating system commands







- Base operating system libraries
- Base operating system curses/termcap
- Base operating system networking
- Base operating system directories/files (symlinks)
- Messages
- X11R3
- X11R4
- X11 fonts

All operating system applications based on AIX 4.2 and those intended for use with POWER family, POWER2, and POWER-based models run compatibly on AIX 5.2 without recompilation for those same models. The only exceptions to this statement are applications using the following:

- Unsupported self-loadable kernel extensions
- Certain High-Function Terminal (HFT) control interfaces
- X11R3 input device interfaces
- CIO LAN device driver interface
- SCSI device configuration methods (IHVs)
- nlist subroutine interface
- DCE threads
- Applications compiled using POWER2 or POWER-based compiler options, but executed on models other than POWER2 or POWER-based models.

**Note:** Any program that must run in all environments (POWER family, POWER2, and POWER-based models 601 and higher) must be compiled using the common mode of the compiler. Programs compiled to exploit POWER2 technology must be run on POWER2 processors. Existing code need not be recompiled to run.

A system using AIX 4.2 can operate as a server system for client machines using AIX 5.2 with the following exceptions:

- Network installation of AIX 5.2 clients
- Service SNA or X.25 to AIX 5.2 clients
- Service HCON to AIX 5.2 clients
- Service CGE extensions of PEX and PEX-PHIGS
- Use of AIX 5.2 client installation formats

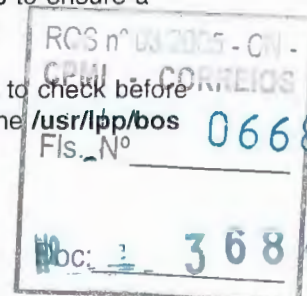
Font servers might be required on the AIX 5.2 clients to reliably handle AIXwindows between server and client.

A system using AIX 5.2 might operate as a server system for client machines using AIX 4.2 or later versions as long as the necessary compatibility options are installed. All statements about binary compatibility apply in this case. AIX 5.2 applications might not execute reliably on AIX 4.2 systems using remote network mounts from an AIX 5.2 file system.

## Pre-Migration and Post-Migration Checking

The **pre\_migration** and **post\_migration** commands perform various system checks to ensure a successful migration installation. Both commands are shipped in the **bos.rte** fileset.

In case the **pre\_migration** command does not exist on a level of AIX that you want to check before performing a migration installation, the **pre\_migration** command is also located in the **usr/lpp/bos**





directory of the CD file system. Copy the **pre\_migration** command from the **/usr/lpp/bos** directory of the new AIX CD version you are about to perform the migration.

The output from the **pre\_migration** command is saved to the system in the **/home/pre\_migrationdate** directory.

The **pre\_migration** command performs the following actions:

- List the device filesets being removed.
- List all other filesets being removed.
- List the saved base configuration files that will not be merged.
- List configuration files that will be merged.
- Verify fileset version consistency.
- Create a list of all filesets installed, to be used by the **post\_migration** command.
- Check the size and location of the boot logical volume.
- Check the major number for rootvg is 10.
- Check for the missing DB directory for the **bos.net.ipsec.keymgt** fileset.
- Determine if Kerberos is being used.
- Check disk and memory sizes.
- If migrating from AIX 4.2, verify that the correct updates are applied.
- Verify system platform.
- Print a recommendation that a system backup be made before the migration.

The output from the **post\_migration** command is saved in the **/home/post\_migrationdate** directory.

The **post\_migration** command performs the following actions:

- Verify fileset version consistency.
- Check the installation list from before the migration, and inform the user of any filesets that might still need migrating.
- Compare saved and merged configuration scripts and save the differences.

## Migrating to AIX 5.2

### Notes:

1. The boot logical volume requires 12 MB of contiguous disk space. During migrations, the **inuextendblv** command runs to ensure there are contiguous partitions for hd5. If contiguous partitions are not present, the **inuextendblv** command attempts to create them. If the partitions are not present and the **inuextendblv** command fails to create them, the migration is stopped.
2. The settings in your bootlist are not migrated. After a migration, the bootlist is set to the primary boot device.

Use the following steps to migrate your current version of the operating system to the AIX 5.2 BOS:

- "Step 1. Complete the Prerequisites" on page 50
- "Step 2. Prepare Your System for Installation" on page 50
- "Step 3. Boot from Your Installation Media" on page 51
- "Step 4. Finish the BOS Migration" on page 52

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**Attention:** This procedure requires shutting down and reinstalling the base operating system. Whenever you reinstall any operating system, schedule your downtime when it least impacts your workload to protect yourself from a possible loss of data or functionality. Before you perform a migration installation, ensure that you have reliable backups of your data and any customized applications or volume groups. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.

## Step 1. Complete the Prerequisites

Before starting the migration, complete the following prerequisites:

- All requisite hardware, including any external devices (such as tape, CD, or DVD-ROM drives), must be physically connected. If you need further information, refer to the hardware documentation that accompanied your system.
- Before migrating your BOS to AIX 5.2, ensure that the root user has a primary authentication method of **SYSTEM**. You can check this condition by typing the following command:

```
# lsuser -a auth1 root
```

Change the value, if needed, by typing the following command:

```
# chuser auth1=SYSTEM root
```

- Before you begin the installation, other users who have access to your system must be logged off.
- Verify that your applications runs on AIX 5.2. Also, verify that your applications are binary-compatible with AIX 5.2. If your system is an application server, verify that there are no licensing issues. Refer to your application documentation or provider to verify on which levels of AIX your applications are supported and licensed. You can also check the *AIX application availability guide* at the following Web address: <http://www-1.ibm.com/servers/aix/products/ibmsw/list/>
- Verify that all currently installed software is correctly entered in the Software Vital Product Database (SWVPD), by using the **lppchk** command. To verify that all filesets have all required requisites and are completely installed, type the following:  

```
# lppchk -v
```
- Verify that your hardware microcode is up-to-date.
- All requisite hardware, including any external devices (such as tape, CD, or DVD-ROM drives), must be physically connected and powered on. If you need further information, refer to the hardware documentation that accompanied your system.
- Use the **errpt** command to generate an error report from entries in the system error log. To display a complete detailed report, type the following:  

```
# errpt -a
```
- There must be adequate disk space and memory available. AIX 5.2 requires 128 MB of memory and 2.2 GB of physical disk space. For additional release information, see the *AIX 5.2 Release Notes*.
- Make a backup copy of your system software and data. For instructions on how to create a system backup, refer to "Creating System Backups" on page 113.

## Step 2. Prepare Your System for Installation

Prepare for migrating to the AIX 5.2 BOS by doing the following:

1. Insert the *AIX Volume 1* CD into the CD-ROM device.
2. Shut down your system. If your machine is currently running, power it off now by following these steps:
  - a. Log in as the root user.
  - b. Type the following command:  

```
# shutdown -F
```
  - c. If your system does not automatically power off, place the power switch in the Off (0) position.

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**Attention:** You *must not* turn on the system unit until instructed to do so in "Step 3. Boot from Your Installation Media".

3. Turn on all attached external devices. These include the following:

- Terminals
- CD or DVD-ROM drives
- Tape drives
- Monitors
- External disk drives

Turning on the external devices first is necessary so the system unit can identify each peripheral device during the startup (boot) process.

### Step 3. Boot from Your Installation Media

If you are using an ASCII console that was not defined in your previous system, complete "Step 3. Set Up an ASCII Terminal" on page 42 before proceeding.

The following steps migrate your current version of the operating system to AIX 5.2:

1. Turn the system unit power switch from Off (0) to On (|).
2. When the system beeps twice, press F5 on the keyboard (or 5 on an ASCII terminal). If you have a graphics display, you see the keyboard icon on the screen when the beeps occur. If you have an ASCII terminal (also called a tty terminal), you see the word keyboard when the beeps occur.

**Note:** If your system does not boot using the F5 key (or the 5 key on an ASCII terminal), refer to your hardware documentation for information about how to boot your system from an AIX product CD.

The system begins booting from the installation media.

3. If your system has an LED display, the three-digit LED should display c31.

If you have more than one console, each might display a screen that directs you to press a key to identify your system console. A different key is specified for each console displaying this screen. If this screen displays, press the specified key *only* on the device to be used as the system console. (The system console is the keyboard and display device used for installation and system administration.) Press a key on one console *only*.

A screen displays, asking you to select a language to be used for installation instructions.

4. Select the language you prefer to use for installation instructions.
5. When the Welcome to Base Operating System Installation and Maintenance screen displays, either begin the migration immediately by typing 1 to select **Start Install Now with Default Settings**, or verify the installation and system settings by typing 2 to select **Change/Show Installation Settings and Install**. If you want to change any settings, follow the procedure in "Step 5. Verify or Change the Installation Settings" on page 43.

**Notes:**

- You should not have to change settings simply to select the migration installation method. If a previous version of the operating system exists, the installation method defaults to migration.
- The available installation methods vary, depending on the version of the operating system that is currently installed (before migration). For information about the BOS installation methods, refer to Chapter 3, "Introduction to Base Operating System Installation", on page 33. For information about the installation options available for a migration installations, refer to Chapter 4, "Installation Options", on page 37.

6. Verify the selections in the Migration Installation Summary screen and press Enter.





7. Confirm the migration installation process in the Migration Confirmation screen, and press Enter to begin the migration installation.

## Step 4. Finish the BOS Migration

After prompting for confirmation, the installation process begins. The Installing Base Operating System screen displays.

As the installation progresses, the numbers increment in the fields that show percentage complete and elapsed time to indicate the installation status. After the base run-time environment is installed, status information displays about other software that is being installed. After the BOS installation is complete, the system automatically reboots.

After the system has restarted, you are prompted to configure your installation of the BOS. Go to Chapter 7, "Configuring the Operating System", on page 53 for information on the configuration process.

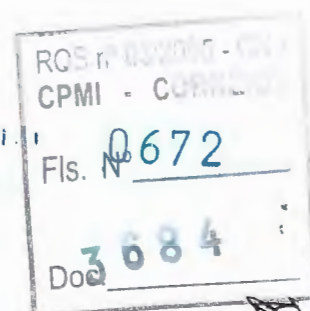
**Note:** If there is not enough space to migrate all of the usually migrated software, a collection of software called a Migration Bundle is available when you install additional software later. You must create additional disk space on the machine on which you want to install, and then you can run **smit update\_all** to complete the installation, during which the Migration Bundle is installed.

If you are not doing the installation from a graphics console, a Graphics\_Startup bundle is created. Refer to "Installing Optional Software Products and Service Updates" on page 71 for more information about installing software bundles and for information on migrating or installing optional software products. "Maintaining Optional Software Products and Service Updates" on page 75 describes how to remove software from the system to release disk space.

---

## Related Information

- For additional release information, see the *AIX 5.2 Release Notes*.
- For late-breaking information, which might include information on the configuration process and installed software, refer to readme files. For information on how to view readme files, see "Viewing Readme Files" on page ix.
- For information about installing optional software, refer to "Installing Optional Software Products and Service Updates" on page 71.





## Chapter 7. Configuring the Operating System

This chapter provides information concerning the tasks you might need to perform after installing the base operating system (BOS). Complete all configuration tasks that apply to your newly installed system. Two configuration tools are available to assist you. Depending on which type of console you are using, one of the following usually begins automatically after installation:

- "Configuration Assistant" for graphics consoles
- "Installation Assistant" on page 54 for ASCII consoles

### Notes:

- If your system was installed by a network installation server, the Configuration Assistant or Installation Assistant does not display when the BOS installation program completes.  
If your system was installed using a system backup image, or if your BOS installation was customized, or if you selected migration installation from AIX 4.2 or later, the Configuration Assistant or Installation Assistant might not display when the BOS installation program completes.
- The Configuration Assistant and the Installation Assistant do not contain the tasks needed to configure your machine as a server. If you need to configure your system for a specific resource, refer to the documentation pertaining to that resource.
- If your terminal type is not set, the first menu displayed by the ASCII Installation Assistant requires you to enter your terminal type (tty). If you enter a terminal type that is not valid, this menu redisplay until a valid type is entered.

If you enter a valid terminal type that does not match your terminal, the next screen displayed might be unreadable. In this case, press the break key sequence to return to the Set Terminal Type screen. For most terminal types, the break key sequence is `Ctrl-C`.

## Configuration Assistant

On a system with a graphical interface, the newly installed BOS reboots and the Configuration Assistant starts to guide you through the configuration tasks. For example, much of the processing on a system uses the date and time-of-day information, requiring the system have the date and time set correctly.

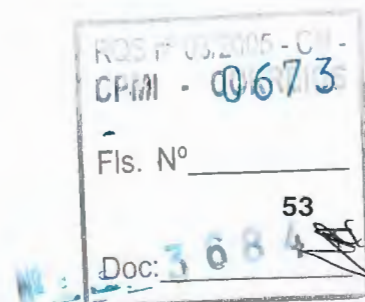
If there are outstanding software license agreements that must be accepted before you can continue to use the machine, the Configuration Assistant prompts you to view and accept these agreements.

The Configuration Assistant guides you through the following configuration tasks:

- Set the system date and time for your time zone.
- Set a root user account password to restrict access to system resources.
- Configure network communications.

**Note:** To configure your machine as an NFS server, refer to NFS Installation and Configuration in the *AIX 5L Version 5.2 System Management Guide: Communications and Networks*.

- Configure Web-based System Manager to run in a Web browser (applet mode).
- Configure Online Documentation Library Service, which lets users conduct searches of online documentation. (It is highly recommended that you complete this configuration task, because some applications depend on the Online Documentation Library Service to conduct searches of their online manuals and helps.) Also, this configuration task optionally helps install a Web browser, Web server, and the associated documentation.
- Manage Software.
- Exit the Configuration Assistant.







The Manage Software option allows you to perform software management tasks immediately after a BOS installation. The following options are available:

- List installed software
- Install additional software
- List software licenses with license text

If you select **List installed software**, the following options are available:

- List automatically installed Software – Displays a list of all installed packages
- List optionally installed software – Displays a list of all optional software that was selected to be installed during BOS installation

If you select **Install additional software**, the following options are available:

- Install by bundles – Allows you to select from a list of software bundles to install additional software, such as the Netscape Communicator Software Bundle or a User-Defined Software Bundle
- Selective install – Allows you to select a specific package or set of packages to install

The graphical interface for the Configuration Assistant provides step-by-step instructions for completing each configuration task. The tasks are presented to you in a logical sequence. Complete all configuration tasks before you use your system.

When you exit the Configuration Assistant, the guide asks you whether you want to start Configuration Assistant again the next time you restart the operating system. After exiting the Configuration Assistant, users can begin logging in to and using AIX.

To access the Configuration Assistant later, type `configassist` on the command line.

---

## Installation Assistant

On a system with an ASCII interface, the newly installed BOS reboots and starts the Installation Assistant to guide you through completing configuration tasks. You must have root user authority to use the Installation Assistant. To access the Installation Assistant later, type `install_assist` on the command line. You can also access it from a graphics system through the SMIT **smit assist** fast path.

If there are outstanding software license agreements that must be accepted before you can continue to use the machine, the Installation Assistant prompts you to view and accept these agreements.

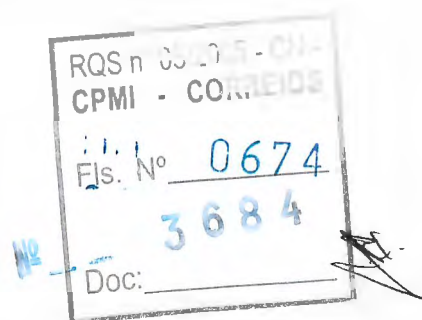
The Installation Assistant guides you through the following configuration tasks:

- Set the system date and time for your time zone.
- Set a root user account password to restrict access to system resources.
- Configure network communications.
- Install software applications.
- Using SMIT (information only).
- Tasks Completed - Exit to Login.

The Install software applications option allows you to perform software management tasks immediately after a BOS installation. The following options are available:

- Add License Passwords for Applications
- Install and Update Software

If you select **Install and Update Software**, the following menu displays:





#### Install and Update Software

Move cursor to desired item and press Enter.

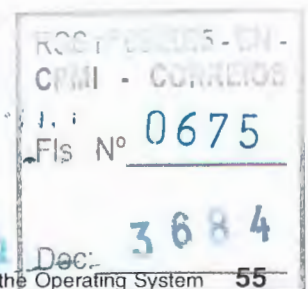
- Install Software
- Update Installed Software to Latest Level (Update All)
- Install Software Bundle
- Update Software by Fix (APAR)
- Install and Update from ALL Available Software

You can also access this SMIT menu by using the **install\_update** fast path.

### Related Information

For late-breaking information, which might include information about the configuration process and installed software, refer to readme files. For information about viewing how to view readme files, see "Viewing Readme Files" on page ix.

If you are installing from CD/DVD-ROM, or would like more information about installing optional software, refer to "Installing Optional Software Products and Service Updates" on page 71.





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## Chapter 8. Customized BOS Installations

This chapter describes how to customize subsequent installations of the BOS after the operating system has been installed. Customizing an installation requires you to edit the **bosinst.data** file and use it with your installation media.

### Introduction to Customized BOS Installations

The first time you install, the Base Operating System (BOS) installation program presents menus from which you must choose setup options. This initial installation also automatically starts a post-installation configuration program, either the graphical Configuration Assistant or the ASCII Installation Assistant. For more information about Configuration Assistant and Installation Assistant, refer to Chapter 7, "Configuring the Operating System", on page 53.

For subsequent installations, you can change many aspects of the default BOS install program by editing the **bosinst.data** file. For example, to install the BOS without menus, you can specify that no prompts be provided. You can also customize a BOS installation to bypass Configuration Assistant or Installation Assistant and start your own configuration script. Also, the **bosinst.data** file can be used to replicate one set of installation settings on other machines. For example, system administrators can create a **bosinst.data** file with settings that can be used to install all the machines they support that have the same configuration. For AIX 4.3.3 and later versions of the operating system, you can use the Web-based System Manager Reinstall Base Operating System wizard to install systems from product or backup media. This application lets you customize your installation by answering prompts before installation and creates a **bosinst.data** file appropriate for the type of installation wanted. For more information on the **bosinst.data** file, refer to Chapter 9, "The bosinst.data File", on page 61.

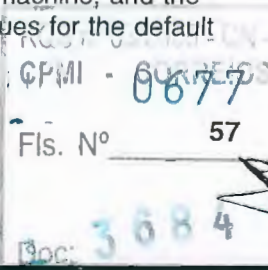
If you run your own configuration script from a **bosinst.data** file or from the Network Installation Management (NIM) interface, the environment that is in place at the time the script is run is a *single-user environment*. This environment is not available as a multiuser environment, and thus, there are limits to what can be run from a configuration script. The **/etc/init** file is not running, so no process management can take place. All available memory cannot be made available because the RAM file system still exists, so devices that require large amounts of memory to run might fail to configure. In addition, signal handling is not available.

Because of the single-user environment, use the following guidelines for configuration scripts:

- Base devices can be configured, but devices that require daemons or more complex configuration should be started at reboot time by adding the necessary code to the end of the **/etc/firstboot** script.
- Daemons should not be started.
- Items such as NIS configuration, which uses system resource controller (SRC) commands, should be done by creating a separate entry in the **/etc/inittab** file and running a configuration script at reboot time.
- Beginning in AIX 5.2, the BOS installation process automatically creates and extends paging space based on available memory.

The **bosinst.data** file directs the actions of the BOS installation program. The file resides in the **/var/adm/ras** directory on the installed machine only, and it is not accessible on the commercial tape or the CD on which you received AIX 5.2.

The **bosinst.data** file contains stanzas with variables set to default values. Each variable is on a new line, in the *Variable=Value* form. A blank line separates each stanza. These stanzas provide the installation program with information such as the method and type of installation, the disks in the machine, and the language used. By editing the file with an ASCII text editor, you can substitute new values for the default variables.







Another installation file, **image.data**, can also be modified and used during BOS installation. The **image.data** file contains information describing the root volume group image created during the BOS installation process. This information includes the sizes, names, maps, and mount points of logical volumes and file systems in the root volume group. The installation program also takes input from the **image.data** file regarding defaults for the machine being installed. For a description of the **image.data** file, see *AIX 5L Version 5.2 Files Reference*. The procedure for using the **bosinst.data** file to customize BOS installation can also be used for the **image.data** file. The modified files can be used together to override BOS installation defaults.

You can also use the instructions in this chapter to create a supplemental diskette, a CD-R, or a DVD-RAM containing a modified **preserve.list** file, which is used during a preservation installation. For more information about a preservation installation, see Chapter 3, "Introduction to Base Operating System Installation", on page 33.

## Customizing and Using a bosinst.data File

You must install the BOS before you can access and modify the default **bosinst.data** file. The Web-based System Manager **Reinstall Base Operating System** wizard can be used to prepare your next installation and in customizing the **bosinst.data** file. This file may also be retrieved and edited like any other ASCII file. If you are editing the **bosinst.data** file, use one of the following procedures:

- "Create and Use a Client File"
- "Create and Use a Supplementary Diskette"

For information about the contents of the file and examples of edited files, refer to "bosinst.data File Stanza Descriptions" on page 61 and "bosinst.data File Example" on page 68. To verify the contents of your modified **bosinst.data** file, use the **bicheck** command.

**Note:** If you are customizing the **/bosinst.data** file so that it becomes part of a system backup (**mksysb**), beginning with AIX 4.3.3, the **mksysb** command always updates the **target\_disk\_data** stanzas to reflect the current disks in the **rootvg**. If you do not want this update to occur, you must create the file **/save\_bosinst.data\_file**. The existence of this file is checked by the **mksysb** command, before the **target\_disk\_data** stanzas are updated.

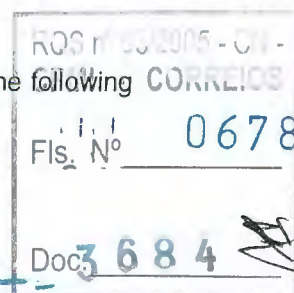
### Create and Use a Client File

Create one customized **bosinst.data** file for each client, and using Network Installation Management (NIM), define the files as NIM resources. For more information about how to use the **bosinst.data** file as a resource in network installations, refer to Chapter 9, "The bosinst.data File", on page 61.

### Create and Use a Supplementary Diskette

Use this procedure to create the supplementary diskette and use it in future installations:

1. Customize the **bosinst.data** file:
  - a. Use the **cd** command to change your directory to the **/var/adm/ras** directory.
  - b. Copy the **/var/adm/ras/bosinst.data** file to a new name, such as **bosinst.data.orig**. This step preserves the original **bosinst.data** file.
  - c. Edit the **bosinst.data** file with an ASCII editor.
  - d. Create an ASCII file consisting of one word:  
data
  - e. Save the new ASCII file, naming it **signature**.
2. Create the diskette and use it for installation:
  - a. Back up the edited **bosinst.data** file and the new **signature** file to diskette with the following command:





```
ls ./bosinst.data ./signature | backup -iqv
```

OR

If you create a bundle file named `mybundle`, back up the edited **bosinst.data** file, the new **signature** file, and the bundle file to diskette with the following command:

```
ls ./bosinst.data ./signature ./mybundle | backup -iqv
```

- b. Insert the diskette in the diskette drive of the target machine you are installing.
- c. Boot the target machine from the installation media (tape, CD/DVD-ROM, or network) and install the operating system.

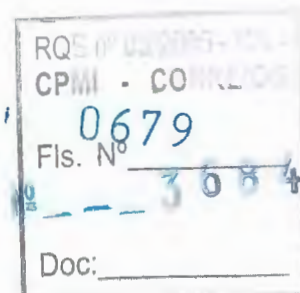
The BOS installation program uses the diskette file, rather than the default **bosinst.data** file shipped with the installation media. For more information on the **bosinst.data** file, refer to Chapter 9, "The bosinst.data File", on page 61.

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## Related Information

For more information about the **bosinst.data** file, refer to Chapter 9, "The bosinst.data File", on page 61.

For a description of the **image.data** file, see *AIX 5L Version 5.2 Files Reference*.





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## Chapter 9. The bosinst.data File

This chapter provides information on the **bosinst.data** file. The chapter includes the following sections:

- "bosinst.data File Stanza Descriptions"
- "bosinst.data File Example" on page 68

### bosinst.data File Stanza Descriptions

This section describes the contents of the **bosinst.data** file. Example files follow the stanza descriptions. (See "bosinst.data File Example" on page 68.)

#### control\_flow Stanza

The control\_flow stanza contains variables that control the way the installation program works:

##### Variable CONSOLE

##### Description

Specifies the full path name of the device you want to use as the console. If this value is **Default**, and you are performing a nonprompted installation, then the console is set to **/dev/lft0**, if this device exists. If **/dev/lft0** does not exist, the console is set to **/dev/tty0**. (Instructions for which key to press are displayed on the screen.) If you change the **PROMPT** variable to **no**, you must specify a console here.

##### INSTALL\_METHOD

Specifies a method of installation: **migrate**, **preserve**, or **new and complete overwrite**. The default value is initially blank. The installation program assigns a value, depending on which version of AIX was previously installed. See Chapter 3, "Introduction to Base Operating System Installation", on page 33 for more information.

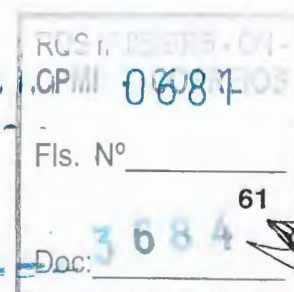
The default method of installation is **migrate** if a previous version of the operating system is on the machine. If no previous version exists, the default method is **new and complete overwrite**.

##### PROMPT

Specifies whether the installation program uses menus from which you make choices. The possible values are **yes** (default) and **no**.

**Note:** You must fill in values for all variables in the locale stanza to uniquely identify the disk, if you set the **PROMPT** variable to **no**. Similarly, if **PROMPT** equals **no**, you must supply values for variables in the control\_flow stanza, with two exceptions: the **ERROR\_EXIT** and **CUSTOMIZATION\_FILE** variables, which are optional.

**Attention:** Fill in values for enough variables in the target\_disk\_data stanza if you set the **PROMPT** variable to **no**. The BOS installation program assigns target disks for blank variables. You can lose data if the installation program assigns a disk where you store data. For more information on disk selection during nonprompted installations, see 62.







## EXISTING\_SYSTEM\_OVERWRITE

Confirms that the installation program can *overwrite* existing volume groups. This variable is applicable only for a nonprompted overwrite installation. The possible values are **no** (default), **yes**, and **any**.

- no** (Default) Only disks that are not part of a volume group can be used for the installation.
- yes** Disks that contain the root volume group is used first, and if additional disks are needed for the installation, then disks that contain no volume groups are used.
- any** Any disks can be used for the installation.

When the installation is nonprompted and the `target_disk_data` stanza is empty, the installation process uses the value of the **EXISTING\_SYSTEM\_OVERWRITE** field to determine the disks to install on.

When you do a prompted installation, this value is changed to **yes**, and is saved with other changes in the `/var/adm/ras/bosinst.data` file. Network Install Manager (NIM) creates a default `bosinst.data` file (NIM `bosinst.data` resource) with this value set to **yes**, and system backups use the `bosinst.data` file that is copied from the `/var/adm/ras` directory, so in most cases this value is already be set to **yes**. If this field is set to **no**, as seen in the `/usr/lpp/bosinst/bosinst.template` file, an error message informs you that there are not enough disks matching the criteria needed to complete the installation during a nonprompted install. The BOS installation is then changed to a prompted BOS installation, and the value of the **EXISTING\_SYSTEM\_OVERWRITE** field is set to **yes**. Starts the Configuration Assistant on first boot after the BOS installation completes, if the system has a graphical interface. Starts Installation Assistant if the machine has an ASCII interface. The possible values are **yes** (default) and **no**. The **no** value is valid only when the **ACCEPT\_LICENSES** field is set to **yes**.

Removes all files and directories in the `/usr/lpp/*inst_roots` directories. The possible values are **no** (default) and **yes**.

The `/usr/lpp/bos/inst_roots` directories must remain if the machine is used as a network server. To save disk space, set this value to **yes** if the machine is not a network server.

Starts an executable program if an error occurs in the installation program. The default value is blank, which signals BOS installation to use a command that is shipped on the installation media. The command starts an error message routine when the installation program halts because of an error. As an alternative to the default, you can enter the path name of your own script or command for a customized error routine.

Specifies the path name of a customization file you create. The default value is blank. The customization file is a script that starts immediately after the installation program concludes.

Specifies whether you want to install the Trusted Computing Base (TCB). When you install the TCB, the trusted path, the trusted shell, and system integrity checking are installed. The TCB must be installed and initialized when the operating system is installed. The TCB cannot be installed later. By not installing the TCB, installation time is reduced. The possible values are **no** (default) and **yes**.

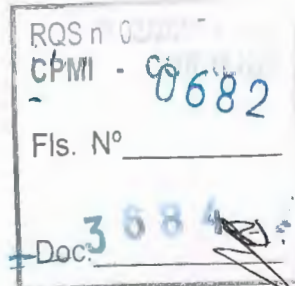
## RUN\_STARTUP

## RM\_INST\_ROOTS

## ERROR\_EXIT

## CUSTOMIZATION\_FILE

## TCB





## BUNDLES

Specifies what software bundles to install. Type the full path name of each bundle file. Be sure there is sufficient disk space and paging space on the target machine for the software you specify in the **BUNDLES** variable.

This list of bundle file names is limited to 139 bytes. If your list of bundle file names is longer than 139 bytes, use the **cat** command to combine the bundle files into a single custom bundle file and enter the name of your custom bundle file in this field.

If you are installing from tape, to specify system-defined bundles on the product media, use the full path name of each bundle file as follows:

`/usr/sys/inst.data/sys_bundles/BundleFileName`

If you are using a **bosinst.data** diskette to define your own bundle files, specify the full path name of each bundle file as follows:

`../DirectoryName/BundleFileName`. For example, if you put a bundle file named `mybundle` in the **root** directory, the full path name would be `../mybundle`.

If you are using preservation installation, create bundle files before you start the installation. Create the files in **/home** and specify the full path name of each bundle file as follows:

`/home/BundleFileName`

## RECOVER\_DEVICES

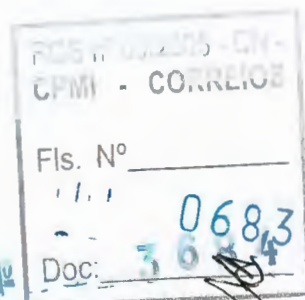
Specifies whether to reconfigure the devices. The default value is **Default**. For **mksysb** installations, the ODM configuration database is saved in the image. The device names and attributes are automatically extracted from the database, and the BOS installation program attempts to recreate the devices the same way they were on the machine the **mksysb** was created on. This is normal procedure for regular **mksysb** restores on the same system. However, for cloning (installing the **mksysb** image on another system), you may not want these devices configured this way, especially for network configuration.

When the **mksysb** image is created, the CPU ID is saved. If you are reinstalling the same system, then the device information is recovered. If the **mksysb** image is used to install another system, device information is *not* recovered from the **mksysb** image.

The **Default** value can be overwritten. For example, if your system had the planar replaced, or you upgraded to another system, you might want to recover devices. In these cases, you can select **yes** in the Backup Restore menu to recover devices.

## BOSINST\_DEBUG

Specifies whether to show debug output during BOS installation. The value **yes** sends **set -x** debug output to the screen during BOS installation. The possible values are **no** (default) and **yes**.







## ACCEPT\_LICENSES

Specifies whether to accept software license agreements during the BOS installation. The default is **no**. To automatically accept them, set this value to **yes**. When the software licenses agreements are not accepted during BOS installation, Configuration Assistant or Installation Assistant prompts you to view and accept them. During a BOS installation, if this value is blank, the default of **no** is assumed.

For **mksysb** installations, when the **ACCEPT\_LICENSES** field is **no**, the user is forced to accept the licenses again before continuing to use the system. When the **ACCEPT\_LICENSES** field is set to **yes**, the licenses are automatically accepted for the user. If blank, the state of the licenses is the same as when the **mksysb** was created.

## DESKTOP

Specifies the desktop to be installed. The choice of available desktops are CDE (the default), NONE, GNOME, and KDE. If you choose GNOME or KDE, you will be prompted for the *AIX Toolbox for Linux Applications* CD.

## INSTALL\_DEVICES\_AND\_UPDATES

When installing a **mksysb** image to a system with a different hardware configuration, boot from product media to get any missing device drivers installed. In addition, if the product media is a later level of AIX than the **mksysb**, software in the **mksysb** image will be updated. To prevent either of these additional installations from occurring, set this field to **no**. The default is **yes**.

## IMPORT\_USER\_VGS

Specifies whether you want any user volume groups to be automatically imported after the system has been installed. The choices are **yes** and **no**.

## ENABLE\_64BIT\_KERNEL

Specifies whether you want to enable the 64-bit kernel. The choices are **yes** and **no**.

## CREATE\_JFS2\_FS

Specifies whether you want to create enhanced journaled file systems. The choices are **yes** and **no**.

## ALL\_DEVICES\_KERNELS

Specifies whether to install all device and kernel filesets. The choices are **yes** and **no**. If you select **no**, your system will be installed with the devices and kernel specific to your system configuration. If you select **yes**, when you create a system backup of your system, you can use that system backup to install any system.

## GRAPHICS\_BUNDLE

Specifies whether to install the graphics software bundle during the BOS installation. This software bundle contains the graphics support for the Web-based System Manager and Linux desktops. The choices are **yes** and **no**.

## DOC\_SERVICES\_BUNDLE

Specifies whether to install the documentation services software bundle during the BOS installation. This software bundle contains the Documentation Library Service software, which is used for viewing and searching online documentation. The choices are **yes** and **no**.

## NETSCAPE\_BUNDLE

Specifies whether to install the Netscape Communicator software bundle during the BOS installation. This software bundle contains the Netscape Communicator software. The choices are **yes** and **no**.

## HTTP\_SERVER\_BUNDLE

Specifies whether to install the HTTP Web server software bundle during the BOS installation. This software bundle installs the HTTP Web server software. The choices are **yes** and **no**.

## KERBEROS\_5\_BUNDLE

Specifies whether to install the Kerberos 5 client software bundle during the BOS installation. This software bundle installs the Kerberos 5 client software. The choices are **yes** and **no**.

## SERVER\_BUNDLE

Specifies whether to install the AIX server software bundle during the BOS installation. This software bundle installs additional networking software, performance tools, and accounting services software. The choices are **yes** and **no**.

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**ALT\_DISK\_INSTALL\_BUNDLE**

Specifies whether to install the alternate disk installation software during the BOS installation. The choices are **yes** and **no**.

**REMOVE\_JAVA\_118**

Specifies whether to remove the Java 1.1.8 software from the current system when performing a migration installation. The choices are **yes** and **no**.

## target\_disk\_data Stanza

The `target_disk_data` stanza contains variables for disks in the machine where the program is to install BOS. The default `bosinst.data` file has one `target_disk_data` stanza, but you can add new stanzas to install BOS on multiple disks, one stanza for each disk.

Multiple `target_disk_data` stanzas can exist. They define the disks that are to contain the root volume group. Only one field (**PVID**, **PHYSICAL\_LOCATION**, **SAN\_DISKID**, **CONNECTION**, **LOCATION**, **SIZE\_MB**, **HDISKNAME**) must be non-null for BOS installation to choose a disk. The order of precedence is **PVID** (Physical Volume ID), **PHYSICAL\_LOCATION**, **SAN\_DISKID**, then **CONNECTION** (parent attribute//connwhere attribute), then **LOCATION**, then **SIZE\_MB**, and then **HDISKNAME**. The BOS installation process uses the following logic to determine how to use the `target_disk_data` stanza information:

- If **PVID** is set, BOS installation checks to see if a disk matches the value. If so, other attributes are ignored.
- If **PVID** is empty and **CONNECTION** is set, then BOS installation checks to see if the parent and connwhere attributes (separated by "//") match a disk. If they do, other attributes are ignored.
- If either **PVID** or **CONNECTION** is set, and neither value matches a disk on the target system, and no other attributes are set, an error message is generated, and a disk must be explicitly selected.
- If **PVID** is empty and **SAN\_DISKID** is set, then, for fibre channel-attached disks, BOS installation interprets the **SAN\_DISKID** as a World Wide Port Name and a Logical Unit ID (separated by "//"). The World Wide Port Name (**ww\_name**) and Logical Unit ID (**lun\_id**) can be obtained on a running system from the `lsattr` command.

The **SAN\_DISKID** field is checked before the **CONNECTION** field.

- If the **ww\_name** and **lun\_id** match a disk, other attributes are ignored.
- If either **PVID** or **SAN\_DISKID** is set, and neither value matches a disk on the target system, and no other attributes are set, an error message is generated and a disk must be explicitly selected.
- If **PVID** and **SAN\_DISKID** are empty and **CONNECTION** is set, BOS installation verifies if the **parent** and **connwhere** attributes (separated by "//") match a disk. If this is true, other attributes are ignored.
- If **CONNECTION** is set, the value does not match a disk on the target system, and no other attributes are set, an error message is generated and a disk must be explicitly selected.
- If other attributes are specified, processing occurs as described below:
  - If **LOCATION** is set, BOS installation ignores **SIZE\_MB** and **HDISKNAME**.
  - If **LOCATION** is not set and **SIZE\_MB** is, BOS installation selects disks based on **SIZE\_MB** and ignores **HDISKNAME**.
  - If **LOCATION** and **SIZE\_MB** are both empty, BOS installation chooses the disk specified in **HDISKNAME**.
  - If all fields are empty, BOS installation chooses a disk for you.

For the **PVID**, **PHYSICAL\_LOCATION**, **SAN\_DISKID**, and **CONNECTION** fields, the BOS installation process uses the following logic to determine how to use the `target_disk_data` stanza information:

- Does the information in one or more of the **PVID**, **PHYSICAL\_LOCATION**, **SAN\_DISKID**, and **CONNECTION** fields match the disk information?
- If the disk information matches the information in one of these four fields, use that information.

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- If the disk information does *not* match the information in one of these four fields, and if the **LOCATION**, **SIZE\_MB**, and **HDISKNAME** fields are not set, display an error message and prompt the user for the correct disk information.

The **PHYSICAL\_LOCATION** information can be retrieved using the **lsdev** command. For example:

```
# lsdev -Cc disk -l hdisk0 -F "name physloc"
```

returns the hdisk0 diskname and the P2/Z1-A8 physical location.

**Attention:** If **prompt=no**, do not leave the target\_disk\_data stanzas empty, unless it is unimportant which disk BOS installation overwrites. This is because the algorithm that determines the default disk for the installation is not always predictable.

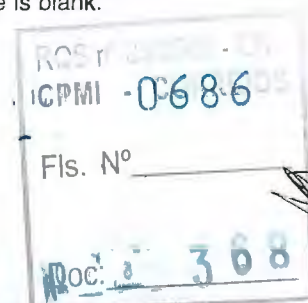
The **SIZE\_MB** field can contain either a size or the word **largest**. If a size is listed, BOS installation does a "best-fit" on the disks. If the word **largest** is in that field, BOS installation selects the largest disk. If there is more than one target\_disk\_data stanza, BOS installation selects the two "largest" disks, and so on.

<b>PVID</b>	Specifies the 16-digit physical volume identifier for the disk.
<b>PHYSICAL LOCATION</b>	The physical location code provides a way to identify fibre channel disks during BOS Install. For fibre channel disks the <b>PHYSICAL_LOCATION</b> field includes the World Wide Port Name and Lun ID that are included in the <b>SAN_DISKID</b> field. The information in the <b>PHYSICAL_LOCATION</b> field supercedes the information in the <b>SAN_DISKID</b> field.
<b>SAN_DISKID</b>	Specifies the World Wide Port Name and a Logical Unit ID for fibre channel-attached disks. The <b>ww_name</b> and <b>lun_id</b> are separated by two slashes (/). This information can be obtained on a running system from the <b>lsattr</b> command.
<b>CONNECTION</b>	Specifies the combination of the <b>parent</b> attribute and the <b>connwhere</b> attribute associated with a disk. The parent and connwhere values are separated by two slashes (/). If the <b>parent</b> value is <b>scsi0</b> and the <b>connwhere</b> value is <b>0,1</b> , then the <b>CONNECTION</b> value is <b>scsi0//0,1</b> . An example of the <b>CONNECTION</b> value for a SSA disk would be <b>ssar//000629CCC07300D</b> . In the example, the <b>parent</b> attribute is represented by <b>ssar</b> and the <b>ConnectionLocation</b> (15-character unique identity) of the disk drive <b>000629CCC07300D</b> is used for the <b>connwhere</b> attribute.
<b>SIZE_MB</b>	Specifies the formatted size of the disk, in megabytes, where the program is to install BOS. The default value is blank. You can specify the size of your target disk by typing the number of megabytes available on the formatted disk. Also, you can type <b>largest</b> if you want to use the largest disk (that has not already been selected) found by the installation program.
<b>LOCATION</b>	Specifies a location code for the disk where the program is to install BOS. The default value is blank. If you do not specify a value, the installation program assigns a value based on the next two variables. For more information about physical location codes, refer to the <i>Diagnostic Information for Multiple Bus Systems</i> guide.
<b>HDISKNAME</b>	Specifies the path name of the target disk. The default value is blank. To name a target disk, use the <i>hdiskname</i> format, where <i>hdiskname</i> is the device name of your disk (for example, <b>hdisk0</b> ).

## locale Stanza

The locale stanza contains variables for the primary language the installed machine is to use. Refer to *Understanding Locale Categories in AIX 5L Version 5.2 National Language Support Guide and Reference*, which provides information about locales and the format to use when editing variables.

<b>BOSINST_LANG</b>	Specifies the language that the installation program uses for prompts, menus, and error messages. The default value is blank.
<b>CULTURAL_CONVENTION</b>	Specifies the primary locale to install. The default value is blank.
<b>MESSAGES</b>	Specifies the locale for message catalogs to install. The default value is blank.
<b>KEYBOARD</b>	Specifies the keyboard map to install. The default value is blank.





## large\_dumplv Stanza

The optional **large\_dumplv** stanza specifies characteristics used if a dedicated dump device is to be created on the systems. A dedicated dump device is only created for systems with 4 GB or more of memory. The following characteristics are available for a dedicated large dump device:

<b>DUMPDEVICE</b>	Specifies the name of the dedicated dump device.
<b>SIZEGB</b>	Specifies the size of the dedicated dump device in gigabytes.

If the stanza is not present, the dedicated dump device is created when required. A dedicated dump device is created in machines with at least 4 Gigabytes of real memory during an overwrite install. By default, the name of the dedicated dump device is **lg\_dumplv** and its size is determined by the following formula:

4>= RAM < 12	size of dump device= 1 GB
12>= RAM < 24	size of dump device= 2 GB
24>= RAM < 48	size of dump device= 3 GB
RAM >= 48	size of dump device= 4 GB

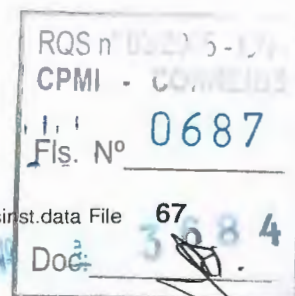
## dump Stanza

The dump stanza specifies the following system dump characteristics:

<b>PRIMARY</b>	Specifies the primary dump device to be set by <b>sysdumpdev -P -p device</b> .
<b>SECONDARY</b>	Specifies the secondary dump device to be set by <b>sysdumpdev -P -s device</b> .
<b>COPYDIR</b>	Specifies the directory to which the dump is copied at system boot.
<b>FORCECOPY</b>	Specifies whether the system boots into menus that allow copy of the dump to external media if the copy fails.
<b>ALWAYS_ALLOW</b>	Specifies whether the key mode switch can be ignored when a dump is requested.

If the stanza is not present in the **bosinst.data** file, no additional dump-device handling occurs beyond what is already in place. Checking on the values of the fields is limited; if the device specified for a dump device is not valid, any error processing comes from the **sysdumpdev** command and is sent to the console and stored in the BOS installation log.

- If **FORCECOPY** is specified and no **COPYDIR** is specified, the value field of the **autocopydump** attribute from **/etc/objrepos/SWservAt** is retrieved and used for the **sysdumpdev -[dID] copydir** operation.
- If only the **COPYDIR** is specified without **FORCECOPY** being specified, **forcecopy** defaults to yes. The **sysdumpdev -d** (**FORCECOPY** = no) or **sysdumpdev -D** (**FORCECOPY** = yes) is used to set the copy directory.
- If **ALWAYS\_ALLOW=yes**, run **sysdumpdev -K**. Otherwise, run **sysdumpdev -k**.
- If any values other than yes and no are specified for **FORCECOPY** or **ALWAYS\_ALLOW**, the default actions occur, and processing continues.
- If no value is specified for a particular dump field, no analogous **sysdumpdev** operation is performed. This leaves the system values in the appropriate state, even for a migration or system backup image installation. If a **COPYDIR** is specified but **FORCECOPY** is not specified, the value of the **forcecopydump** attribute is retrieved from the **/etc/objrepos/SWservAt** file to determine the correct form of **sysdumpdev** to invoke.





## bosinst.data File Example

The following example **bosinst.data** file shows you how customize a nonprompted network installation. The values in the **bosinst.data** file for this example are not specific to a network installation and can be applied for other types of installations, such as a **mksysb** installation.

**Note:** The depicted values illustrate formatting only and do not apply to your installation.

For information about a **bosinst.data** variable or values, see "bosinst.data File Stanza Descriptions" on page 61.

To check the contents of your customized **bosinst.data** file, use the **bicheck** command, as follows:

```
/usr/lpp/bosinst/bicheck filename
```

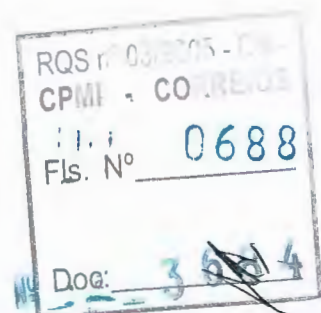
## Nonprompted Network Installation

The following is an example of a modified **bosinst.data** file that might be used in a nonprompted network installation:

```
control_flow:
  CONSOLE = Default
  INSTALL_METHOD = overwrite
  PROMPT = no
  EXISTING_SYSTEM_OVERWRITE = yes
  RUN_STARTUP = no
  RM_INST_ROOTS = yes
  ERROR_EXIT =
  CUSTOMIZATION_FILE =
  TCB = no
  BUNDLES =
  RECOVER_DEVICES = Default
  BOSINST_DEBUG = no
  ACCEPT_LICENSES = yes
  INSTALL_CONFIGURATION =
  DESKTOP = CDE
  INSTALL_DEVICES_AND_UPDATES = yes
  IMPORT_USER_VGS = yes
  ENABLE_64BIT_KERNEL = yes
  CREATE_JFS2_FS = yes
  ALL_DEVICES_KERNELS = yes
  GRAPHICS_BUNDLE = no
  DOC_SERVICES_BUNDLE = no
  NETSCAPE_BUNDLE = yes
  HTTP_SERVER_BUNDLE = yes
  KERBEROS_5_BUNDLE = yes
  SERVER_BUNDLE = yes
  ALT_DISK_INSTALL_BUNDLE = yes
  REMOVE_JAVA_118 = no
```

```
target_disk_data:
  PVID =
  CONNECTION =
  LOCATION =
  SIZE_MB =
  HDISKNAME = hdisk0
```

```
locale:
  BOSINST_LANG = en_US
  CULTURAL_CONVENTION = en_US
  MESSAGES = en_US
  KEYBOARD = en_US
```





## Chapter 10. Optional Software Products and Service Updates

After the Base Operating System (BOS) is installed, you might want to install optional software or service updates. This chapter includes information on the following topics:

- "Optionally Installed Software"
- "Software Product Identification" on page 70
- "Software Licensing" on page 70
- "Installing Optional Software Products and Service Updates" on page 71
- "Maintaining Optional Software Products and Service Updates" on page 75
- "Cleaning Up Optional Software Products and Service Updates" on page 77
- "Software Service Management" on page 79
- "InstallShield MultiPlatform Packaged Installations" on page 81
- "Emergency Fix Management" on page 86

**Note:** AIX 5.2 provides the **cdromd** CD and DVD automount facility, which is included in the **bos.cdmount** fileset. To determine if the **cdromd** daemon is enabled on your system, run the following command:

```
# lssrc -s cdromd
```

The **cdromd** daemon can interfere with scripts, applications, or instructions that attempt to mount the CD or DVD device without first checking to see if the device is already enabled. A resource or device busy error occurs in such a condition. Use the **cdumount** or **cdeject** command to unmount the device. Then mount the device as specified in the program or instructions. Alternatively, use the **cdcheck -m** or **mount** command to determine the current mount point of the device. For further information, see the **cdromd** command documentation in the *AIX 5L Version 5.2 Commands Reference*.

The installation code allows for this automatic mounting. If **cdromd** is enabled and the **mkcd** command is run, the CD-R or DVD-RAM is ejected after the image is completed. If you do not want to have the media ejected, then the **cdromd** daemon must be put in the inoperative state with the following command:

```
# stopsrc -s cdromd
```

### Optionally Installed Software

Optionally installable software includes:

- **Optional Software Products:** Software that is not automatically installed on your system when you install the BOS. Software products include those shipped with the operating system and those purchased separately. The BOS is divided into subsystems that can be individually updated, such as **bos.rte.install**. Any update that begins with **bos.rte** updates a BOS subsystem.
- **Service Updates:** Software that corrects a defect in the BOS or in an optional software product. Service updates are organized by filesets. This type of update always changes part of a fileset.

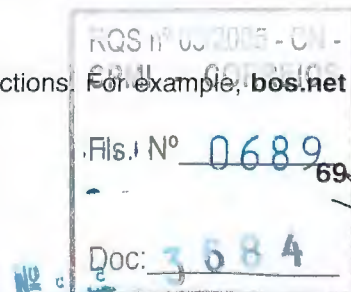
Software products can be divided into the following categories:

#### Licensed Program

A licensed program (LP) is also known as a *licensed program product* (LPP) or a *product*. An LP is a complete software product including all packages associated with that licensed program. For example, **bos** (the base operating system) is a licensed program.

#### Package

A group of separately installable units that provide a set of related functions. For example, **bos.net** is a package.







### Fileset

An individually installable option. Filesets provide a specific function. An example of a fileset is **bos.net.nfs.client 5.1**. For more information on fileset packaging, see "Fileset Installation Packaging" on page 140.

### Fileset Update

An individually installable update. Fileset updates either enhance or correct a defect in a previously installed fileset.

### Bundle

A collection of packages, products, or individual filesets that suit a specific purpose, such as providing personal productivity software or software for a client machine in a network environment. A set of bundles is provided with BOS that contain a specific set of optional software. For more information on bundle packaging, see "Bundle Packaging" on page 141.

A product can be composed of several packages, which in turn can be composed of different filesets. A product might be installed in its entirety, or only certain packages or filesets for the product might be installed. Software products are subdivided in this way, because many software products are large and have many pieces that can be used independently. Dividing a product into separately installable filesets allows you to install only those filesets you need.

You can install all the filesets included in a package or the entire product, or you can install only *selected* filesets, especially if you have limited hard disk space on your system.

---

## Software Product Identification

The product name and level number identify a software product. The format for a software product level in AIX 5.2 is as follows:

*versionnumber.releasenummer.modificationlevel.fixlevel*

Each field in the software product identification is defined as follows:

- The *versionnumber* field consists of 1 to 2 digits that identify the version number.
- The *releasenummer* field consists of 1 to 2 digits that identify the release number.
- The *modificationlevel* field consists of 1 to 4 digits that identify the modification level.
- The *fixlevel* field consists of 1 to 4 digits that identify the fix level.

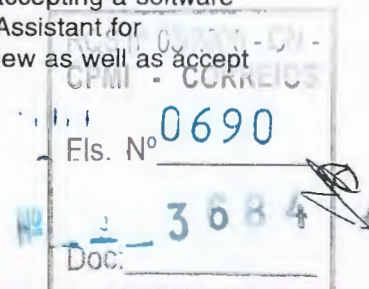
For example, 05.01.0000.0000 is a software product level number, and 05.01.0000.0032 is a software product update level. It is not necessary to include the leading zeroes in the version, release, modification level, and fix level fields of the level. Level 05.01.0000.0000 can also be written as 5.1.0.0.

---

## Software Licensing

The types of software licensing that can be implemented in the software purchase are run-time licensing and acceptance of software license agreements. Normally, software requiring run-time licenses is only selected for installation when you have a license to use that software. Although the Web-based System Manager and System Management Interface Tool (SMIT) allow you to install licensed software even if you do not own a license, you might be prevented from using the newly installed software until you have obtained the appropriate license.

Accepting software license agreements requires that the license agreement be accepted as part of the installation process. If software installed as part of your BOS installation requires accepting a software license agreement, you cannot exit the Configuration Assistant (or the Installation Assistant for non-graphics consoles) until the license agreement has been accepted. You can view as well as accept







the license agreement. The BOS installation can be customized to automatically accept software licenses. For more information, refer to Chapter 8, "Customized BOS Installations", on page 57.

For optional software installation, you can preview the license agreements on the installation media using the **smit license\_on\_media** fast path or the **installp -EI** command. During the installation process, you can use the menu item to accept the software license, or you can use the **installp** command with the **-Y** flag. To view accepted license agreements on a system, you can use the SMIT **smit installed\_license** fast path or the **lsipp -E** command. To view licenses using the Web-based System Manager, type **wsm** to start the application, and select **Software**. When a product is uninstalled, the license agreement acceptance is changed to the inactive state. If the product is reinstalled, you are not prompted to reaccept the license agreement.

After completing the prerequisites in the next section, your next step is deciding whether to install software with the Web-based System Manager or with SMIT. Descriptions of both applications are included in this chapter.

Before you install optional software and service updates, refer to the specific instructions that accompany your installation media. If you ever need to reinstall your system, refer to the installation media instructions.

**Note:** For information about developing software products that are installed using the **installp** command, refer to *Packaging Software for Installation in AIX 5L Version 5.2 General Programming Concepts: Writing and Debugging Programs*.

## Installing Optional Software Products and Service Updates

If either of the following conditions apply to you, go to the referenced section. Otherwise, continue with the procedures in this chapter.

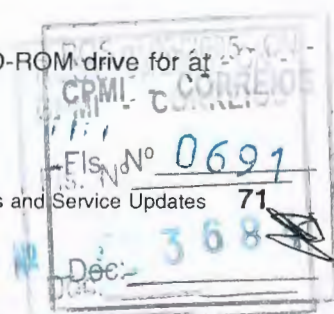
- If you need to commit updates or remove previously installed software, go to "Maintaining Optional Software Products and Service Updates" on page 75.
- If you are using a network installation server, refer to Part 3, "Network Installation", on page 163.

### Step 1. Complete the Prerequisites

Before installing optional software or service updates, complete the following prerequisites:

- You must be logged in to the system as the root user.
- AIX 5.2 BOS must be installed on your system. If the BOS is not yet installed on your system, go to Chapter 3, "Introduction to Base Operating System Installation", on page 33, or if you are installing over a network, refer to Part 3, "Network Installation", on page 163.
- Either insert the media that contains the optional software or service updates into the appropriate drive or know the local or routed path to the software.
- If you are installing service updates and do not have a current backup of your system, use the procedures in "Creating System Backups" on page 113. To create a system backup, you must have the backup fileset (**bos.sysmgt.sysbr**) installed on your system.
- If system files have been modified, back them up separately before updates are applied, because the update process might replace configuration files.
- If you are installing from CD-ROM or DVD-ROM and have a mounted *documentation CD* in the same CD/DVD-ROM drive that you want to install from, run the following commands in the sequence shown:

```
# unlnkbasecd
# umount /infocd
```
- To eject the documentation CD/DVD-ROM, press the eject button on the CD/DVD-ROM drive for at least two seconds.







## Step 2. Install Optional Software Products or Service Updates

Optional software products and service updates can be installed using system management tools provided with the operating system. The following sections provide a brief description of the procedures:

- Web-based System Manager. See "Install Optional Software Products or Service Updates with Web-based System Manager".
- System Management Interface Tool (SMIT). See "Install Optional Software and Service Updates Using SMIT" on page 73.

To view the files as they are being installed, do the following:

- In SMIT, you can set the **DETAILED Output** field to **yes** to list the files being restored during an installation.
- In Web-based System Manager, expand the **Software** container and select **Installed Software**. From the **Software** menu, select **New Software (Install/Update)** → **Install Additional Software** → **Advanced Method**. In the resulting screen, select the source drive and click on **Advanced**. In the resulting dialog, click beside **Show detailed messages**.
- You can also use the **installp** command with the verbose option (**-V2**) to show which files have been updated.

### Install Optional Software Products or Service Updates with Web-based System Manager

The graphics interface provides access to Web-based System Manager options for installing the following:

- Optional software. See "Installing Optional Software".
- Service updates. See "Installing Service Updates".
- Software bundles. See "Installing Software Bundles".

The Web-based System Manager allows you to install software, as well as to change the system's default install settings and specify other options. By default, the Web-based System Manager *applies* and *commits* any software updates you are installing. However, you can change this default setting and have the software updates applied only.

**Note:** Base software applications are always committed. If a previous version of the software is installed, it cannot be saved.

#### Installing Optional Software:

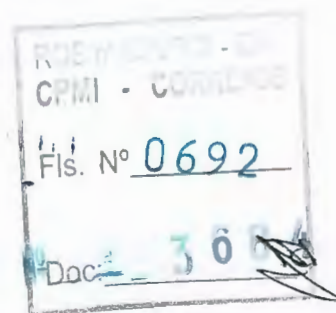
1. Start the Web-based System Manager by typing **wsm** on the command line.
2. Expand the machine name.
3. Expand **Software** in the Navigation area.
4. Select **Overview and Tasks**.
5. Select **Install Software**.

#### Installing Service Updates:

1. Start the Web-based System Manager by typing **wsm** on the command line.
2. Expand the machine name.
3. Expand **Software** in the Navigation area.
4. Select **Overview and Tasks**.
5. Select **Update Software to the Latest Level**.

#### Installing Software Bundles:

1. Start the Web-based System Manager by typing **wsm** on the command line.
2. Expand the machine name.





3. Expand **Software** in the Navigation area.
4. Select **Installed Software**.
5. From the **Software** menu, select **New Software (Install/Update)** → **Install Bundles (Easy)**.

## Install Optional Software and Service Updates Using SMIT

The following installation paths are available in SMIT:

### Install Software

Install or update software from the latest levels of software available on the media. To shorten the list of software displayed, message and locale software are omitted from the list. To use this option, type `smit install_latest` on the command line.

### Update Installed Software to Latest Level

Update all currently installed software to the latest level available on the installation media. To use this option, type `smit update_all` on the command line.

Beginning in AIX 5L Version 5.2 with the 5200-01 Recommended Maintenance package, if you select the option to install all devices and kernels during a BOS installation, then during subsequent **update\_all** processing, any new **devices.\*** filesets are installed from the installation media. This option can be turned off by setting the **ALL\_DEVICES\_KERNELS** variable in the `/var/adm/ras/bosinst.data` file to no.

### Install Software Bundle

Install complete bundles of software simply by specifying the input device and which bundle you are installing. You can also preview a bundle installation to see what software will be installed and how much space is required in the file system to install the bundle. To use this option, type `smit install_bundle` on the command line.

### Update Software by Fix

Install a specific fix for a problem. This menu allows you to list all service fixes on the media and select a fix to install. You can also preview the installation to see what software will be updated and how much space is required in the file system to apply the fix. To use this option, type `smit update_by_fix` on the command line.

### Install and Update from ALL Available Software

Install or update software from all software available on the media. To use this option, type `smit install_all` on the command line.

**Note:** If a problem occurs during the installation of optional software that causes the installation process to halt abnormally, you might have to complete a *cleanup* procedure to remove the partially installed software from the system before attempting to reinstall it. If the system instructs you to do a cleanup, go to "Cleaning Up Optional Software Products and Service Updates" on page 77.

## Completing the SMIT Installation and Reading the Status Messages

This section describes the system activity and actions that you must take after the installation process has begun.

1. When you press Enter to start the installation, the **COMMAND STATUS** screen displays. As the installation proceeds, a series of messages display. The amount of time that the installation takes varies depending on your system and the software you are installing and updating.

**Note:** The system might prompt you to insert the volume of the installation media, with a message similar to the following:

Mount volume 2 on /dev/cd0.  
Press the Enter key to continue.

When this message displays, insert the specified media and press Enter.

RCST USER - CN -
APMI - 0693
Fls. N°
Doc: 3684





When the installation finishes, the **Command: status** field on the COMMAND STATUS screen changes to **OK** or **failed**. **OK** indicates that the installation ran to completion, although some filesets may not have installed successfully. The **failed** status means that there was a problem with the installation. Although a preview installation always finishes with an **OK** status, always check the summaries.

For information about error messages, refer to "Handling System and Error Messages" on page 150.

2. When the installation halts or finishes, the screen returns to the top of the list of messages that display during installation. You can review the message list as described in the next step, or you can exit SMIT and review the **smit.log** file (**/smit.log** or **/home/user\_id/smit.log**).
3. Review the message list for error messages on software products or service updates that may not have been successfully installed. Use the following procedure to correct any errors in the installation:
  - a. Look at the pre- and post-installation summaries at the end of the message list to see whether any installation failure occurred.
  - b. Use the message list to determine problems and which software products or service updates were involved. For example, space limits might have been exceeded or the requisites might not have been met for some software. The system lists how much extra space is needed and which requisite software products or service updates to install.
  - c. Any product that is marked as **FAILED**, **BROKEN**, or **CANCELLED** can be reinstalled after the condition that caused the failure has been corrected. You do not need to reinstall any service update or software product that was marked as **SUCCESS** in the Installp Summary report. If you need to perform the installation again, change installation settings as appropriate. For example, if requisites were missing, set **AUTOMATICALLY install requisite software?** to **yes**. If there was not enough space to complete the installation, set **EXTEND file systems if space needed?** to **yes**.

If you need to install again and you have AIX BOS multivolume media, insert volume 1 of the AIX product CDs. Press F3 to return to the previous screen, then restart the installation. See "Handling System and Error Messages" on page 150 for information about **bosboot** command errors that may occur while the installation program is running, and about recovery procedures for these errors.

- d. If the installation was interrupted (for example, a power failure), you might need to use the cleanup procedure before continuing. Press F10 (or Esc+0) to exit SMIT, and refer to "Cleaning Up Optional Software Products and Service Updates" on page 77.
- e. If the software has been installed successfully, and you have no other software to install, go to Step 4.

If you have additional software to install from a different installation media, remove the media that is in that drive and insert the new media.

Press F3 (or Esc+3) to return to the previous screen and continue installing the software product or service update.

4. Press F10 (or Esc+0) to exit SMIT.
5. Remove all installation media from the drives.
6. When you are directed, reboot your system by typing:

```
# shutdown -Fr
```

### Update Installed Software to Latest Level from the Command Line

The **install\_all\_updates** command updates installed system software to the latest level that is on the media and verifies the current recommended maintenance level.

Beginning in AIX 5L Version 5.2 with the 5200-01 Recommended Maintenance package, if you select the option to install all devices and kernels during a BOS installation, then during subsequent **update\_all** processing, any new **devices.\*** filesets are installed from the installation media. This option can be turned off by setting the **ALL\_DEVICES\_KERNELS** variable in the **/var/adm/ras/bosinst.data** file to no.





If the **ALL\_DEVICES\_KERNELS** variable is set to no, the **install\_all\_updates** command does not install any filesets that are present on the installation media but not installed on the system, unless these filesets are installed as requisites of other selected filesets.

For **installp** images, all **installp** requisites are enforced.

The following example shows how to install all **installp** updates on the **/dev/cd0** device and to verify the current recommended maintenance level:

```
# install_all_updates -d /dev/cd0
```

For more information about the **install\_all\_updates** command, refer to the *AIX 5L Version 5.2 Commands Reference*.

## Maintaining Optional Software Products and Service Updates

During and after installation, the following major maintenance actions can be taken with optional software products and service updates. Optional software and service updates can be:

- Applied. See "Apply Action (Service Updates Only)".
- Committed. See "Commit Action (Service Updates Only)" on page 76.
- Rejected. See "Reject Action (Service Updates Only)" on page 76.
- Removed. See "Remove Action (Software Products Only)" on page 77.

Whether a particular action can be taken depends on whether the action is being applied to the entire software product, or only to a service update that has had a previous action taken on it.

You can perform these actions using either the Web-based System Manager or the System Management Interface Tool (SMIT) or by using commands directly from the command line. The following sections briefly describe how to do each action using Web-based System Manager, SMIT, or a command. Both Web-based System Manager and SMIT provide online help to guide you through each process.

### Apply Action (Service Updates Only)

When installing a service update, it can be left in the *applied* state. In this state, the former version of that software product is saved in the **/usr/lpp/PackageName** directory. Service Updates in the applied state allow you to restore the former version of the software without having to reinstall it.

Only service updates can be placed in the applied state. In contrast, after you install an entire software product, the product is left in the *committed* state. Software products in the committed state do not save the previous version of the software, because two versions of the same software product cannot be installed at the same time.

#### To apply a service update using Web-based System Manager:

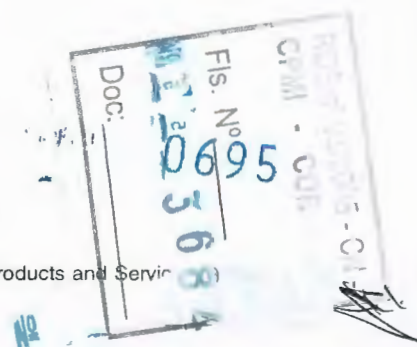
1. Start the Web-based System Manager by typing **wsm** on the command line.
2. Expand the machine name.
3. Expand **Software**.
4. Select **Overview and Tasks**.
5. Select **Update Software to the Latest Level**.

#### To apply a service update using SMIT:

Type **smit update\_by\_fix** on the command line.

#### To apply a service update from the command line:

Use the **installp -a** command to only apply the update.







## Commit Action (Service Updates Only)

Committing a service update removes the previous version of a product from the system, which conserves disk space. After a software product or update has been committed, it cannot be deleted from the system except by removing the entire software product (the base level product and all of its updates) or by force-installing it back to a previous level. To do a force-installation, you must have the base level of the fileset available on media.

Although applying and committing a service update are considered separate actions, both can be accomplished while installing the update. In fact, the default action under Web-based System Manager and SMIT is to both apply and commit the service update during installation. This default can be changed to just apply the update.

### To commit a service update using Web-based System Manager:

1. Start the Web-based System Manager by typing `wsm` on the command line.
2. Expand the machine name.
3. Expand the **Software** container.
4. Select **Installed Software**.
5. From the **Software** menu, choose **Software Utilities -> Commit Applied Updates**.

You can list all service updates in the applied state by selecting **List Installed Software -> Updates in Applied State** from the Software menu.

### To commit a service update using SMIT:

Type `smit commit` on the command line.

You can list all service updates in the applied state by typing `smit list_installed` on the command line.

### To commit a service update from the command line:

Use the `installp -c` command to commit applied updates.

You can list all service updates in the applied state by typing `installp -s` on the command line.

## Reject Action (Service Updates Only)

When you reject an applied service update, the update files are removed from the system and the previous version of the software is restored. Only service updates in the applied state can be rejected. You can use the Web-based System Manager or SMIT to reject applied service updates.

### To reject a service update using Web-based System Manager:

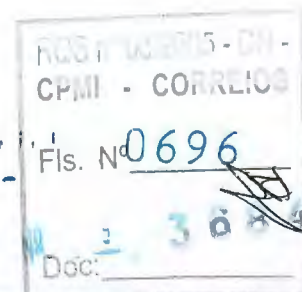
1. Start the Web-based System Manager by typing `wsm` on the command line.
2. Expand the machine name.
3. Expand the **Software** container.
4. Select **Installed Software**.
5. From the **Software** menu, choose **Software Utilities -> Reject Applied Updates**.

### To reject a service update using SMIT:

Type `smit reject` on the command line.

### To reject a service update from the command line:

Use the `installp -r` command to reject an applied update.





## Remove Action (Software Products Only)

When you remove a software product, that product's files are removed from the system and the Software Vital Product Data information is changed to indicate that the product is removed. The remove process also attempts to restore the system's configuration to its previous state, although this is dependent on the product and might not always be complete. After a product is removed, no version of that product remains running on the system.

Use the Web-based System Manager or SMIT to remove software products. In either application, if you set the **Remove dependent software?** field to **yes**, any requisite software (software that is dependent on the product you are removing) is also removed, unless it is required by other software on your system.

### To remove a software product using Web-based System Manager:

1. Start the Web-based System Manager by typing `wsm` on the command line.
2. Expand the machine name.
3. Expand the **Software** container.
4. Select **Installed Software**.
5. Select the software product you want to remove.
6. From the **Selected** menu, choose **Remove Software**.

### To remove a software product using SMIT:

Type `smit remove` on the command line.

### To remove a software product from the command line:

Use the `geninstall -u` command to remove the product.

## Copy Software Bundle to Hard Disk for Future Installation

The Copy Software Bundle to Hard Disk for Future Installation option allows you to copy a software bundle from a specified source to a location on your local system.

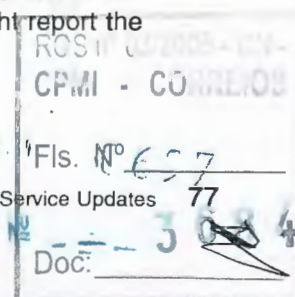
Installation software bundles include the following:

- Alt\_Disk\_Install
- CDE
- DocServices
- GNOME
- Graphics
- HTTP\_Server
- KDE
- Kerberos\_5

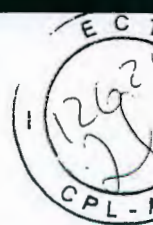
## Cleaning Up Optional Software Products and Service Updates

**Note:** This procedure applies only to the update or installation of optional software products. If your AIX 5.2 BOS installation was unsuccessful, see "Accessing a System That Does Not Boot" on page 147 for more information.

This section describes how to clean up software products and service updates after an interrupted installation. The cleanup procedure attempts to delete items that were partially installed or left in an incomplete state. For example, after an update is interrupted, the `lspp -l` command might report the update status as **APPLYING** rather than **APPLIED**.







The cleanup procedure attempts to revert the update to its previous state. For example, when cleaning up an update that was interrupted in the **COMMITTING** state, the cleanup procedure attempts to return the update to its **APPLIED** state.

If the interruption occurs during the initial state of an installation, then the cleanup procedure attempts to delete the installation entirely and restore the previous version of the product (if there is one). When the previous version is restored, it becomes the active version. When the previous version cannot be restored, the software is listed by the **lspp -l** command as **BROKEN**.

When the product is deleted or **BROKEN**, you can attempt to reinstall the software. Any product in the **BROKEN** state cannot be cleaned up; it can only be reinstalled or removed.

The system automatically initiates a cleanup when an installation fails or is interrupted. Normally, you must initiate a cleanup procedure if the system shuts down or loses power during an installation or if the installation process terminates abnormally. Occasionally, you are prompted to reboot (restart) the system after running the cleanup procedure.

#### To initiate a cleanup procedure using Web-based System Manager:

1. Start the Web-based System Manager by typing **wsm** on the command line.
2. Expand the machine name.
3. Expand the **Software** container.
4. Select **Installed Software**.
5. From the **Software** menu, choose **Troubleshooting** → **Cleanup Failed or Interrupted Installation**.

#### To initiate a cleanup procedure using SMIT:

1. Type **smit maintain\_software** on the command line.
2. Select **Clean Up After Failed or Interrupted Installation**.

#### To initiate a cleanup procedure from the command line:

Type **installp -C** on the command line.

If you get a message indicating that no products were found that could be cleaned up, you may have run the cleanup procedure when it was not needed. Try your installation again.

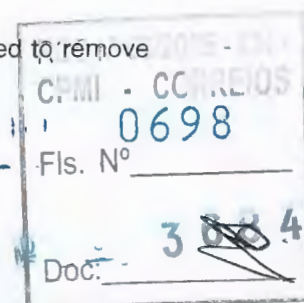
If you get a message indicating that you need to clean up a failed installation, contact your point of sale for assistance.

## Manage an Existing installp Image Source

The **lppmgr** command is used to manage an existing **installp** image source. The **lppmgr** command performs the following functions on an existing **installp** image source (also known as an **lpp\_source** resource in the NIM environment):

- Remove duplicate updates (**-u** flag).
- Remove duplicate base levels (**-b** flag).
- Eliminate update images that are the same level as base images of the same fileset. Such update images can create conflicts that lead to installation failure (**-u** flag).
- Remove message and locale filesets other than the language you specify (**-k** flag).
- Remove superseded filesets (**-x** flag).
- Remove non-system images from a NIM **lpp\_source** resource (**-X** flag).

By default, **lppmgr** lists all images filtered by the preceding routines. The **-r** flag can be used to remove the filtered images and the **-m** flag can be used to move the images to another location.







The **lppmgr** command does not replace the **bffcreate** command, perform installations, or work with installed filesets. Before using the **-X** flag, it is recommended that you have a good understanding of NIM, system images (known as SIMAGES in NIM), and the workings of a NIM **lpp\_source** resource.

To list all duplicate and conflicting updates in the **/myimages** image source directory, type:

```
# lppmgr -d /myimages -u
```

To remove all duplicate and conflicting updates in the **/myimages** image source directory, type:

```
# lppmgr -d /myimages -u -r
```

For more information about the **lppmgr** command, refer to the *AIX 5L Version 5.2 Commands Reference*.

---

## Software Service Management

The Software Service Management menu generates comparison reports to manage filesets installed on a system, filesets contained in a repository, and filesets available from the IBM eServer pSeries support Web site. The Software Service Management menu also provides a way for you to clean up and rename software images in a repository. The following options are available:

- "Comparison Reports"
- "Rename Software Images in Repository" on page 80
- "Clean Up Software Images in Repository" on page 81

You can perform these actions using either the SMIT **service\_software** fast path or by using commands directly from the command line. The following sections briefly describe how to do each action using SMIT or a command.

### Comparison Reports

The Comparison Reports menu allows you to generate several comparison reports to verify that the filesets for a particular fix or preventive maintenance package are installed by comparing filesets installed on a system to another source. This source could be a fix repository, such as an **lpp\_source** or a directory of fixes, or a downloaded list from the IBM eServer pSeries support Web site.

If you want to verify that your **lpp\_source** is up to date, you can also compare a fix repository to a downloaded list.

You can perform these actions in the SMIT **compare\_report** fast path or using the **compare\_report** command.

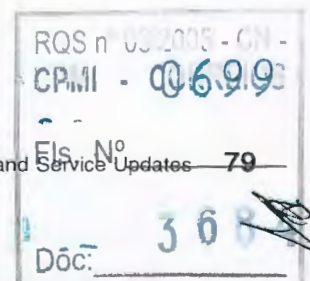
### Compare Installed Software to Fix Repository

The Compare Installed Software to Fix Repository menu allows you to compare the filesets installed on a system to a fix repository. The following report lists are generated:

- Filesets on the system that are back-level (**lowerlevel.rpt**)
- Filesets on the system that are at a later level (**higherlevel.rpt**)
- Filesets in the fix repository that are not installed on the system (**notinstalled.rpt**)
- Filesets installed on the system that are not in the fix repository (**no\_update\_found.rpt**)

The Compare Installed Software to Fix Repository option is available using the SMIT **instofix\_compare** fast path or the **compare\_report** command with the following options:

```
compare_report -s -i FixDir {[ -l ] [ -h ] [ -m ] [ -n ]} \  
[ -t ReportDir -Z | -v ]
```







## Compare Installed Software to List of Available Updates

The Compare Installed Software to List of Available Updates menu allows you to compare the filesets installed on a system to a downloaded list of available updates from the IBM eServer pSeries service Web site. The following report lists are generated:

- Filesets on the system that are back-level from the latest (**lowerthanlatest1.rpt**)
- Filesets on the system that are at a later level from the latest maintenance level (**higherthanmaint.rpt**)
- Filesets on the system that are back-level from the latest maintenance level (**lowerthanmaint.rpt**)

The Compare Installed Software to List of Available Updates option is available using the SMIT **instolist\_compare** fast path or the **compare\_report** command with the following options:

```
compare_report -s -r ServiceReport {[ -l ] [ -h ] } [ -t ReportDir -Z | -v ]
```

## Compare Fix Repository to List of Available Updates

The Compare Fix Repository to List of Available Updates menu allows you to compare the filesets in a fix repository, such as a fix directory or **lpp\_source**, to a downloaded list of available updates from the IBM eServer pSeries service Web site. The report list that is generated contains information on filesets in the fix directory that are back-level from latest (**lowerthanlatest2.rpt**).

The Compare Fix Repository to List of Available Updates option is available using the SMIT **fixtolist\_compare** fast path or the **compare\_report** command with the following options:

```
compare_report -i FixDir -r ServiceReport [ -t ReportDir -Z | -v ]
```

## Compare a List of Installed Software on a Base System to Another System

You can also compare a list of installed software on a base system to another system. This option allows you to compare the filesets installed on a system to another system. The **lsipp -Lc** output from one system is saved to a file and compared with the **lsipp -Lc** output from another system. The following report lists are generated:

- A list of base system installed software that is at a lower level (**baselower.rpt**)
- Filesets not installed on the base system, but installed on the other system (**otheronly.rpt**)
- A list of base system installed software that is at a higher level (**basehigher.rpt**)
- Filesets installed on the base system that are not installed on the other system (**baseonly.rpt**)

To compare a list of installed software on a base system to another system use the **compare\_report** command with the following options:

```
compare_report -b BaseList -o OtherList {[ -l ] [ -h ] [ -m ] [ -n ] } [ -t ReportDir -Z | -v ]
```

## Rename Software Images in Repository

The Rename Software Images in Repository option allows you to rename updates that have FIX ID numbers for names, to more meaningful fileset names like those generated when updates are copied to hard disk for future installation. This action renames all filesets in the indicated directory with the same format. This option is available using the SMIT **rename\_software** fast path.

You can also use the **bffcreate** command to rename software images in a directory. To rename software images in a directory using the **bffcreate** command, use the **-c** flag and the **-d** flag for the directory containing the filesets. For example, to rename filesets in the **/usr/sys/inst.images** directory, type:

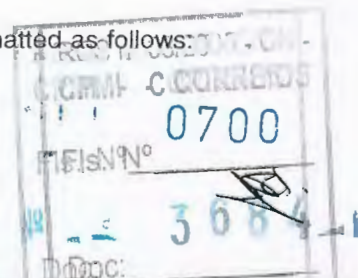
```
# /usr/sbin/bffcreate -cd /usr/sys/inst.images
```

You can also create a log file containing a mapping between the old names and new names, using the **-s logfile** option, as shown in the following example:

```
# /usr/sbin/bffcreate -cd /usr/sys/inst.images -s /usr/sys/inst.images/names.log
```

This example creates a **/usr/sys/inst.images/names.log** file that contains content formatted as follows:

```
old_fileset_name:new_fileset_name
```





This option is also available in SMIT Rename Software Images in Repository menu as the **LOG software name changes (location of log file)** option.

## Clean Up Software Images in Repository

The Clean Up Software Images in Repository option allows you to remove unneeded or duplicate software images from a local software-image repository. You can remove duplicate software, superseded updates, and language software:

- The Remove Duplicate software option allows you to remove duplicate base and update images from the specified directory.
- The Remove Superseded updates option allows you to remove superseded filesets from the specified directory. This action applies only to update images.
- The Remove Language software option allows you to remove language and locale filesets that are not needed on your system. This option removes all language and locale filesets from the specified directory, except the language specified in the PRESERVE language field. By default, the value of the **LANG** environment variable for the system is used to determine the language to preserve.
- The Save Removed files option allows you to save all removed files to the location specified in the **DIRECTORY for storing saved files** field. Select true in this field if you want to move the images to another location instead of removing them from the hard drive.

This option is available using the SMIT **cleanup\_software** fast path.

## InstallShield MultiPlatform Packaged Installations

Some products that are distributed for installation on AIX are packaged and installed with InstallShield MultiPlatform (ISMP). Unlike **installp** or RPM Package Manager (RPM) installations which only provide nonprompted or silent installations of a product, ISMP-packaged products provide both interactive and silent interfaces for installing and uninstalling a product.

Similar to products packaged and installed with **installp** and RPM, ISMP-packaged products can be installed using the AIX system management tools, including SMIT and Web-based System Manager. These tools use the **geninstall** command to install or uninstall products that are packaged and installed with **installp**, RPM, or ISMP. As expected, the **geninstall** command can be used directly to install, list, or uninstall ISMP-packaged products.

For instructions for installing or uninstalling a specific product packaged and installed with ISMP, consult the product's documentation.

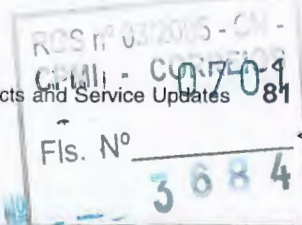
This section provides information about the following topics:

- "Installing an InstallShield MultiPlatform Product"
- "Uninstalling an InstallShield MultiPlatform Product" on page 82
- "Silent Installations and Using Response Files" on page 83
- "Using Response Files with NIM" on page 86

## Installing an InstallShield MultiPlatform Product

You install an InstallShield MultiPlatform product using SMIT, Web-based System Manager, the **geninstall** command, or the files provided by the product.

- Use the SMIT **install\_software** fast path to install ISMP products without knowledge of the exact location of the product installation files. For information on installing optional software using SMIT, see "Installing Optional Software Products and Service Updates" on page 71. Use the F4 key on the **SOFTWARE to install field** to select the product you want to install. ISMP products are displayed in the list similar to **installp** packages or RPM packages. Select the ISMP products, and press Enter to begin the installation.







By default, ISMP product installations launched through SMIT is *silent* or *nonprompted* installations. To perform an interactive installation, use the Web-based System Manager, the **geninstall** command, or the instructions provided with the product documentation.

Although SMIT has a preview option, this option is not available for ISMP installations. If you select the preview option, a message instructs you to launch an interactive installation using Web-based System Manager or the command line, which allows you to view the preinstallation summary panel before completing the product installation.

- Use the Software Application in the Web-based System Manager to launch ISMP-packaged product installations. For information on installing optional software using the Web-based System Manager, see "Installing Optional Software Products and Service Updates" on page 71. When you press the **Browse** button to list products on the media, ISMP-packaged products are displayed in the list.

**Note:** If you select the preview option, but proceed through the entire installation wizard, the product is installed. Most ISMP products include a preinstallation summary panel that provides preview information about the installation, including space requirements and file system expansion. If you do not want to proceed with the installation after viewing this information, press the **CANCEL** button to exit the wizard.

- Use the **geninstall** command to install an ISMP-packaged product. To perform an interactive installation, specify the device or directory containing the product installation files with the **-d** flag and specify the product name. The product name is the same as the subdirectory name containing the product installation files. For example, if we have a product called MyProduct, and the product installation files are in the `/usr/sys/inst.images/ismpppc/MyProduct/` directory, use the following command for an interactive installation:

```
/usr/sbin/geninstall -d /usr/sys/inst.images MyProduct
```

OR

```
/usr/sbin/geninstall -d /usr/sys/inst.images J:MyProduct
```

Use the **J:** prefix to inform the **geninstall** command that the product is an ISMP package. The **geninstall** command recognizes the **ismpppc** subdirectory, just as it recognizes **RPMS/ppc** for RPM packages and **installppc** for **installp** packages, so it is only necessary to pass the `/usr/sys/inst.images` base directory. You can also use the directory that contains the installation files. In this example, specify the directory as follows:

```
/usr/sbin/geninstall -d /usr/sys/inst.images/ismpppc/MyProduct J:MyProduct
```

If you want to launch a *silent* or *nonprompted* installation with **geninstall**, include the **-Z** flag:

```
/usr/sbin/geninstall -d /usr/sys/inst.images -Z J:MyProduct
```

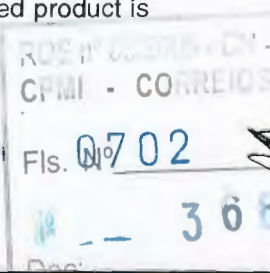
For more information about silent installations, see "Silent Installations and Using Response Files" on page 83.

- You can use the installation files provided by the product developer to install an ISMP-packaged product. The product developer might provide a script or executable that can be used to launch an ISMP-packaged product installation. For more information, refer to the documentation provided with the product.

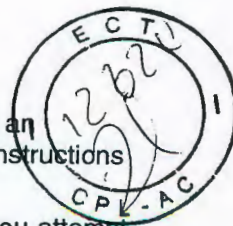
## Uninstalling an InstallShield MultiPlatform Product

You uninstall an ISMP product using SMIT, Web-based System Manager, the **geninstall** command, or the files provided by the product's developer.

- You can use the SMIT **remove** fast path to uninstall an ISMP-packaged product. If you use the F4 key to list the installed software for the **SOFTWARE to remove** field, the ISMP-packaged product is displayed in the list. You can also type the name of the product in the field.







By default, uninstallation processes performed in SMIT are *silent* or *nonprompted*. To perform an interactive uninstallation, use Web-based System Manager, the **geninstall** command, or the instructions provided with the product documentation.

In SMIT, the preview option is not available for the ISMP product uninstallation procedure. If you attempt to preview the uninstallation, a message instructs you to launch an interactive uninstallation using Web-based System Manager or the command line. This allows you to view the pre-uninstallation summary panel before completing the product uninstallation.

- You can use the Software Application in Web-based System Manager to uninstall ISMP-packaged products.

**Note:** If you select the preview option, but proceed through the entire uninstallation wizard, the product is uninstalled. Most ISMP products include a pre-uninstallation summary panel that provides preview information about the uninstallation. If you do not want to proceed with the installation after viewing this information, press the **CANCEL** button to exit the wizard.

- You can use the **geninstall** command to perform an uninstallation for an ISMP-packaged product. To perform the uninstallation interactively, specify the **-u** flag for uninstallation, and the product name. For example, to uninstall the *MyProduct* product, type the following:

```
/usr/sbin/geninstall -u MyProduct
```

OR

```
/usr/sbin/geninstall -u J:MyProduct
```

To speed processing, use the **J:** prefix to inform the **geninstall** command that you are uninstalling an ISMP-packaged product.

To perform a *silent* or *nonprompted* uninstallation with the **geninstall** command, use the **-Z** flag, as follows:

```
/usr/sbin/geninstall -Zu J:MyProduct
```

- You can use installation files provided by the product developer to uninstall an ISMP-packaged product. The product developer might provide instructions for performing an ISMP-packaged product uninstallation. For more information, see the documentation provided with the ISMP product.

## Silent Installations and Using Response Files

The section provides information on how to perform silent installations for ISMP-packaged products using response files.

A response file contains predetermined responses for an installation. By default, the **geninstall** command searches on the product media in the ISMP-product subdirectory for response files for each ISMP product. For example, the *MyProduct* ISMP product subdirectory is similar to the following:

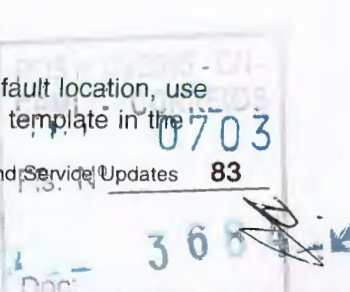
```
/basedir/ismpppc/MyProduct/
```

The **geninstall** command searches in the ISMP-product subdirectory for each ISMP product specified in the install list or bundle for a **\*.response** file. If multiple **\*.response** files are found, the file named **Product.response** is used. If a **\*.response** file does not exist, a warning message is displayed and the installation of the ISMP product is skipped.

The **-t ResponseFileLocation** option allows you to specify an alternate location for response files or response file templates. The *ResponseFileLocation* can either be a file or directory name. If the *ResponseFileLocation* is a directory, it must already exist. If the *ResponseFileLocation* is not an existing directory, it is assumed that a file name is specified.

To use response files with ISMP products, the following methods are available:

- Create a response file template. To create an ISMP response file template in the default location, use the **geninstall** command with the **-T** flag. The **-T** flag creates an ISMP response file template in the







default location, which is the directory containing the product installation files. The resulting template can be used to create a response file for future installations of the same product with the desired options. Creation of the response file template does not result in installation of the ISMP product.

To create an ISMP response file template for the MyProduct ISMP product using the product installation files in the /usr/sys/inst.images/ismpppc/MyProduct/ default directory, do the following:

```
/usr/sbin/geninstall -d /usr/sys/inst.images -T J:MyProduct
```

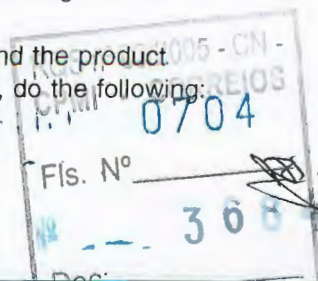
The MyProduct.template response file template that is generated is similar to the following:

```
#####
#
# InstallShield Options File Template
#
# Wizard name: Setup
# Wizard source: setup.jar
# Created on: Tue Jun 25 10:59:55 CDT 2002
# Created by: InstallShield Options File Generator
#
# This file can be used to create an options file (i.e., response file) for the
# wizard "Setup". Options files are used with "-options" on the command line to
# modify wizard settings.
#
# The settings that can be specified for the wizard are listed below. To use
# this template, follow these steps:
#
# 1. Enable a setting below by removing leading '###' characters from the
# line (search for '###' to find settings you can change).
#
# 2. Specify a value for a setting by replacing the characters <value>.
# Read each settings documentation for information on how to specify its
# value.
#
# 3. Save the changes to the file.
#
# 4. To use the options file with the wizard, specify -options <filename>
# as a command line argument to the wizard, where <filename> is the name
# of this options file.
#
#####
#####
#
# My Product Install Location
#
# The install location of the product. Specify a valid directory into which the
# product is installed. If the directory contains spaces, enclose it in
# double-quotes. For example, to install the product to C:\Program Files\My
# Product, use
#
# -P installLocation="C:\Program Files\My Product"
#
### -P installLocation=<value>
```

Although the preceding is a simple example, products often have many user-configurable options that might be set in the response file. Each of these options is presented in the template with an explanation of the expected value for that option.

- Create a response file recording. To create a response file recording, use the **geninstall** command with the **-E** flag. The **-E** flag creates an ISMP response file recording in the default location, which is the directory containing the product installation files. This option requires running the ISMP installation interactively and completely. The resulting response file can be used with the **-R** flag to select the same options on future installations of the same product. Creation of the response file recording will also result in installation of the ISMP product.

To record the MyProduct.response response file with the MyProduct ISMP product and the product installation files in the /usr/sys/inst.images/ismpppc/MyProduct/ default directory, do the following:







```
/usr/sbin/geninstall -d /usr/sys/inst.images -E J:MyProduct
```

This starts the interactive installation wizard. It is necessary to run the wizard to completion to successfully create the response file recording. When completed, a message similar to the following displays:

Options record mode enabled - run the wizard to completion to create the options file response.file

The resulting file `MyProduct.response` response file is similar to the following:

```
#####
#
# InstallShield Options File
#
# Wizard name: Setup
# Wizard source: setup.jar
# Created on: Tue Jun 25 11:05:34 CDT 2002
# Created by: InstallShield Options File Generator
#
# This file contains values that were specified during a recent execution of
# Setup. It can be used to configure Setup with the options specified below when
# the wizard is run with the "-options" command line option. Read each setting's
# documentation for information on how to change its value.
#
# A common use of an options file is to run the wizard in silent mode. This lets
# the options file author specify wizard settings without having to run the
# wizard in graphical or console mode. To use this options file for silent mode
# execution, use the following command line arguments when running the wizard:
#
# -options "record.txt" -silent
#
#####
#
# My Product Install Location
#
# The install location of the product. Specify a valid directory into which the
# product is installed. If the directory contains spaces, enclose it in
# double-quotes. For example, to install the product to C:\Program Files\My
# Product, use
#
# -P installLocation="C:\Program Files\My Product"
#
-P installLocation="/opt/MyProduct"
```

The **-P installLocation** value has been completed according to the response given while running the wizard. In the preceding example, the **/opt/MyProduct** directory was specified as the installation location in the wizard. The response file generated by this action can be used directly to launch a silent installation with the chosen installation location.

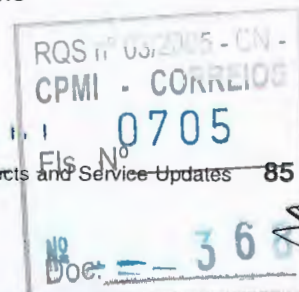
- Use a response file for a silent installation. You can use a response file generated by the two methods mentioned previously or one provided with the product to perform a silent installation with the desired options.

To use a response file for a silent installation with the **geninstall** command, the **MyProduct** product, and the installation files and response file in the `/usr/sys/inst.images/ismpppc/MyProduct/` default directory, do the following:

```
/usr/sbin/geninstall -Zd /usr/sys/inst.images -R J:MyProduct
```

To use a response file for a silent installation with the **geninstall** command, **MyProduct** product, installation files in `/usr/sys/inst.images/ismpppc/MyProduct/` directory, and the `/tmp/MyProduct/MyProduct.response` response file, do the following:

```
/usr/sbin/geninstall -Zd /usr/sys/inst.images -R \
-t /tmp/MyProduct/MyProduct.response J:MyProduct
```





## Using Response Files with NIM

If you are using NIM to install an ISMP-packaged product on one or more NIM clients, you can create and use a separate response file for each client. This is useful when there are properties of the installation operation that must be configured differently for each client. In order to install multiple clients, you must name each response file **CLIENT\_NAME.response**. These response files must be located in the default location (the same location as the product installer files).

For example, to install the **MyProduct** ISMP-packaged product located in an **lpp\_source** resource in the **/export/lpp\_source/lpp\_source1/ismpppc/MyProduct** directory on the **CLIENT1** and **CLIENT2** clients, do the following:

1. Create a **CLIENT1.response** and **CLIENT2.response** response file.
2. Place the response files in the **/export/lpp\_source/lpp\_source1/ismpppc/MyProduct** directory.
3. Create the correct responses for each client in the corresponding response file.
4. When you run the NIM **cust** operation to install the **MyProduct** ISMP-packaged product on **CLIENT1** and **CLIENT2**, the response files are used automatically and appropriately for each client.

If you want to use the same response file for all clients, name the response file **PRODUCT\_NAME.response** and place in the same default location as the ISMP-packaged product (the product location in the **lpp\_source** resource). For example, create a response file called **MyProduct.response** in the **/export/lpp\_source/lpp\_source1/ismpppc/MyProduct/** directory. If there are no client response files when you perform the NIM **cust** operation, the **MyProduct.response** file is used automatically.

## Emergency Fix Management

The emergency fix (efix) management solution allows users to track and manage efices on a system. You might get an efix package as an emergency fix, debug code, or test code. The efix package might contain commands, library archive files, or scripts that run when the efix is installed.

The efix management solution consists of: the efix packager (**epkg**) command and the efix manager (**emgr**) command.

The **epkg** command creates efix packages that can be installed by the **emgr** command. The **emgr** command installs, removes, lists, and verifies system efices.

**Note:** In this section when the term *package* is used, **installp**'s reference is the term *fileset*.

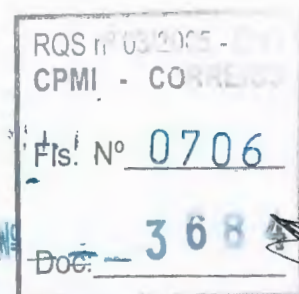
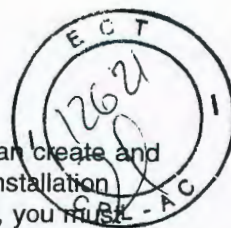
This section includes the following information:

- "Installing and Managing Emergency Fixes"
- "Additional Emergency Fix Information" on page 91
- "Packaging Emergency Fixes" on page 95

## Installing and Managing Emergency Fixes

The **emgr** command installs, removes, lists, and verifies system efices. The **emgr** command installs and manages packages created with the **epkg** command, and maintains a database with efix information on the system. The **emgr** command performs the following operations:

- "Package Installation Operation" on page 87
- "Removal Operation" on page 88
- "Listing Operation" on page 89
- "Checking Operation" on page 90
- "Mount Installation Operation" on page 90
- "Mounting and Unmounting Operations" on page 91







- "Display Package Locks Operation" on page 91
- "Force Removal Operation" on page 91

### Package Installation Operation

The **emgr** command installs efix packages that are created with the **epkg** command. The following example shows how to install an efix package:

```
emgr -e efix pkg | -f input file [-w dir] [-bkpIqmFX]
```

The efix package installation operation consists of the following phases:

1. "Installation Preview Phase"
2. "Installation Phase"
3. "Summary and Cleanup Phase" on page 88

**Installation Preview Phase:** During the installation preview phase, the following steps occur:

1. The efix manager initializes all commands and libraries, and extracts the efix metadata from the efix package.
2. The efix attributes and description are listed.
3. The **emgr** command performs a lock checking procedure by checking the installed efix data if the target files that are being delivered by this efix package already have existing efices installed. If one or more efix files that are delivered by this efix package are locked, the **emgr** command does not allow the installation or installation preview operation to proceed.
4. The **emgr** command performs prerequisite verification. If the user supplied an **installp** prerequisite file, the **emgr** command checks the prerequisites at this stage. If one or more of the prerequisites is not met, the **emgr** command does not allow the installation or installation preview operation to proceed.
5. The **emgr** command checks for space requirements by checking if the target file systems contain adequate space for the installation of the efix package. This includes space for unpacking the efix files, creating database entries, saving replaced files, installing efix files, creating efix mounts when using the **-m** flag, archiving library members, and other miscellaneous tasks. The **emgr** command also adds a small buffer to the various space calculations to account for file metadata and other factors.

If the user specifies the auto-expand flag using the **-X** flag, then the **emgr** command attempts to expand the file system to the required size. If space requirements can not be ultimately met, the **emgr** command halts the installation.

If the user specifies a preview installation operation using the **-p** flag, then the **emgr** command only reports the space statistics without attempting expansion. Also, if the user specifies a preview installation operation using the **-p** flag, the **emgr** command does not perform the efix installation phase and skips to the summary and cleanup phase.

**Installation Phase:** During the installation phase, the following steps occur:

1. During the efix installation setup step, the entire efix package is unpacked and the installation tools are initialized.
2. If a **pre\_install** script is specified, it is run. If the **pre\_install** script returns a failure, the **emgr** command halts the installation. If the **pre\_install** script succeeds, the **emgr** command proceeds with the installation and sets the efix state to **INSTALLING**.
3. Any files that are replaced by efix files in the efix package are saved to a secured directory. If the efix package does not deliver any files, this step is skipped.

From this point forward, any major failure causes the **emgr** command to run a failure-cleanup procedure, which attempts to clean up the failed installation. If this process fails, the efix is placed into the **BROKEN** state.

4. All efix files are installed to their target locations. If the installation is a mount installation operation using the **-m** flag, then the **emgr** command creates a unique mount file within the parent directory of the target file. The target file is then over-mounted by the efix mount point. For more information about the mount installation operation, see "Mount Installation Operation" on page 90.





5. Package locking occurs. The efix package locks are then processed. If the installer for which the efix package is created supports efix package locking, the **emgr** command locks the package associated with the efix files installed in step 4. For example, the **installp** command supports efix locking, so an efix created for an **installp** package will support efix package locking.
6. If a **post\_install** script is specified it is then run. If the **post\_install** script returns a failure, the **emgr** command halts the installation.
7. Reboot processing occurs. If the efix package specifies that a reboot operation is required, the **emgr** command issues a message to the user and makes any necessary changes to the boot image. The **emgr** command does *not* reboot the system automatically.
8. At this point, all installation steps have succeeded and the **emgr** command changes the efix state to STABLE for a standard installation operation, or MOUNTED for a mount installation operation.

**Summary and Cleanup Phase:** During the summary and cleanup phase, the following steps occur:

1. The **emgr** command displays a summary of all operations and results. If more than one efix package was specified with an input file using the **-f** flag, the **emgr** command provides a report for each efix package.
2. The **emgr** command cleans up any temporary directories and files. It also unloads any memory modules that have been loaded into memory.

## Removal Operation

The efix removal operation removes an installed efix. You can specify an individual efix by using one of the efix identification methods or specifying several individual efixes by using a list file. For more information about the efix identification methods, see "Referencing Emergency Fixes" on page 91.

The syntax for removing an installed efix is as follows:

```
emgr -r -L label | -n efix num | -u VUID | -f lfile [-w dir] [-bkpIqX]
```

The efix package removal operation consists of the following phases:

1. "Removal Preview Phase"
2. "Removal Phase"
3. "Summary and Cleanup Phase" on page 89

**Removal Preview Phase:** During the removal preview phase, the following steps occur:

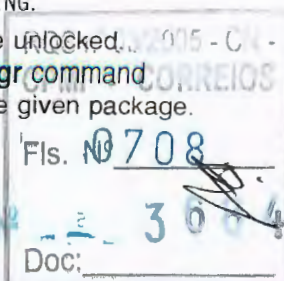
1. The efix manager initializes all commands and libraries, and loads efix metadata from the efix database.
2. Listing of efix attributes and description.
3. Space requirements are checked. The **emgr** command checks if the target file systems contains adequate space to restore the saved files. This includes space changing database entries, restoring saved files, archiving library members, and other miscellaneous tasks. The **emgr** command also adds a small buffer to the various space calculations to account for file metadata and other factors.

If the user specifies the auto-expand flag using the **-X** flag, the **emgr** command attempts to expand the file system to the required size. If space requirements can not be ultimately met, the **emgr** command halts the remove operation. If the user specifies a preview installation operation using the **-p** flag, then the **emgr** command only reports the space statistics without attempting expansion.

If the user specifies a preview installation using the **-p** flag, the **emgr** command does not perform the efix removal and skips to the summary and cleanup phase.

**Removal Phase:** Any failure in the removal phase causes the efix state to change to BROKEN. During the removal phase, the following steps occur:

1. The **emgr** command initializes all remove utilities and changes the efix state to REMOVING.
2. Package unlocking occurs. All packages that are locked by the efix being removed are unlocked. Because it is possible that a single package may be locked by multiple efixes, the **emgr** command only unlocks a package if this efix is the last (or the only) efix still holding a lock on the given package.







3. If a **pre\_remove** script is specified, it is run. If the **pre\_remove** script returns a failure, the **emgr** command halts the remove operation.
4. The **efix** is removed. If the **efix** was installed with a standard installation operation, the **emgr** command replaces the current **efix** files with the previously saved original files. If the installation was a mount installation operation, the **emgr** command unmounts the **efix** files and removes them from the system.
5. If a **post\_remove** script is specified, it is run. If the **post\_remove** script returns a failure, the **emgr** command halts the installation.
6. Reboot processing occurs. If the **efix** package specified that a reboot is required, the **emgr** command issues a message to the user and make any necessary changes to the boot image. The **emgr** command does *not* reboot the system automatically.
7. At this point, all remove steps have succeeded and the **emgr** command removes the remaining **efix** data from the database and save directories.

**Summary and Cleanup Phase:** During the summary and cleanup phase, the following steps occur:

1. The **emgr** command issues a summary of all operations and results. If more than one **efix** package was specified with an input file using the **-f** flag, the **emgr** command reports for each **efix** package.
2. The **emgr** command cleans up any temporary directories and files. It also unloads any memory modules that have been loaded.

### Listing Operation

The **emgr** command lists data on installed **efixes** with various levels of verbosity. The syntax for listing **efixes** is as follows:

```
emgr -l [ -L label | -n efix num | -u VUID ] [-v{1-3}X]
```

By default, the **emgr** command reports data on all installed **efixes**. You can specify an individual **efix** by using one of the **efix** identification methods. For information about the **efix** identification methods, refer to "Referencing Emergency Fixes" on page 91.

The default level of verbosity is 1. You can specify up to level 3 with the **-v** flag. The verbosity levels include the following information:

#### LEVEL 1

Lists one **efix** per line with the following information:

- **efix** ID
- **efix** state
- Install time
- **efix** abstract

#### LEVEL 2

Lists the following information:

- All LEVEL 1 information
- VUID
- Number of **efix** files
- Location for each **efix** file
- Package for each **efix** file
- Installer for each **efix** File
- mount installation (yes or no) for each **efix** file

#### LEVEL 3

Lists the following information:

- All LEVEL 2 information
- Reboot requirement (yes or no)
- Prerequisite files needed

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- Pre-install script
- Post-install script
- Pre-remove script
- Post-remove script
- File type for each efix file
- File size for each efix file
- Checksum for each efix file
- Access ownership and modes for each efix file
- Prerequisite information
- efix description
- Archive member name for each efix file
- If this is a mount installation operation, then display the mount status for each efix file

### Checking Operation

The **emgr** command checks the status of installed efixes. The syntax for efix checking is as follows:

```
emgr -c [ -L label | -n efix num | -u VUID | -f lfile ]  
        [ -w dir ] [-v{1-3}X]
```

By default the **emgr** command verifies all installed efixes. You can specify an individual efix by using one of the efix identification methods or specify several individual efixes by using a list file. For information about the efix identification methods, refer to "Referencing Emergency Fixes" on page 91.

The default level of verification is 1. You can specify up to level 3 with the **-v** flag. The verification levels include the following checks:

#### LEVEL 1

Checks the following information:

- efix data and state
- If this is a mount installation operation, then check the efix mount status for all files

**Note:** If the efix file is unmounted, the **emgr** command changes the efix state to UNMOUNTED

- efix checksum for *all* efix files or archive members

#### LEVEL 2

Checks the following information:

- All LEVEL 1 checks
- efix ownership and mode for all efix files or archive members

#### LEVEL 3

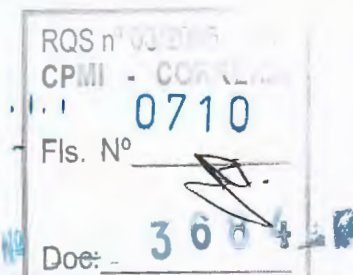
Checks the following information:

- All LEVEL 2 checks
- All prerequisites

### Mount Installation Operation

If the **-m** flag is specified during efix installation, the **emgr** command performs a mount installation operation of the efix package. This means that the existing files that are being fixed are not removed from their present locations. Instead they are over-mounted by the efix files. This approach has both advantages and disadvantages. One advantage is that a system reboot unmounts all of the efixes. This means that any efix that created a serious problem is not mounted after a reboot. The disadvantages are that the administrator must monitor the mount status of efixes and some efixes may not be removed without a reboot.

The mount installation operation is not supported with efix packages that deliver new files.





## Mounting and Unmounting Operations

The **emgr** command mounts or unmounts efices that have been installed using the mount installation operation. The syntax for efice checking is as follows:

```
emgr -M | -U [ -L label | -n efice num | -u VUID | -f lfile ]  
[ -w dir ] [X]
```

By default, the **emgr** command applies the mount or unmount operation to all installed efices. You can specify an individual efice by using one of the efice identification methods or specify several individual efices by using a list file. For information about the efice identification methods, refer to "Referencing Emergency Fixes".

Using the mount operation with the **-M** flag, the **emgr** command attempts to mount all efice files that are unmounted. If all efice files are successfully mounted, and the previous efice state was UNMOUNTED, then the **emgr** command changes the efice state to MOUNTED.

Using the unmount operation with the **-U** flag, the **emgr** command attempts to unmount all efice files that are mounted. If at least one efice file is successfully unmounted, and the previous efice state was MOUNTED, then the **emgr** command changes the efice state to UNMOUNTED.

## Display Package Locks Operation

The display package-locks operation displays all packages that are locked by efice manager, their installer, and the locking label or labels. The syntax for the display package-locks operation is as follows:

```
emgr -P [ Package ] [X]
```

By default, the **emgr** command lists all locked packages. The user can specify an individual package as an argument to the **-P** flag.

## Force Removal Operation

The force removal operation removes efice data. This operation also unlocks all efice packages associated with the efice label without removing the actual efice files, executing any removal scripts, or boot processing. The force removal operation can only be run on one efice at a time, and the efice label is required to identify the target efice. The syntax for performing a force removal operation is as follows:

```
emgr -R efice label [-w dir] [X]
```

**Note:** The force removal operation must be considered an emergency procedure. It must *only* be run if all other methods to remove the efice have failed. This method may create inconsistencies on the target system.

## Additional Emergency Fix Information

Additional information about emergency fixes includes the following topics:

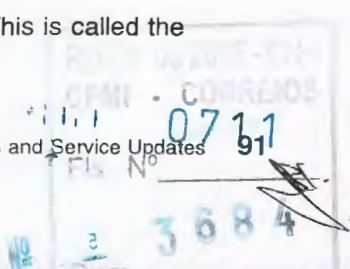
- "Referencing Emergency Fixes"
- "Using a List File" on page 92
- "Emergency Fix States" on page 92
- "Emergency Fix Logging" on page 93
- "Failure Cleanup" on page 93
- "Considerations for Systems Using the Trusted Computing Base" on page 93
- "Emergency Fix Manager Command Paths" on page 93

## Referencing Emergency Fixes

Emergency fixes can be referenced as follows:

### Reference by Label

Each efice that is installed on a given system has its own unique efice label. This is called the







*unique key* that binds all of the different database objects. To reference an efix by label, pass the label as an argument to the **-L** flag. For example, to run a check operation on an efix with label ABC123, type the following:

```
# emgr -cL ABC123
```

### Reference by efix ID

Each efix that is installed on a given system has its own efix ID. This is the order number in which the efix is listed in the efix database. Using this option may be convenient if performing operations on efixes based on efix listings. The **emgr** command converts the efix ID into an efix label before performing the given operation. To reference an efix by ID, pass the ID as an argument to the **-n** flag. For example, to run a check operation on the first efix with an ID equal to 1, type the following:

```
# emgr -cn1
```

**Note:** Emergency fix IDs are ephemeral and change as efixes are removed and added. *Always* verify the current efix ID number by listing the efix using the **-l** flag.

### Reference by VUID

The VUID (Virtually Unique ID) is used to differentiate packages that have the same label. Unlike APARs (Authorized Program Analysis Reports), which are officially tracked, emergency fixes are not tracked by any organization, so it is possible to have two efix packages with the same label. However, the **emgr** command does not allow the installation of more than one efix with the same label. The **emgr** command converts the VUID into an efix label before performing the given operation. For example, to list an installed efix with VUID equal to 000775364C00020316020703, type the following:

```
# emgr -l -u 000775364C00020316020703
```

The VUID is also displayed in the preview section of the efix installation and removal operations, and when using the listing operation with verbosity level 2 or greater.

### Using a List File

You can perform operations on a set of efixes by specifying a list file. For the installation operation, the list file must contain one efix package location per line. For the removal operation and the mount and unmount operations, the list file must have one efix label name per line. The **emgr** command ignores any blank lines, or lines where the first non-white space character is the **#** character.

### Emergency Fix States

The **emgr** command maintains a state for each installed efix, as follows:

#### STABLE

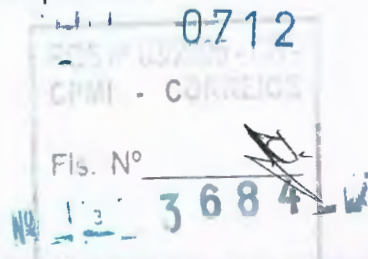
The efix was installed with a standard installation, and successfully completed the last installation operation. To verify the efix details, run a check operation on the given efix or efixes.

#### MOUNTED

The efix was installed with a mount installation operation, and successfully completed the last installation or mount operation. A state of MOUNTED does not mean all efixes are currently mounted. For example, the efixes might have been manually unmounted. This state represents the **emgr** command's previous actions and determination of the mount status. To verify the efix details, including mount status, run a check operation on the given efix or efixes.

#### UNMOUNTED

The efix was installed with a mount installation operation and one or more efix files were unmounted in a previous **emgr** command operation. The state of UNMOUNTED does not mean that all efixes are currently unmounted. For example, the efixes might have been manually mounted or partially mounted. This state represents the **emgr** command's previous actions and determination of the mount status. To verify the efix details, including mount status, run a check operation on the given efix or efixes.







## BROKEN

An unrecoverable error occurred during an installation or removal operation. The status of the efix is unreliable. You can attempt to remove this efix and reinstall it from the efix package.

## INSTALLING

The efix is in the process of installing. Normally, this state occurs only for a brief time during efix installation. However, if an efix installation is suddenly interrupted (such as in a sudden power loss or a system crash), and the **emgr** command is unable to clean up the failed installation, an efix might be left in the **INSTALLING** state. You can attempt to remove this efix and reinstall it from the efix package.

## REMOVING

The efix is in the process of being removed. Normally, this state occurs only for a brief time during efix removal. However, if an efix installation is suddenly interrupted (such as in a sudden power loss or a system crash), and the **emgr** command is unable to clean up the failed installation, an efix might be left in the **REMOVING** state. You can attempt to remove this efix and reinstall it from the efix package.

## Emergency Fix Logging

The following operations are logged to the `/var/adm/ras/emgr.log` **emgr** log file:

- Installation
- Removal
- Checking
- Mounting
- Unmounting
- Force Removal

## Failure Cleanup

The failure-cleanup procedure is run when an efix installation operation fails after the installation preview (and **pre\_install** script, if specified). The failure-cleanup procedure attempts to reverse any of the changes that have already been made by the installation process. The failure-cleanup procedure is similar to the removal phase of the efix removal operation. The failure-cleanup procedure sets the **EMGR\_UNDO** global environment variable to 1. This allows packaging to take different paths in the **pre\_remove** and **post\_remove** scripts.

## Considerations for Systems Using the Trusted Computing Base

The **emgr** command automatically detects if a system is enabled with the Trusted Computing Base (TCB). If TCB is enabled, the **emgr** command registers all installed efices with the efix database. When the efices are removed, the **emgr** command restores the previous TCB data. Because mount installation operations can create variations in file attributes when efix files are mounted and unmounted, mount installation operations are not supported on a TCB enabled system and are blocked by the **emgr** command.

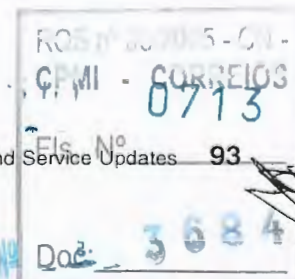
If you do not want the **emgr** command to automatically manage TCB data, then export the **EMGR\_IGNORE\_TCB** variable and set this variable to any value that is not null. When the **EMGR\_IGNORE\_TCB** variable is set, the **emgr** command behaves as if the system is not TCB enabled. If the **EMGR\_IGNORE\_TCB** variable is set on a TCB enabled system, you might be required to manually manage efix files within TCB.

To check if TCB is enabled on your system, run the `/usr/bin/tcbck` command. If you get a usage statement, then TCB is enabled. Otherwise, you receive a message indicating that TCB is not enabled.

## Emergency Fix Manager Command Paths

The **emgr** command calls one or more of the following UNIX commands:

ar  
awk  
cat







chmod  
chown  
compress  
cp  
date  
df  
diff  
du  
egrep  
fuser  
id  
ksh  
ln  
ls  
mkdir  
mount  
mv  
printf  
ps  
rm  
rmdir  
sed  
sleep  
sort  
sum  
tail  
tar  
tee  
touch  
umount  
uname  
vi  
wc  
zcat

The **emgr** command calls one or more of the following AIX commands:

aciget  
aciput  
bosboot  
lspp  
odmchange  
odmget  
slibclean  
tcbck

The **emgr** command looks for the UNIX and AIX commands mentioned in the following path order





1. /usr/emgrdata/bin
2. /usr/bin
3. /usr/sbin
4. /bin
5. /sbin
6. /usr/local/bin
7. /usr/local/sbin

The **/usr/emgrdata/bin** directory is a secured directory that is created the first time the **emgr** command is run.

If you are attempting to install or remove an efix for one of the commands that the **emgr** command uses, you might not be able to successfully complete the operation. To solve this problem, do the following:

1. Manually install the efix file into the **/usr/emgrdata/bin** directory.
2. Perform the **emgr** operation.
3. Remove the manually installed efix file from the **/usr/emgrdata/bin** directory.

Using this method, the efix is registered and tracked with efix manager and all other **emgr** command processing takes place.

If the efix file is the **/usr/bin/ksh** file and the problem it fixes prevents the **emgr** command's operations from succeeding, then do the following:

1. Back up the original **/usr/bin/ksh** file.
2. Manually install the **/usr/bin/ksh** efix file to **/usr/bin/ksh**.
3. Perform the **emgr** command installation or remove operation.

## Packaging Emergency Fixes

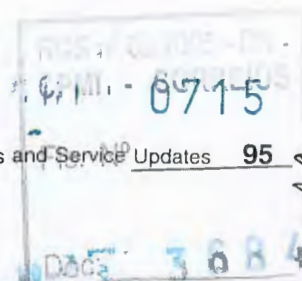
If you need to create your own efix and package it for distribution, use the **epkg** command to package the efix. The **epkg** command can be run in two different modes: *interactive* and *template-based*. The interactive method prompts the user with several questions and constructs the efix package based on the answers. The template-based method uses an efix control file that is pre-filled with default answers that are then asked in interactive mode. The efix package can then be installed by the **emgr** command.

By using an efix control file as a template, efix packages can be created noninteractively. The following is an example of a completed efix control file:

```
# efix control file example
ABSTRACT=This is a test of epkg.
PRE_INSTALL=/tmp/pre_install
POST_INSTALL=.
PRE_REMOVE=/tmp/pre_remove
POST_REMOVE=.
REBOOT=yes
PREREQ=.
DESCRIPTION=/tmp/description
EFIX_FILES=2
```

```
EFIX_FILE:
  EFIX_FILE_NUM=1
  SHIP_FILE=/home/test/ls
  TARGET_FILE=/usr/bin/ls
  TYPE= 1
  INSTALLER= 1
  ACL= DEFAULT
  AR_MEM=.
```

```
EFIX_FILE:
  EFIX_FILE_NUM=2
```





```
SHIP_FILE=/home/test/mystrcat.o
TARGET_FILE=/usr/ccs/lib/libc.a
TYPE= 2
INSTALLER= 1
ACL= root:system:555
AR_MEM=strcat.o
```



## User-Specified efix Package Components

The following efix control-file components are part of the overall efix package and are not related to specific files:

### ABSTRACT

Briefly describes the efix package. The abstract is limited to 38 bytes.

### PRE\_INSTALL

This script is run after an installation preview and before any efix files are installed. Failure in the **pre\_install** script causes the efix package installation to be aborted. This script is useful for doing any preinstallation checking or work. Because the **emgr** command does not call a failure-cleanup procedure for preinstallation failures, this script performs failure cleanup (related to the script) before it exits. This component is optional.

### POST\_INSTALL

This script is run after all efix files have been successfully installed. A failure in the **post\_install** script causes the installation to fail and causes efix manager to run a failure-cleanup procedure. This component is optional. For more information about the **post\_install** script, refer to "Installing and Managing Emergency Fixes" on page 86.

### PRE\_REMOVE

This script is run after the removal preview and before any efix files are removed during a remove operation and in the first stage of a failure-cleanup procedure. A failure in the **pre\_remove** script causes the given operation to fail. In the case of a failure-cleanup procedure, the **emgr** command sets an **EMGR\_UNDO** global environment variable to 1. If necessary, the **EMGR\_UNDO** variable is used to take different actions for removal as opposed to a failure-cleanup. This component is optional.

### POST\_REMOVE

This script is run after efix files are removed during a remove operation and a failure-cleanup procedure. A failure in the post-remove script causes the given operation to fail. In the case of a failure-cleanup procedure, the **emgr** command sets an **EMGR\_UNDO** global environment variable to 1. The **EMGR\_UNDO** variable is used to take different actions for removal as opposed to a failure-cleanup (if necessary). This component is optional.

### REBOOT

This variable indicates whether a reboot operation is required for this efix. If this variable is set to yes, the **emgr** command makes any necessary changes to the boot image and issues a message instructing the user to reboot after installation.

### PREREQ

This is a file that contains **installp** prerequisites. This component is optional.

- The file has one prerequisite per line.
- The format of the prerequisite entry is as follows:

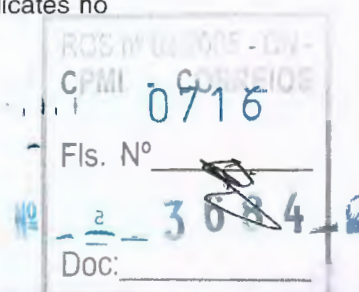
*Fileset Min Level Max Level Type*

#### Fileset

The name of the **installp** fileset requisite.

#### Min Level

The minimum level for the requisite fileset. The specification of NONE indicates no minimum level.





### Max Level

The maximum level for the requisite fileset. The specification of NONE indicates no maximum level.

**Type** The following types are supported: PREREQ and IFREQ. PREREQ is the default type and requires that the requisite fileset meets all criteria. IFREQ requires that requisite fileset meet all criteria *only* if it is installed.

- Blank lines or lines that start with # are ignored, as shown in the following examples:

```
# Require that abc.xyz is installed at any level:
abc.xyz NONE NONE
# Require that bos.rte.lvm is installed at level 5.1.0.10 or above:
bos.rte.lvm 5.1.0.10 NONE
# Require bos.mp be between 5.1.0.0 and 5.1.0.40 if it is installed:
bos.mp 5.1.0.0 5.1.0.40 IFREQ
```

### DESCRIPTION

This is a file that contains a detailed description of the efex package that is being installed.

### File Components

The following efex control-file components are related to specific files. The maximum number of efex files for each efex that the **epkg** and **emgr** commands support is 200.

### EFEX\_FILE\_NUM

The number of the given file (1 - 200).

### SHIP\_FILE

The local file location that the **epkg** command is archiving into the efex package. Specify either an absolute or relative path to this file. The ship file is the efex that is delivered.

### TARGET\_FILE

This is the target file location where the **SHIP\_FILE** is installed. This location is located on the system where the efex package is installed. Specify the absolute path to this file. If this file is part of a registered package, such as an **RPM** or **installp** package, you must specify the tracked location.

### INSTALLER

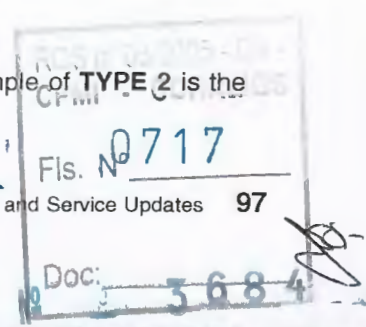
This variable represents the type of installer that owns the efex package. Valid integer choices are as follows:

- 1 Tracked by **installp**
- 2 Tracked by **RPM**
- 3 Tracked by **ISMP**
- 4 Tracked by another installer
- 5 New file that will be tracked by **installp**
- 6 New file that will be tracked by **RPM**
- 7 New file that will be tracked by **ISMP**
- 8 New file that will be tracked by another installer
- 9 Not tracked by any installer

**TYPE** This is the type of file that is being installed. The valid choices are as follows:

- 1 Standard file or executable file
- 2 Library or archive member

An example of **TYPE 1** is the **/usr/bin/lis** file or the **/usr/bin/rm** file. An example of **TYPE 2** is the **shr.o** archive member as a member of the **libc.a** library.







**ACL** Specifies the access attributes (mode and ownership) for a given file. If this attribute is set to **DEFAULT**, the **emgr** command maintains the current permissions of the file to be replaced. However, if the target file is a new file or the user wants to specify permissions using the **-v** flag, the **ACL** attribute can be entered with the syntax *Owner:Group:OctalModes*, similar to the following:

```
ACL= root:system:555
```

#### **AR\_MEM**

Specifies the name of the archive member. This option is only valid if **TYPE=2**. In this case, **SHIP\_FILE** represents the local location of the archive member that is being shipped, **TARGET\_FILE** represents the target archive, and **ACL** applies to the archive member. For example, the following attributes ship the **myshr.o** local file to the **shr.o** member in the **/usr/ccs/lib/libc.a** target archive:

```
TYPE=2
SHIP_FILE=/home/myshr.o
TARGET_FILE=/usr/ccs/lib/libc.a
AR_MEM=shr.o
```

### **Automatic Common Components**

The following components are part of the overall efix package and are not related to specific files. These components are automatically determined by the **epkg** command. Typically, the user does not set the following components:

**DATE** Date and time that the backup was made.

#### **INSTWORK**

Amount of space (in 512 byte-blocks) required for unpacking the efix metadata.

**VOID** Virtually Unique ID. A combination of time and **cpuid**, this ID can be used to differentiate fixes that are otherwise identical.

#### **QNEXT and QORDER**

Internal trackers for interactive mode. If you are using an efix control file in nonprompted mode, make sure **QNEXT** and **QORDER** are not set, or set to **QEND**.

### **Automatic File Components**

The following components are related to specific files. These components are automatically determined by the **epkg** command. Typically, the user does not set these components.

#### **CKSUM**

File checksum for the given file

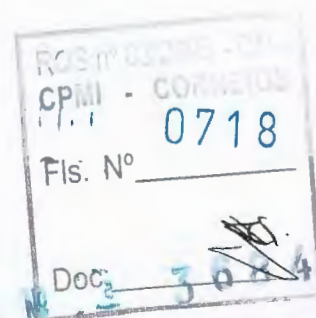
**SIZE** Size for the given file

### **Interactive Mode**

By default, the **epkg** command is run in interactive mode. The only required parameter is the efix label. If the user interrupts a running **epkg** session, the efix control file is saved. If the user starts a new session with the same efix label, they are asked whether they want to keep working with the previous efix control file, and the user can use the **-u** flag to answer this question.

The **epkg** command maintains a record of the question order and allows the user to navigate between questions by using subcommands. Also, the **epkg** command remembers the previous answer the user provided and sets that answer as the default answer. The **epkg** subcommands are the following:

- b!** Returns to the previous question.
- s!** Shows the current efix control file.
- q!** Quits without saving efix control file (using the Ctrl-C key sequence will prompt).
- h!** Displays help information for the current question.





The **epkg** command asks the following questions, one at a time:

1. Enter efix abstract [38 bytes maximum]:  
\*\* If "-s" flag is specified, go to question #3 \*\*\*
2. Does this efix deliver one or more files ? (yes/no):  
\*\* If "no", go to question #9 \*\*
3. Enter the local ship file location for efix file number 1:
4. Enter target location for efix file number 1:
5. Select file type for efix file number 1:
  - 1) Standard (file or executable)
  - 2) Library member
  - 3) Other
6. Select the installer which tracks the file that is being fixed by efix file number 1:
  - 1) Currently tracked by installp.
  - 2) Currently tracked by RPM.
  - 3) Currently tracked by ISMP.
  - 4) Currently tracked by another installer.
  - 5) This is a NEW file that will be tracked by installp.
  - 6) This is a NEW file that will be tracked by RPM.
  - 7) This is a NEW file that will be tracked by ISMP.
  - 8) This is a NEW file that will be tracked by another installer.
  - 9) Not tracked by any installer.

\*\*\* If "-m flag" and not new go to #7.1 \*\*\*

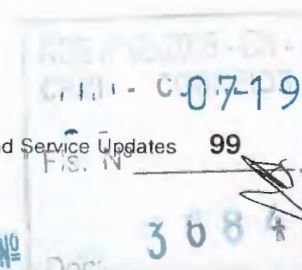
\*\*\* If new, go to #7.2 \*\*\*

\*\*\* Else, go to #8 \*\*\*

7.1 Enter the ACL for file 1 in the format of <owner>:<group>:<octal modes>. For example to make the user="root", the group="system", and the modes "444", you would enter root:system:444. Enter "." if you want to keep the default (i.e. current) permissions on the existing target file.

7.2 Enter the ACL for file 1 in the format of <owner>:<group>:<octal modes>. For example to make the user="root", the group="system", and the modes "444", you would enter root:system:444.

8. Are there more efix files ? (yes/no):  
\*\* If "yes", increment file and go to question #3 \*\*  
\*\* If "no" and "-s" flag, go to #14 \*\*  
\*\* If "no" go to question #9 \*\*
9. Enter the local location for the pre-install script or "." to skip.
10. Enter the local location for the post-install script or "." to skip.
11. Enter the local location for the pre-remove script or "." to skip.
12. Enter the local location for the post-remove script or "." to skip.
14. Is a reboot required after installing this efix ? (yes/no):
15. Enter the local location for the installp prerequisite file or "." to skip.  
\*\*\* This question is skipped if -p flag \*\*\*
16. Enter the local location for the efix description file or "." to compose it in an editor:  
\*\*\* This question is skipped if "-d" flag is specified \*\*\*  
\*\*\* If the description file is not specified, the user will be \*\*\*  
\*\*\* put into an editor to compose it. The user can specify \*\*\*  
\*\*\* which editor to use by setting the EDITOR global environment \*\*\*  
\*\*\* variable. The default editor is /usr/bin/vi. \*\*\*



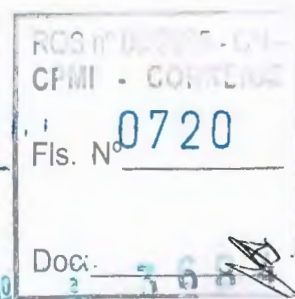




After all of the questions are answered, the **epkg** command verifies the efix control file and creates a compressed **tar** package that can be installed by using the **emgr** command.

## Related Information

- For information about developing software products that are installed using the **installp** command, refer to Packaging Software for Installation in *AIX 5L Version 5.2 General Programming Concepts: Writing and Debugging Programs*.
- For information about creating a new backup of your system, refer to "Creating System Backups" on page 113.
- Read the readme files that were shipped with the operating system. Any additional software you installed also might have associated readme files with late-breaking news. For information about how to view readme files, refer to "Viewing Readme Files" on page ix.
- For information about installing the Documentation Library Service or the operating system's online documentation, see "Using the Documentation Library Service" on page 102.
- For additional release information, see the *AIX 5.2 Release Notes*.





## Chapter 11. AIX Documentation and the Documentation Library Service

The AIX online documentation library is available through the IBM eServer pSeries Information Center. The IBM eServer pSeries Information Center provides information about IBM eServer pSeries and the AIX operating system.

Even if you do not want to install the operating system documentation, you should install and configure the documentation library service, because other applications might depend on this service to provide their online documentation.

This chapter covers the first-time installation and configuration of the library service. If you already have the service configured and you want to change the configuration, see *Changing the Configuration of the Documentation Library Service* in the *AIX 5L Version 5.2 System Management Concepts: Operating System and Devices*.

This chapter provides information about the following topics:

- "Information Center"
- "Using the Documentation Library Service" on page 102
- "Installing the Online Documentation" on page 110

### Information Center

The IBM eServer pSeries Information Center installs with the Base Operating System in the following filesets:

#### **X11.Dt.bitmaps**

AIX CDE Bitmaps

#### **X11.Dt.rte**

AIX Common Desktop Environment

#### **bos.rte.install**

LPP Installation Commands

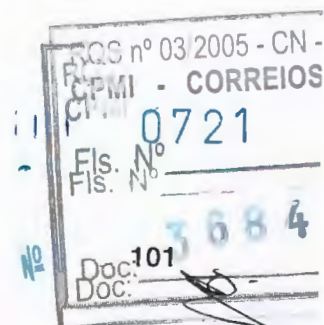
Because the **bos.rte.install** fileset is always installed, the **infocenter** command will always be available. The **X11.Dt.bitmaps** and **X11.Dt.rte** filesets are installed only if the CDE (Common Desktop Environment) desktop is installed. If the CDE desktop is installed, an **Information Center** icon is available on the desktop.

The Information Center Web address is contained in the **/usr/lpp/bosinst/bos.vendor.profile** file. The Information Center command and icon starts the Information Center Web page in a browser only if a valid Web address is specified in this file.

To view the Information Center content fully, a Web browser that supports JavaScript is required.

The IBM eServer pSeries Information Center is available at the following Web address:

[http://publib16.boulder.ibm.com/pseries/en\\_US/infocenter/base](http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base)







## Using the Documentation Library Service

The Documentation Library Service allows you to navigate, read, and search registered HTML-formatted documents through your Web browser. The library service presents documents in an expandable-tree format, through which you can easily navigate by clicking on associated buttons. You can click to view a selected document. You can also search for specific information in one book, a selection of books, or the entire installed library.

The library service produces two types of graphical user interfaces (GUIs), a global GUI and an application GUI. The global GUI shows you all HTML documents on the document server that are registered with the global GUI. Global views may contain documents from many different applications. Access the global library application by typing **docsearch** on the command line or by clicking the **Documentation Library** icon in the Help subpanel under the CDE Desktop front panel.

The application GUI is launched when you click on a link inside a menu or document of an application. The resulting display shows library pages that contain online information for that application. For example, the **Search** link in the Web-based System Manager Help menu calls a library page that only displays the documentation for Web-based System Manager.

The components of the Documentation Library Service are installed along with the BOS. After installation, the service may need to be configured.

**Note:** If you ordered a preinstalled system from the factory, the complete library service might have already been installed and configured at the factory.

If you are not sure whether the Documentation Library Service is installed and configured on your system, go to "Testing the Documentation Library Service". If you need to install or configure the library service, go to "Configuring the Documentation Library Service" on page 103.

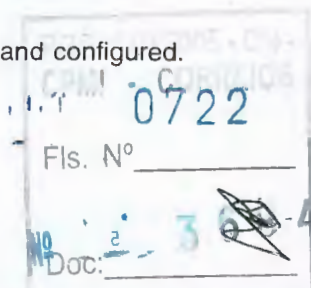
## Testing the Documentation Library Service

If you are not sure whether the library service is installed and configured, type **docsearch** on the command line.

One of the following occurs:

- **The library service appears, without error messages, and the search form appears at the top of the page.** This search form contains one or more fields for entering words that you want to search for. A listing of documents is visible in at least one of the views. When you open a document, you can read its contents. The search function completes successfully.
  - **The library service appears functional but you cannot read the documents properly.** Go to "Configuring the Documentation Library Service" on page 103.
  - **The library service appears functional but the search fails.** Go to Problem Determination in the *AIX 5L Version 5.2 System Management Guide: Operating System and Devices*.
- **You see the message There are no documents installed for this view.** The library service might be installed correctly, but the service cannot find any installed documents that are registered for the current view. Try clicking on the other views to see if they contain documents. When you find a view with documents, try reading and searching the documents.

You cannot fully test the library service until all appropriate documentation has been installed and registered. The operating system and all applications that use the library service register themselves during document installation. To install the operating system online documentation, see "Installing the Online Documentation" on page 110. Ensure any application documentation is correctly installed. After you have done this, retest the library functions.
- **You see the message Search is not enabled.** The service has not been fully installed and configured. Go to "Configuring the Documentation Library Service" on page 103.







- **You see the message Search is not supported in this language.** The search engine cannot support searches in the language used by this installation of the operating system. This is not an error. The search function is not compatible with all languages supported by the operating system. This message always displays when you are using a language that the search function cannot support.

If documents are visible in one of the Views, try reading the documents. If your documents display correctly and you can open them for reading, then no further configuration of the library service is necessary. If no documents are available in any view, the documentation has not been installed and registered. The operating system and all applications that use the library service register themselves during document installation. To install the operating system online documentation, see "Installing the Online Documentation" on page 110. Ensure any application documentation is correctly installed. After you have done this, retest the library functions.

- **You see a message similar to Cannot find or execute ds\_form.** The exact wording of this message varies, but it means the library service is not installed and configured correctly. Go to "Configuring the Documentation Library Service".
- **No browser appears.** The library service is not installed and configured correctly. Go to "Configuring the Documentation Library Service".

## Configuring the Documentation Library Service

You can set up a machine either as a documentation server or as a documentation client system. When users on a client request a search form or an HTML document, the request is sent to the Web server on a documentation server, which then sends back the requested object. When searches are performed, they are done on the server and the results are then sent back to the user on the client.

A documentation server has the following software installed:

- Documentation library service server and client software
- Library service search engine
- Documents
- Document search indexes - for searchable documents. If an application package is using the library service, these indexes are installed automatically when the documents are installed, or the system administrator may manually create indexes for locally written documents. Documents written in certain languages cannot be searched and do not have indexes.
- Web server software

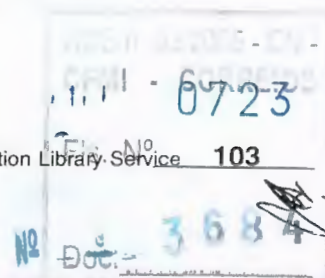
A client needs only the Documentation Library Service client software and a Web browser installed.

If you have a standalone machine, both the server and client software are installed. Instead of going to a remote server, requests from users on a standalone machine go to the Web server software on that same computer. A documentation server on a network can also be made standalone in the sense that you can configure its Web server software to accept only requests from users logged in to the documentation server.

If you have a console that supports a graphical user interface and are running in AIXwindows, you can use the Configuration Assistant to install and configure the library service. Otherwise, you can use commands to install and configure manually. It is highly recommended that you use the Configuration Assistant because it automatically performs some steps for you and is easier to use.

To use the Configuration Assistant, see "Using Configuration Assistant for the Documentation Library Service" on page 104.

To use the manual method, see "Manually Installing and Configuring the Documentation Library Service" on page 104.







## Using Configuration Assistant for the Documentation Library Service

The Configuration Assistant helps you configure this system as a documentation server or as a client that gets its documents from a remote documentation server.

**Note:** HTTP Web server software must be installed on this computer before you can install documents and register them with the Documentation Library Service. The Configuration Assistant can automatically install the Lite NetQuestion Web server software or the IBM HTTP Server software. Both options are shipped with the operating system.

If you want to use different Web server software, that software must have been installed and configured before you launch the Configuration Assistant. You must also know the full pathnames of the Web server's HTML documents home directory and the CGI-BIN directory.

This machine does not need Web server software if you are configuring it as a client that obtains its documents from a remote documentation server.

To launch the Configuration Assistant, make sure you are logged in to the system as the root user, and enter the **configassist** command. When the Configuration Assistant opens, press **Next**. Then select **Configure Online Documentation and Search**. The Configuration Assistant guides you through installation and configuration.

After you have finished, use the same procedure as shown in step 3 on page 105 to add language support.

## Manually Installing and Configuring the Documentation Library Service

This section describes how to install and configure the Documentation Library Service using the system management tools.

For information about installing the client, see "Installing the Client" on page 108.

### Installing the Server

Use this procedure if you want to configure this machine as a documentation server, where you will install your online documentation. A server can be networked to serve remote clients, or it can be standalone to serve only its own users.

To create a documentation search server, complete the following steps:

#### 1. Install the Web server and browser software, if needed.

Web server software must be installed. You can use any Web server software that can run CGI programs. The Lite NetQuestion Web server is automatically installed with the base operating system, but it can serve only local users, not remote users.

To serve both local and remote users, you must install server software. Any compatible HTTP server software can be used; however, the IBM HTTP Server software can be installed from a CD shipped with AIX 5.2.

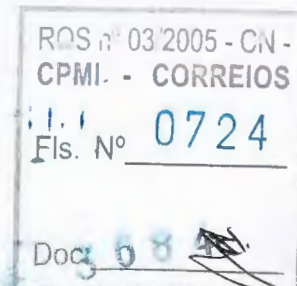
To verify what is already installed, type `smit list_installed` on the command line.

To manually install the IBM HTTP Server software using SMIT, do the following:

- Use the SMIT **install\_bundle** fast path.
- Select **HTTP\_Server** from the bundle list.
- Verify with the product documentation if you need to select **yes** to accept new license agreements.
- Accept the default values for the remaining Install Software Bundle menu options.

To manually install the IBM HTTP Server software from the command line, type:

```
# geninstall -d. -IacYXg -f HTTP_Server.bnd
```







If the software product contains a license agreement, the **-Y** flag accepts the new license agreement.

A Web browser that can display forms must be installed. (The Netscape browser is on the AIX 5.2 Expansion Pack CD.)

## 2. Configure and start Web server software.

Unless you are using the automatically installed Lite NetQuestion server, you must configure your Web server software to perform correctly with your system. Consult the documentation provided with your Web server software to configure and start your Web server software. Write down the full path names of the Web server directories where the server starts looking for HTML documents and CGI programs. If you are using one of the following Web servers, and you installed to the default location, you do not need to know the directory name:

- IBM HTTP Server
- IBM Internet Connection Server

Other Web servers might not automatically create the HTML and CGI directories. If yours does not, you must create these directories before you continue.

You must also configure your Web server software's permissions to allow access from the users and remote computers who should use this computer as their documentation search server.

## 3. Configure the Documentation Library Service for additional languages, if needed.

You might want this documentation server to be able to serve documents that are written in a different language than the one used by the operating system installed on this machine. If this is the case, you must install additional language support filesets for the other languages you want to serve.

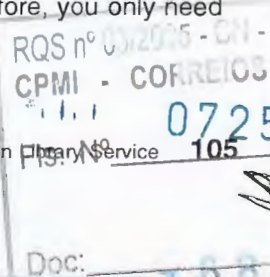
For example, assume that you are using English when you are installing the base operating system and you want users to be able to access documents in both English and Spanish from the documentation server. The English messages will be automatically installed because that is the language in use during the operating system installation. You need only to manually install the Spanish language support package.

There are two ways to install the library service package for another language:

- After you install the base operating system and the Documentation Library Service, you can install the operating system locale (language environment) for the language you want to add. Installing a language's locale installs the available support for all applications that are currently installed on your system.  
To install or update an entire locale, type `smitt m1e_add_lang` on the command line. Use the online help if you need additional explanation.
- If the locale for the desired language has been installed before the **bos.docsearch** package was installed, you can install only the Documentation Library Service messages.

### To install library service messages using Web-based System Manager:

- Start the Web-based System Manager by typing `wsm` on the command line.
- Expand the machine name.
- Expand **System Environment** in the Navigation area.
- Select **Settings**.
- Select **Cultural**, then **Available Resources**.
- When the dialog appears, use either the pull-down menu or select **Add** and install the language.  
Always install the Common messages. If you have the desktop installed on your system, also install the CDE messages. For example, assume that your server is configured for English when you are installing and you want to be able to serve both English and Spanish documents from the documentation server. The English messages are automatically installed. Therefore, you only need to manually select Spanish.







The message filesets are not inside the docsearch package; instead, they are stored in the BOS messages packages (**bos.msg.locale**, where *locale*=desired language) and are named:

- **bos.msg.locale.docsearch.client.com** DocSearch CDE Action - *locale*
  - **bos.msg.locale.docsearch.client.Dt** DocSearch Common Messages - *locale*
- g. After you have added all of the filesets you want to install into the window, click on the **OK** button.
- h. A message dialog displays, showing the status of the installation. If the process completes with no problems, a **Success** message displays.

#### To install library service support using SMIT:

- a. From the command line, type `smit install_all`.
- b. Always install the Common messages. If you have the desktop installed on your system, also install the CDE messages. For example, assume that your server is configured for English when you are installing and you want to be able to serve both English and Spanish documents from the documentation server. The English messages are automatically installed. Therefore, you only need to manually select Spanish.

The message filesets are not inside the **bos.docsearch** package; they are stored in the BOS messages packages (**bos.msg.locale**, where *locale* is the desired language) and are named:

- **bos.msg.locale.docsearch.client.com** DocSearch CDE Action - *locale*
- **bos.msg.locale.docsearch.client.Dt** DocSearch Common Messages - *locale*

In the dialog box that displays, type in the location of the filesets you want to install in the **INPUT device / directory for software** field, or click on the **List** button for a list of the available devices and directories.

- c. When the next dialog displays, enter the fileset names you want to install. If you want to install more than one fileset at this time, separate each fileset name with a space. If you do not know the exact name of the fileset you want to install, or want to browse the available languages, click on the **List** button. Highlight the packages you want to install from the list.
- d. Click on **OK**.
4. **Configure the Documentation Library Service.**

To configure the Documentation Library Service using Web-based System Manager:

- a. As root user, start the Web-based System Manager by typing **wsm** on the command line.
- b. Expand the machine name.
- c. Expand **System Environment** in the Navigation area.
- d. From the **System Environment** menu, choose **Settings** —> **Documentation Server**.
- e. In the Browser command field, type the name of the command that launches the Web browser with a URL. This selection will be the default Web browser for all users of this computer.
- If you are using the Netscape browser, type `netscape` in the Browser field and continue with the next step.
  - If you are using another browser, you must include any necessary flags that include a URL in the launch command. For example, if launching your Web browser to a specific site requires a **-u** flag, and your launch command looks similar to the following:

`YourWebBrowser -u http://www.w3.org`

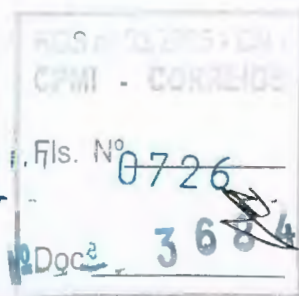
Your entry in the Browser field would be:

`YourWebBrowser -u`

You do not include the URL itself in the Browser field entry.

**Note:** Many browsers (for example, Netscape) do not require a flag.

- f. Click **OK**.







- g. Select **Settings** → **Documentation Server** again.
- h. Select **Local server**.
- i. Under the **Location of document and CGI programs on local server**, select your Web server software. If the name of your Web server software is not listed, select **Other**, then type the full path names of the CGI directory and the Documents directory. If you selected your Web server from the listing, continue with the next step.

**Note:** If you installed any of the listed Web servers in any location other than the default, or if you have set up servers to use nonstandard locations for their CGI-BIN and HTML directories, you must select **Other**.

- j. In the Server port field, type in the port number that the Web server software is using. The standard port is 80. If you are not certain of the actual port number, set it to 80. If you are using the Lite NetQuestion Web server, the port number must be set to 49213.
- k. Optionally, you can change the Default Documentation Language from this same screen. This is the language users see when they launch the library using the **docsearch** command or the library icon in the Help subpanel of the CDE desktop front panel.
- l. Click **OK** to complete the configuration.

To configure the Documentation Library Service using SMIT:

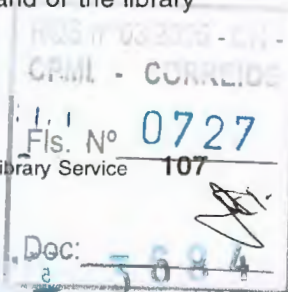
- a. On the server, change to root user. On a command line, type `smit web_configure`.
- b. Select **Change/Show Default Browser**. In the **\*Default browser LAUNCH COMMAND** field, type the command that sets the default browser for all users on this computer. Include any flags that are required when a URL is included in the command. If you want to have the default browser to open to a specific URL, also add the URL after the command to open the browser. For example, if you want your browser to open with the [http://publib16.boulder.ibm.com/pseries/en\\_US/infocenter/base](http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base) page, type the following in the **\*Default browser LAUNCH COMMAND** field:  
*YourWebBrowser flag http://publib16.boulder.ibm.com/pseries/en\_US/infocenter/base*

**Note:** Many browsers (for example, Netscape) do not require a flag.

- c. Return to the Web configuration main menu. Select **Change Documentation and Search Server**.
- d. On the Documentation Search Server LOCATION screen, click **List** and select **local - this computer** for server location. Click **OK**.
- e. On the Web Server SOFTWARE screen, click **List** and select the Web server software that you are using.

**Note:** If you installed any of the listed Web servers in any location other than the default, or if you have set up servers to use nonstandard locations for their CGI-BIN and HTML directories, you must select **Other**.

- f. On the next screen, type in the full path names of the CGI directory and the Documents directory. If you selected a listed Web server that is installed in its default location, the correct path names should be already displayed.  
If you set up your Web server to use a port other than the standard port 80, enter that port number. Leave it set to 80 if you are not sure of the port number. If you are using Lite NetQuestion, the port number must be set to 49213.
- g. Click **OK**. When the configuration is completed, a Documentation server configuration completed! message displays in the results panel.
- h. Optionally, you can change the Default Documentation Language from this same screen. This is the language users see when they launch the library using the **docsearch** command or the library icon in the Help subpanel of the CDE desktop front panel.
- i. Click **OK** to complete the configuration.



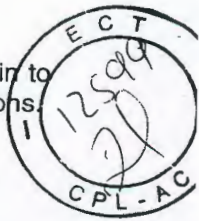


The documentation search functions on this server should now be ready to use. Any users logged in to this system before configuration finished must log off and then log back in to use the search functions.

5. **Install/register your documentation.**

Before any document can be searched using the Documentation Library Service, it must have an existing index that is registered with the library service. Some applications, such as Web-based System Manager, ship prebuilt documents inside their installation package. When the application is installed, the indexes are automatically registered. Indexes for all operating system documentation are registered during installation.

You can create indexes for your own HTML documents and register them with the library service so they can be searched online. For information about creating and registering indexes, see *AIX 5L Version 5.2 General Programming Concepts: Writing and Debugging Programs*.



## Installing the Client

Use this procedure if you want to set up a client of a remote documentation library server. When users on this computer want to read or search online documentation, the request is sent to a remote documentation library server, where the request is handled and the results then sent back to a Web browser on this client.

**Note:** The search function is not supported in all languages.

To create a documentation library client, complete the following steps:

1. **Install the client software.**

First, check the list of software that is installed on your system by typing **smit list\_installed** on the command line. If the following software is not already installed on your client system, install it now:

- A Web browser that can display HTML forms. (The Netscape browser is on the base operating system Netscape Products CD.)
- The Documentation Library Service package (**bos.docsearch**). This package is installed by default with the base operating system. If it has been removed from your system, you need only install the following filesets of the package:
  - **Docsearch Client** fileset
  - **Docsearch Client - CDE Desktop Icons and Actions** fileset (if you are using the CDE Desktop).
  - **Docsearch Support** filesets. When you install the base operating system, it automatically installs support for the language used by this system. However, if you want to be able to use the library service in other languages, you must also install the docsearch support filesets for those languages. The support filesets are stored in the BOS messages packages (**bos.msg locale**) and are named **DocSearch CDE Action - language** and **DocSearch Common Messages - language**. You do not need to install the CDE message set if you are not using the CDE desktop.

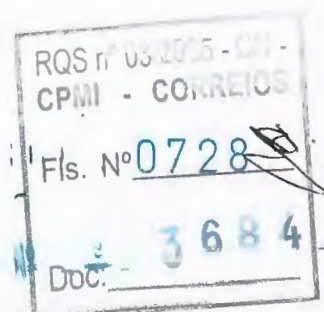
**Note:** You must also have the BOS locale (language environment) installed for any language you want to use. If you install the locale *after* the Documentation Library Service is installed on your system, the messages for that language are also automatically installed. However, if the locale was installed *before* the library service (for example, you are updating the operating system), you must manually install the library service messages.

For instructions on adding language support, use the procedure as shown in step 3 on page 105 of *Installing the Server*.

2. **Configure the Documentation Library Service.**

To configure the Documentation Library Service using Web-based System Manager:

- a. As root user, start the Web-based System Manager by typing **wsm** on the command line.
- b. Expand the machine name.
- c. Expand **System Environment** in the Navigation area.







- d. From the **System Environment** menu, choose **Settings** —> **Documentation Server**.
- e. In the Browser command field, type the name of the command that launches the Web browser with a URL. This selection will be the default Web browser for all users of this computer.
  - If you are using the Netscape browser, type `netscape` in the Browser field and continue with the next step.
  - If you are using another browser, you must include any necessary flags that include a URL in the launch command. For example, if launching your Web browser to a specific site requires a `-u` flag, and your launch command looks similar to the following:

*YourWebBrowser -u http://www.w3.org*

Your entry in the Browser field would be:

*YourWebBrowser -u*

You do not include the URL itself in the Browser field entry.

**Note:** Many browsers (for example, Netscape) do not require a flag.

- f. Click **OK**.
- g. Select **Settings** —> **Documentation Server** again.
- h. Select **Remote server**.
- i. Type the name of the documentation server into the **Computer name** field. This documentation server contains the documents that you want this client to be able to search.
- j. In the Server port field, type in the port number the Web server software is using. The standard port is 80.
- k. Click **OK** to complete the configuration.
- l. Close the Web-based System Manager.

To configure the Documentation Library Service using SMIT:

- a. On the client, change to root user. On a command line, type `smit web_configure`.
- b. Select **Change/Show Default Browser**. In the **\*Default browser LAUNCH COMMAND** field, type the command that sets the default browser for all users on this computer. Include any flags that are required when a URL is included in the command. If you want to have the default browser to open to a specific URL, also add the URL after the command to open the browser. For example, if you want your browser to open with the [http://publib16.boulder.ibm.com/pseries/en\\_US/infocenter/base](http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base) page, type the following in the **\*Default browser LAUNCH COMMAND** field:

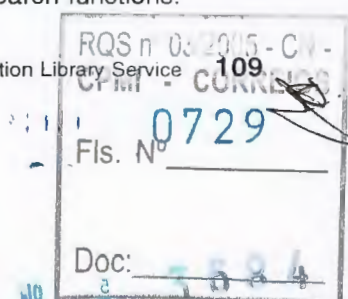
*YourWebBrowser flag http://publib16.boulder.ibm.com/pseries/en\_US/infocenter/base*

**Note:** Many browsers (for example, Netscape) do not require a flag.

- c. Return to the Web configuration main menu. Select **Change Documentation and Search Server**.
- d. On the Documentation Search Server LOCATION screen, click **List** and select **Remote computer** for server location. Click **OK**.
- e. On the next screen, enter the name of the remote documentation search server you want the client to send its search requests to in the **NAME of remote documentation server** field. You can type a name or an IP address.

If the Web server on the remote server is set to use some port other than the standard port 80, enter that port number.
- f. Click **OK** to configure your client system. When it is finished, a Documentation server configuration completed! message displays at the bottom of the results panel.

The documentation search functions on this client are now ready to use. Any users logged in to this client before configuration finished must log off and then log back in to use the search functions.







## Installing the Online Documentation

**Note:** It is not necessary to install the operating system's online documentation onto your server. You can access all of the documentation through the IBM eServer pSeries Information Center on the Internet at the following URL:

[http://publib16.boulder.ibm.com/pseries/en\\_US/infocenter/base](http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base)

However, if you use the Documentation Library Service to search any online documentation, it only searches the registered documentation that is installed. It does not search the documentation at the above Web site.

## Documentation CD

The following types of documentation are located on the *documentation CD*:

- User guides
- System management guides
- Application programmer guides
- All commands reference volumes
- Files reference
- Technical reference volumes used by application programmers

The operating system and related products documentation on this CD is designed for use with an HTML 3.2 Web browser, such as the Netscape browser that is shipped with the operating system.

**Note:** The *documentation CD* can be either installed or mounted. If you mount the CD, the entire CD is mounted. You cannot install part of the CD and mount the remainder.

While mounting the CD saves on the amount of hard disk space used, it requires the CD be kept in the CD-ROM drive at all times. Also, searching the documentation from the CD-ROM drive can be significantly slower (in some cases, up to ten times slower) than searching the information if it is installed on a hard disk.

You can use either the Web-based System Manager or System Management Interface Tool (SMIT) to install the documentation. Both tools create a temporary mount point for the CD. Also, you can install the entire CD or only selected documentation. Some documentation might have been previously installed with the operating system or other licensed products. Run the **lspp** command to determine which packages and filesets are already installed on your system.

The first time that you access the documentation CD, do the following steps. You can use the SMIT help panels can guide you through the process.

### 1. Create a CD file system.

On the command line, type `smit crcdrfs`. In the MOUNT POINT field, type `/infocd`.

### 2. Mount the CD file system.

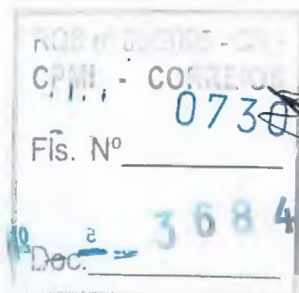
On the command line, type `smit mountfs`. Mount the CD as Read Only.

**Note:** If the CD is ejected from the system while it is still mounted, the connection is broken and you cannot access the information. To remove the CD from the system, run the **unlink** script. Then unmount the file system using the **umount** command before ejecting the CD. To access the CD again, remount the CD file system.

### 3. Run the link script.

Type the following two commands:

```
cd /infocd
./linkbasecd
```





**Note:** You must have root user authority or be a member of the **system** group to perform these tasks.

When you need to unmount the CD, use the following commands:

```
cd /infocd
./unlinkbasecd
umount /infocd
```

**Note:** When the CD is mounted and the **linkbasecd** script is run, links to the man pages (for example, **signal** documentation is a softlink to **sigaction** man page) will not be created. Therefore, any man page entries based on softlinks do not work. To check this, if you type the following:

```
# man signal
```

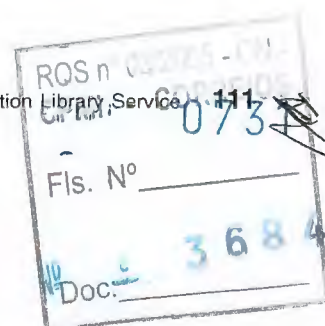
A message similar to the following displays:

There is not an entry for signal.

---

## Related Information

- Review readme files for late-breaking news. For information on how to view readme files, refer to "Viewing Readme Files" on page ix.
- Begin configuring and using the document search application. See "Using the Documentation Library Service" on page 102.





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Doc: 3684



## Chapter 12. Creating and Installing System Backups

This chapter provides information on creating and installing system backups. The chapter includes the following sections:

- "Creating System Backups"
- "Installing System Backups" on page 125

### Notes:

1. References to CD in this chapter also apply to DVD.
2. AIX 5.2 provides the **cdromd** CD and DVD automount facility, which is included in the **bos.cdmount** fileset. To determine if the **cdromd** daemon is enabled on your system, run the following command:

```
# lssrc -s cdromd
```

The **cdromd** daemon can interfere with scripts, applications, or instructions that attempt to mount the CD or DVD device without first checking to see if the device is already enabled. A resource or device busy error occurs in such a condition. Use the **cdumount** or **cdeject** command to unmount the device. Then mount the device as specified in the program or instructions. Alternatively, use the **cdcheck -m** or **mount** command to determine the current mount point of the device. For further information, see the **cdromd** command documentation in the *AIX 5L Version 5.2 Commands Reference*.

The installation code allows for this automatic mounting. If **cdromd** is enabled and the **mkcd** command is run, the CD-R or DVD-RAM is ejected after the image is completed. If you do not want to have the media ejected, then the **cdromd** daemon should be put in the inoperative state with the following command:

```
# stopsrc -s cdromd
```

## Creating System Backups

This section describes how to create and verify a bootable backup copy, or *mksysb image*, of your root volume group and how to make separate backup copies of user volume groups.

The *root volume group* is a hard disk or group of disks that contains:

- Startup files
- Base Operating System (BOS)
- System configuration information
- Optional software products

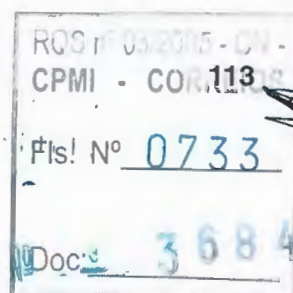
A *user volume group*, also called the *nonroot volume group*, typically contains data files and application software.

A system backup does the following:

- Contains a working copy of your system. In the event your system data becomes corrupted, you can use this information to restore your system to working order.
- Allows you to transfer installed and configured software from one system to others. You can use the Web-based System Manager or SMIT to make a backup image of the root volume group or user volume groups.

A backup transfers the following configurations from the source system to the target system:

- **rootvg** volume group information
- Paging space information
- Logical volume information







- Placement of logical partitions (if creating map files has been selected in the Web-based System Manager or SMIT).

**Note:** The use of map files is not recommended if you plan to reinstall the backup to target systems other than the source system, or the disk configuration of the source system is to be changed before reinstalling the backup.

Using the Web-based System Manager or the SMIT backup menu lets you preserve configuration information, thus avoiding some of the configuring tasks normally required after restoring a system backup. A backup preserves the configuration if the following are true:

- The target system has the same hardware configuration as the source system.
- AND
- The target disk has enough space to hold the backup image.

The Web-based System Manager and SMIT both use the **mksysb** command to create a backup image, stored either on CD, DVD, tape, or in a file. If you choose CD, DVD, or tape, the backup program by default writes a *boot image*, which makes the medium suitable for installing. For more information, see "System Backup to CD-R, DVD-R, or DVD-RAM" on page 117.

## Install All Device and Kernel Support Before the Backup is Created

In AIX 5.2, all devices and kernels are installed by default when performing a base operating system installation. This allows you to create a system backup that contains all devices and kernel types. Because the system backup contains all the devices and kernel support, the system backup can be used to install another system without the need for the AIX product media. This option is available in the Install Options menu in the BOS installation menus. If you change the default (**yes**) to **no**, only the devices and kernel type for your system configuration will be installed.

This value is read from the **ALL\_DEVICES\_KERNELS** field in the **/var/adm/ras/bosinst.data** file on the product media that you used to boot the system.

After the system is installed, you can check if all the devices and kernel types have been installed on the system as follows:

```
# grep ALL_DEVICES_KERNELS bosinst.data
```

Output similar to the following displays:

```
ALL_DEVICES_KERNELS = yes
```

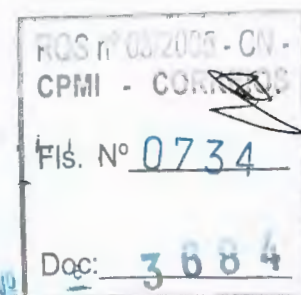
For more information about the **bosinst.data** file, refer to Chapter 8, "Customized BOS Installations", on page 57.

## Prerequisites for Creating Backups

Before creating system backups, complete the following prerequisites:

- Be sure you are logged in as root user.
- Consider altering passwords and network addresses if you use a backup to make master copies of a source system. Copying passwords from the source to a target system can create security problems. Also, if network addresses are copied to a target system, duplicate addresses can disrupt network communications.
- Mount all file systems you want to back up. The **mksysb** command backs up mounted JFS (journaled file systems) and JFS2 (enhanced journaled file systems) in the **rootvg**. Refer to the **mount** command for details.

**Note:** The **mksysb** command does not back up file systems mounted across an NFS network.







- Unmount any local directories that are mounted over another local directory.

This backup procedure backs up files twice if a local directory is mounted over another local directory in the same file system. For example, if you mount **/tmp** over **/usr/tmp**, the files in the **/tmp** directory are then backed up twice. This duplication might exceed the number of files a file system can hold, which can cause a future installation of the backup image to fail.

- Use the **/etc/exclude.rootvg** file to list files you do not want backed up.
- Make at least 8.8 MB of free disk space available in the **/tmp** directory. The **mksysb** command requires this working space for the duration of the backup.

Use the **df** command, which reports in units of 512-byte blocks, to determine the free space in the **/tmp** directory. Use the **chfs** command to change the size of the file system, if necessary.

For example, the following command adds 12 MB of disk space to the **/tmp** directory of a system with 4 MB partitions:

```
chfs -a size=+24000 /tmp
```

- All hardware must already be installed, including external devices, such as tape and CD-ROM drives.
- The **bos.sysmgt.sysbr** fileset in the BOS System Management Tools and Applications software package must be installed. The **bos.sysmgt.sysbr** fileset is automatically installed in AIX 5.2. To determine if the **bos.sysmgt.sysbr** fileset is installed on your system, type:

```
lspp -l bos.sysmgt.sysbr
```

If your system has the **bos.sysmgt.sysbr** fileset installed, continue with one of the following procedures:

- “Creating a Root Volume Group Backup to Tape or File”
- “System Backup to CD-R, DVD-R, or DVD-RAM” on page 117
- “User Volume Group Backup” on page 121

If the **lspp** command does not list the **bos.sysmgt.sysbr** fileset, install it before continuing with the backup procedure. Refer to Chapter 10, “Optional Software Products and Service Updates”, on page 69 for instructions, or enter the following command:

```
installp -agqXd device bos.sysmgt.sysbr
```

where *device* is the location of the software; for example, **/dev/cd0** for CD-ROM drive.

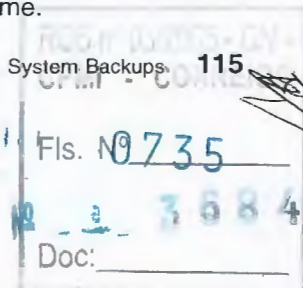
## Creating a Root Volume Group Backup to Tape or File

You can use either the Web-based System Manager or SMIT to create a system backup to be stored to tape or in a file.

For instructions on how to back up to CD or DVD, see “System Backup to CD-R, DVD-R, or DVD-RAM” on page 117.

To create a root volume group backup:

- Use the Web-based System Manager **Backup and Restore** application and select **Back up the system**.  
OR
- Use the following SMIT procedure:
  1. Enter the **smit mksysb** fast path.
  2. In the Back Up the System menu, make the following selections:
    - Select which medium you want to use in the **Backup DEVICE or File** field. If you want to create a bootable backup, the medium must be tape or CD. See “System Backup to CD-R, DVD-R, or DVD-RAM” on page 117 for more information. Then, select the appropriate option below:  
**TAPE** Press the F4 key to list available devices and highlight the device name.







**FILE** Enter a full path and file name in the entry field.

- If you want to create map files, select **yes** in the **Create Map Files?** field.

Map files match the physical partitions on a drive to its logical partitions. When installing from a backup image, the BOS installation program uses map files to position the logical volumes on the target drive in the same partitions they were on in the source system. If you do not create map files, the installation program relies on the logical volume manager (LVM) to determine placement for the logical volumes. For more information, see *Using Map Files for Precise Allocation in AIX 5L Version 5.2 System Management Concepts: Operating System and Devices*.

**Note:** If you plan to reinstall the backup to target systems other than the source system, or if the disk configuration of the source system might change before reinstalling the backup, do not create map files.

- To exclude certain files from the backup, select **yes** in the **Exclude Files** field, then create an **/etc/exclude.rootvg** file with an ASCII editor, and enter the file names that you do not want included in your system backup image. You can use patterns for the file names that conform to the pattern matching conventions of the **grep** command. For example, to exclude all the contents of the directory called **scratch**, put the following line in the exclude file:

```
/scratch/
```

For another example, exclude the contents of the directory called **/tmp** and avoid excluding any other directories that have **/tmp** in the pathname by adding the following line to the exclude file:

```
^./tmp/
```

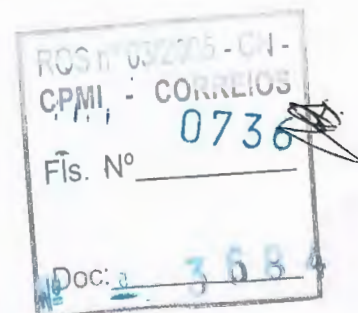
**Note:** All files are backed up relative to the current working directory. This directory is represented by a **.** (dot character). To exclude any file or directory for which it is important to have the search match the string at the beginning of the line, use a **^** (caret character) as the first character in the search string, followed by a **.** (dot character), and then followed by the file name or directory to be excluded.

If the file name or directory being excluded is a substring of another file name or directory, use **^.** (caret character followed by dot character) to indicate that the search should begin at the beginning of the line and/or use **\$** (dollar sign character) to indicate that the search should end at the end of the line.

- To list each file as it is backed up, select **yes** in the **List files as they are backed up?** field. Otherwise, you see a percentage-completed progress message while the backup is created.
  - If you modified the **image.data** file and do not want a new one created, select **no** for **Generate new /image.data file?**. (The **image.data** file contains information about the sizes of all the file systems and logical volumes in your rootvg.)
  - If you are creating a bootable tape and you want to expand the system **/tmp** file system (if required by the backup program), select **yes** for **EXPAND /tmp if needed?**.
  - If the tape drive you are using provides packing (or compression), set the **Disable software packing of backup?** field to **yes**.
  - If you chose tape as the backup medium, either leave the default in the **Number of BLOCKS to write in a single output** field or enter a different number.
  - If you chose file as the backup medium, press Enter. If you chose tape as the backup medium, insert the first blank backup tape into the drive and press Enter.
3. The **COMMAND STATUS** screen displays, showing status messages while the system makes the backup image.

If you chose tape as the backup medium, the system might prompt you to insert the next tape during the backup by displaying a message similar to the following:

Mount next Volume on /dev/rmt0 and press Enter.





If this message displays, remove the tape and label it, including the BOS version number. Then insert another tape and press Enter.



When the backup process finishes, the **COMMAND:** field changes to **OK**.

4. When the backup completes, press F10 to exit SMIT.
5. If you selected tape as the backup medium, remove the last tape and label it. Write-protect the backup tapes.
6. Record any backed-up root and user passwords. Remember that these passwords become active if you use the backup to either restore this system or install another system.

You have created the backup of your root volume group (rootvg). If you created bootable tapes, you can use these tapes to start your system if for some reason you cannot boot from hard disks.

## System Backup to CD-R, DVD-R, or DVD-RAM

Creating a backup on CD-R, DVD-R, or DVD-RAM media is similar to making a backup tape for your personal use, but with some noticeable differences. For DVD media, the following formats for creating backups are available:

- ISO9660 CD format, which is available for DVD-R/DVD-RAM media.
- Universal Disk Format (UDF), which is available for DVD-RAM media. For information about creating a backup to DVD-RAM using UDF, see "DVD-RAM and Universal Disk Format" on page 120.

**Note:** For information about CD-R, DVD-R, or DVD-RAM drives and CD-R, DVD-R, or DVD-RAM creation software, refer to the following readme file:

`/usr/lpp/bos.sysmgmt/mkcd.README.txt`

Both Web-based System Manager and SMIT use the **mkcd** command, which calls the **mksysb** or **savevg** command, if needed.

For system backups, the CDs or DVDs can be created as:

- Non-bootable CDs or DVDs
- Bootable CDs or DVDs

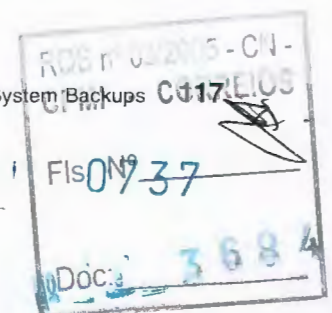
In AIX 5.2, a bootable system backup contains the **chrp** boot image and all the device and kernel packages necessary to install a system. A backup CD or DVD can be used to install (clone) a large number of machines, which is convenient when each machine in the system environment needs to have the same image installed.

**Note:** It is possible that a backup CD or DVD would not boot all machines of the same type because not every machine has the same hardware configuration. Depending on what packages were made available during the creation of the backup, the backup might not have all the necessary packages to boot an individual system. Most required packages for systems are present on the BOS AIX 5.2 media.

Web-based System Manager and SMIT interfaces are available for the **mkcd** command. Online help can guide you through the required steps.

### Hardware and Software Requirements

The **mkcd** command requires that you already have the software installed to create a CD/DVD file system in Rock Ridge format and to *burn* or write the CD/DVD. The GNU versions of the **cdrecord** and **mkisofs** commands are installed with a BOS installation. Hardware and software that has been tested with this command includes the following:





Software	Hardware
GNU and Free Software Foundation, Inc.  readcd command version 1.9 mkisofs command version 1.13	Matsushita LF-D291 DVD-RAM



## Using the mkcd Command

To run the **mkcd** command, you need extra working space. A separate file system or directory is required for each of the following:

- Storing a **mksysb** or **savevg** image
- Storing the CD or DVD file system contents
- Storing the CD or DVD images before they are recorded

The **mkcd** command creates the following file systems if they are not already present or if alternative file systems or directories have not been specified:

### /mkcd/mksysb\_image

Space requirement depends on the size of the **mksysb** image that is to be created. The **mkcd** command attempts to calculate this space and verify that adequate space is available before starting to create the **mksysb** image.

**Note:** When the **mkcd** command calculates the space requirements needed for the **/mkcd/mksysb\_image** directory, it also adds the space used by the excluded files (**/etc/exclude.rootvg**). It is therefore possible that the **mkcd** command might not be able to create the **/mkcd/mksysb\_image** directory.

### /mkcd/cd\_fs

Requires 645 megabytes (up to 4.38 GB for DVD)

### /mkcd/cd\_images

Requires at least 645 megabytes (up to 4.38 GB for DVD) of space. If the **-R** or **-S** flags are used to specify not removing the images and there are multiple volumes required, more space must be provided.

The space used in these file systems is only temporary (unless the **-R** or **-S** flag is specified to save the images). If the **mkcd** command creates the file systems, it also removes them. Each file system or directory might require over 645 megabytes (up to 4.38 GB for DVD).

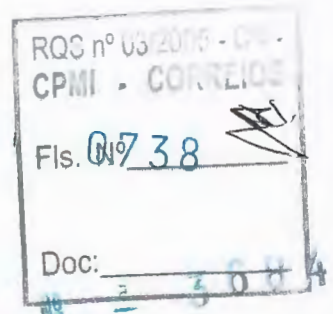
If your machine does not have sufficient space, you can use NFS to mount some space from another server system; however, the file systems must be writable. You can create a **/mkcd** file system that is very large (1.5 GB for CD or 9 GB for DVDs). The **/mkcd** file system can then be mounted onto the clients when they want to create a backup CD or DVD for their systems. When creating very large backups (larger than 2 GB) with the **mkcd** command, the file system must be large-file enabled and the **ulimit** values must be set to unlimited.

The **mkcd** command with the **-L** flag allows the creation of ISO9660 DVD-sized images. The **mkcd** command with the **-U** flag allows the creation of UDF DVD images.

## Creating a Root Volume Group Backup on CD or DVD with the ISO9660 Format

You can use Web-based System Manager or SMIT to create a root volume group backup on CD or DVD with the ISO9660 format, as follows:

- Use the Web-based System Manager **Backup and Restore** application and select **System backup wizard method**. This method lets you create bootable or non-bootable backups on CD-R, DVD-R, or DVD-RAM media.
- OR







- To create a backup to CD, use the **smit mkcd** fast path.
- To create a backup to DVD, use the **smit mkdvd** fast path and select **ISO9660 (CD format)**.

The following procedure shows you how to use SMIT to create a system backup to CD. (The SMIT procedure for creating a system backup to an ISO9660 DVD is similar to the CD procedure.)

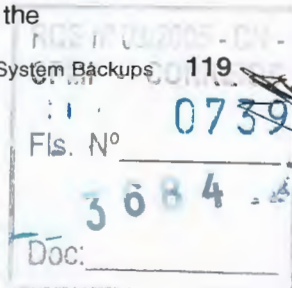
1. Type the **smit mkcd** fast path. The system asks whether you are using an existing **mksysb** image.
2. Type the name of the CD-R device. (This can be left blank if the **Create the CD now?** field is set to no.)
3. If you are creating a **mksysb** image, select **yes** or **no** for the **mksysb** creation options, **Create map files?** and **Exclude files?**. Verify the selections, or change as appropriate.

The **mkcd** command always calls the **mksysb** command with the flags to extend **/tmp**.

You can specify an existing **image.data** file or supply a user-defined **image.data** file. See step 16 on page 120.

4. Enter the file system in which to store the **mksysb** image. This can be a file system that you created in the **rootvg**, in another volume group, or in NFS-mounted file systems with read-write access. If this field is left blank, the **mkcd** command creates the file system, if the file system does not exist, and removes it when the command completes.
5. Enter the file systems in which to store the CD or DVD file structure and final CD or DVD images. These can be file systems you created in the **rootvg**, in another volume group, or in NFS-mounted file systems. If these fields are left blank, the **mkcd** command creates these file systems, and removes them when the command completes, unless you specify differently in later steps in this procedure.
6. If you did not enter any information in the file systems' fields, you can select to have the **mkcd** command either create these file systems in the **rootvg**, or in another volume group. If the default of **rootvg** is chosen and a **mksysb** image is being created, the **mkcd** command adds the file systems to the exclude file and calls the **mksysb** command with the **-e** exclude files option.
7. In the **Do you want the CD or DVD to be bootable?** field, select **yes** to have a boot image created on the CD or DVD. If you select **no**, you must boot from a product CD at the same *version.release.maintenance* level, and then select to install the system backup from the system backup CD.
8. If you change the **Remove final images after creating CD?** field to **no**, the file system for the CD images (that you specified earlier in this procedure) remains after the CD has been recorded.
9. If you change the **Create the CD now?** field to **no**, the file system for the CD images (that you specified earlier in this procedure) remains. The settings that you selected in this procedure remain valid, but the CD is not created at this time.
10. If you intend to use an Install bundle file, type the full path name to the bundle file. The **mkcd** command copies the file into the CD file system. You must have the bundle file already specified in the **BUNDLES** field, either in the **bosinst.data** file of the **mksysb** image or in a user-specified **bosinst.data** file. When this option is used to have the bundle file placed on the CD, the location in the **BUNDLES** field of the **bosinst.data** file must be as follows:  

```
../../usr/sys/inst.data/user_bundles/bundle_file_name
```
11. To place additional packages on the CD or DVD, enter the name of the file that contains the packages list in the **File with list of packages to copy to CD** field. The format of this file is one package name per line.  
If you are planning to install one or more bundles after the **mksysb** image is restored, follow the directions in the previous step to specify the bundle file. You can then use this option to have packages listed in the bundle available on the CD. If this option is used, you must also specify the location of installation images in the next step.
12. Enter the location of installation images that are to be copied to the CD file system (if any) in the **Location of packages to copy to CD** field. This field is required if additional packages are to be placed on the CD (see the previous step). The location can be a directory or CD device.
13. You can specify the full path name to a customization script in the **Customization script** field. If given, the **mkcd** command copies the script to the CD file system. You must have the







**CUSTOMIZATION\_FILE** field already set in the **bosinst.data** file in the **mksysb** image or else use a user-specified **bosinst.data** file with the **CUSTOMIZATION\_FILE** field set. The **mkcd** command copies this file to the **RAM** file system. Therefore, the path in the **CUSTOMIZATION\_FILE** field must be as follows:

`../filename`

14. You can use your own **bosinst.data** file, rather than the one in the **mksysb** image, by typing the full path name of your **bosinst.data** file in the **User supplied bosinst.data file** field.
15. To turn on debugging for the **mkcd** command, set **Debug output?** to **yes**. The debug output goes to the **smit.log**.
16. You can use your own **image.data** file, rather than the **image.data** file in the **mksysb** image, by typing the full path name of your **image.data** file for the **User supplied image.data file** field.

## DVD-RAM and Universal Disk Format

This section provides information on the Universal Disk Format (UDF) and how to create system backups using DVD-RAM media and UDF.

UDF allows you to manipulate files directly on the DVD-RAM media. The system backup image is an archived file composed of many files that cannot be manipulated. However, the installation packages and any files that are not contained in the backup image, can be directly manipulated on the DVD-RAM. After the DVD is mounted the files can be changed by using an editor or new files can be copied to the DVD using the various copy and restore commands such as the **cp**, **mv**, **restore** commands.

With UDF and DVD-RAM, system space is only needed for the backup image. A high-level description of the UDF backup process is as follows:

1. Create a backup of a volume group to a file (archive) on a hard disk containing enough space to hold the backup image.
2. Populate UDF with files needed to boot and install a system.
3. Copy backup to DVD-RAM media.

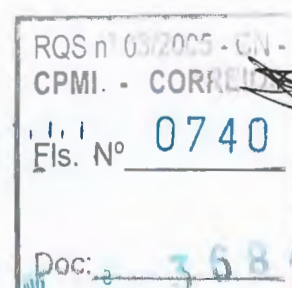
The **mkcd** command with the **-U** flag is used to create a UDF file system on the DVD-RAM.

UDF allows for the possibility of changing files directly on the DVD-RAM media, such as a **bosinst.data** file and **image.data** or **vgname.data** file. Without UDF for example, to add a user-defined **bosinst.data** file to a backup image, you must restore the backup image to a location, add the file, and then back up the files again.

Or, you had to create a supplemental diskette containing the changed **bosinst.data** file, and use the supplemental diskette in conjunction with the backup. However, some system configurations might not provide diskette drives, making this procedure more difficult.

**Creating a Root Volume Group Backup on DVD-RAM with Universal Disk Format:** To create a root volume group backup on DVD-RAM with UDF, do the following:

- Use the Web-based System Manager **Backup and Restore** application and select **System backup wizard method**. This method lets you create bootable or non-bootable backups on DVD-RAM media.  
OR
- Use SMIT to create a backup to DVD-RAM with UDF, as follows:
  1. Enter the **smit mkdvd** fast path. The system asks whether you are using an existing **mksysb** image.
  2. Select **UDF (Universal Disk Format)**.
  3. Enter the name of the DVD-RAM device.
  4. If you are creating a **mksysb** image, select **yes** or **no** for the **mksysb** creation options. The options are as follows:
    - **Create map files?**







– Exclude files?

The **mkcd** command always calls the **mksysb** command with the flags to extend **/tmp**.

You can specify an existing **image.data** file or supply a user-defined **image.data**. See step 14.

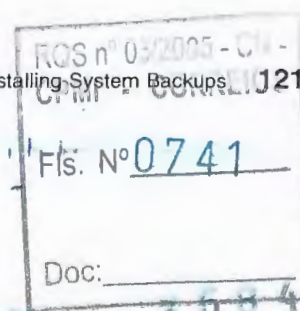
5. Enter the file system or directory in which to store the **mksysb** image. This can be a file system you created in the **rootvg**, in another volume group, or in NFS mounted file systems with read-write access. If left blank, the **mkcd** command creates the file system and removes it when the command completes.
6. If you did not enter information in the file system field, you can select to have the **mkcd** command either create these file systems in the **rootvg**, or in another volume group. If the default of **rootvg** is chosen and a **mksysb** image is being created, the **mkcd** command adds the file systems to the exclude file and calls the **mksysb** command with the exclude files option **-e**.
7. Do you want the DVD to be bootable? If you select **no**, you must boot from a product CD at the same *version.release.maintenance* level, and then select to install the system backup from the system backup DVD.
8. If you intend to use an Install bundle file, enter the full path name to the bundle file. The **mkcd** command copies the file into the DVD file system. You must have the bundle file already specified in the **BUNDLES** field, either in the **bosinst.data** file of the **mksysb** image or in a user-specified **bosinst.data** file. When this option is used to have the bundle file placed on the DVD, the location in the **BUNDLES** field of the **bosinst.data** file must be as follows:  

```
../../usr/sys/inst.data/user_bundles/bundle_file_name
```
9. Additional packages can be placed on the CD by entering the name of the file that contains the packages list in the **File with list of packages to copy to DVD** field. The format of this file is one package name per line.  
  
If you are planning to install one or more bundles after the **mksysb** image is restored, follow the directions in the previous step to specify the bundle file. You can then use this option to have packages listed in the bundle available on the DVD. If this option is used, you must also specify the location of installation images in the next step.
10. Enter the location of installation images that are to be copied to the CD file system (if any) in the **Location of packages to copy to DVD** field. This field is required if additional packages are to be placed on the DVD (see the previous step). The location can be a directory or DVD device.
11. You can specify the full path name to a customization script in the **Customization script** field. If given, the **mkcd** command copies the script to the CD file system. You must have the **CUSTOMIZATION\_FILE** field already set in the **bosinst.data** file in the **mksysb** image or use a user-specified **bosinst.data** file with the **CUSTOMIZATION\_FILE** field set. The **mkcd** command copies this file to the **RAM** file system. Therefore, the path in the **CUSTOMIZATION\_FILE** field must be as follows:  

```
../../filename
```
12. You can use your own **bosinst.data** file, rather than the one in the **mksysb** image, by entering the full path name of your **bosinst.data** file in the **User supplied bosinst.data file** field.
13. To enable debugging for the **mkcd** command, set **Debug output?** to **yes**. The debug output goes to the **smit.log**.
14. You can use your own **image.data** file, rather than the **image.data** file in the **mksysb** image, by entering the full path name of your **image.data** file for the **User supplied image.data file** field.

## User Volume Group Backup

The **savevg** command provides the ability to create a user-volume group backup to a CD, DVD, tape, or file. The **savevg** command finds and backs up all files belonging to a specified volume group. The volume group must be varied-on, and the file systems must be mounted.





This user backup contains a copy of a non-rootvg volume group, and is useful for volume groups that contain user data.



The **savevg** command uses a data file created by the **mkvgdata** command. The data file created is as follows:

```
/tmp/vgdata/vgname/vgname.data
```

The *vgname.data* file contains information about a user volume group. The **savevg** command uses this file to create a backup image that can be used by the **restvg** command to re-create the user volume group.

The **savevg** command with the **-r** flag is used to back up only a user-volume group's logical volume structure information. The data needed to list backup properties is also backed up. The **-r** flag runs the **mkvgdata** command for the volume group specified to create a *vgname.data* file. The **-r** flag backs up only the *vgname.data* file, any map files, and the **backup.data** file. The backup image that is created is used with the **restvg -r** command option to create only the volume group, logical volumes, and file system information contained in the file, without restoring any data. For example, to back up only the paul user volume group's structure information to the */vg\_backup/paul\_vg\_data* file, type the following:

```
savevg -r -f /vg_backup/paul_vg_data paul
```

You can also use the **mkcd** command to create a user volume group backup to CD or DVD. The **mkcd** command saves one volume group at a time to a CD or DVD.

The **mkcd** command with the **-L** flag allows the creation of ISO9660 DVD sized images. The **mkcd** command with the **-U** flag allows the creation of UDF DVD images.

If your **rootvg** image and **savevg** image are small enough to fit on one CD, you can save them both by using the **-l** (stacklist) and **-z** (customization\_script) flags. The **-l** flag gives a list of images to copy to the CD. The **-z** flag lets you create a script to restore **savevg** backups. For example, if you make a copy of a non-rootvg volume group ahead of time, and then write a script that calls the **restvg** command, your non-rootvg volume group would be restored to *hdisk2* at the end of the installation of **rootvg**, as shown by the following command:

```
restvg -d /SPOT/installp/ppc/savevg_image hdisk2
```

This procedure is recommended *only* if you know you want to restore the non-rootvg volume group every time you install. Otherwise, you might just want to store it on the CD/DVD, then use **restvg** to restore it after reboot. The **restvg** command can restore from CD or DVD if the name of the image is *savevg\_image*. If you save the non-rootvg backup on a CD or DVD with a different file name, you can insert that CD or DVD and use the full path to the file name as the device for the **restvg** command.

Use either Web-based System Manager or SMIT to back up user volume groups to CD or DVD.

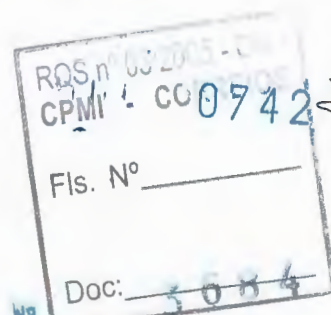
### Creating a User Volume Group Backup Using Web-based System Manager

Use Web-based System Manager and select **System backup wizard method**. You can create a non-bootable CD or DVD that contains only a volume group backup image of a user volume group.

### Creating a User Volume Group Backup Using SMIT

Use SMIT to create a backup image of a user volume group, as follows:

1. To back up a user volume group to tape or file using SMIT, type **smit savevg** on the command line. Back up a user volume group to CD by typing **smit savevgcd** on the command line. Back up a user volume group to DVD by typing **smit savevgdvd** on the command line.
2. When the Save a Volume Group screen displays, use the steps for backing up the root volume group as a guide for backing up user volume groups. There is one exception to this procedure. If you want to exclude files in a user volume group from the backup image, create a file named */etc/exclude.volume\_group\_name*, where *volume\_group\_name* is the name of the volume group you want to backup.







3. If you exclude files, edit the `/etc/exclude.volume_group_name` file and enter the patterns of file names that you do not want included in your backup image. The patterns in this file are input to the pattern-matching conventions of the **grep** command to determine which files are excluded from the backup.

## Backup Options

After you have a system backup or a user volume group backup, you may want to verify the backup or list information about the backup image. This section provides information on the operations you can perform on a backup image. The commands used to perform these operations are the **lsmkysb** command for system backups, and the **lssavevg** command for user volume groups. Using the **lsmkysb** command or the **lssavevg** command, you can perform the following operations:

- "Preview Information About a Backup"
- "Verifying a System Backup"
- "View the Backup Log" on page 124
- "List Information About Filesets in a System Image" on page 124
- "List Files in a System Image" on page 124

### Preview Information About a Backup

The preview option allows you to view volume group information, the date and time the backup was made, and the level of AIX.

You can use the **lsmkysb** command or the **lssavevg** command with the **-l** option to preview a backup image. For example, to preview a system backup file called `/tmp/mybackup`, type the following:

```
# lsmkysb -l -f /tmp/mybackup
```

Output similar to the following displays:

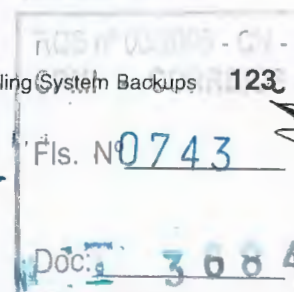
```
VOLUME GROUP:      rootvg
BACKUP DATE/TIME:   Mon Jul 29 22:03:27 CDT 2002
UNAME INFO:         AIX va08 2 5 000974AF4C00
BACKUP OSLEVEL:     5.2.0.0
none
MAINTENANCE LEVEL:  none
BACKUP SIZE (MB):   1408
SHRINK SIZE (MB):   1242
```

```
rootvg:
LV NAME      TYPE      LPs      PPp      PVs      LV STATE      MOUNT POINT
hd5          boot      1        1        1        closed/syncd  N/A
hd6          paging    16       16       1        open/syncd    N/A
hd8          jfs2log   1        1        1        open/syncd    N/A
hd4          jfs2      1        1        1        open/syncd    /
hd2          jfs2      21       21       1        open/syncd    /usr
hd9var       jfs2      1        1        1        open/syncd    /var
hd3          jfs2      1        1        1        open/syncd    /tmp
hd1          jfs2      1        1        1        open/syncd    /home
hd10opt      jfs2      1        1        1        open/syncd    /opt
fs1v00       jfs2      31       31       1        open/syncd    /export/nim
fs1v01       jfs2      1        1        1        open/syncd    /tftpboot
```

To preview a backup image in the SMIT, use the **lsbackupinfo** fast path.

### Verifying a System Backup

To list the contents of a **mksysb** image on tape or CD, you can use either Web-based System Manager (type **wsm** on the command line, then choose the Backup and Restore application) or SMIT (type **smit lsmkysb** on the command line). The listing verifies most of the information on the tape or CD, but does not verify that the backup media can be booted for installations. The only way to verify that the boot image(s) on a **mksysb** tape or CD function properly is by booting from the media.







## View the Backup Log

You can view the backup log that is created each time a volume group is backed up. The log file contains information on previous volume group and system backups.

You can use the **lsmksysb** command or the **lssavevg** command with the **-B** option to view the backup log file. Type:

```
# lsmksysb -B
```

Output similar to the following displays:

```
#Device;Command;Date;Shrink Size;Full Size;Maintenance Level
/export/mksysb/generic_sysb;"mksysb -X -e /export/mksysb/generic_sysb";M
on Jul 29 22:11:17 CDT 2002;1242;1408;
/export/mksysb/generic_sysb;"mksysb -X -e /export/mksysb/generic_sys
b";Tue Jul 30 16:38:31 CDT 2002;2458;2720;
```

To view the backup log in the SMIT, select **View the Backup Log** in the System Backup Manager menu.

## List Information About Filesets in a System Image

You can view the filesets installed in a system backup using the **lsmksysb** command with the **-L** option. For example, to view the filesets installed in a system backup, type the following:

```
# lsmksysb -L -f generic_sysb
```

Output similar to the following displays:

Fileset	Level	State	Description
-----			
Path: /usr/lib/objrepos			
IMNSearch.bld.DBCS	2.4.0.0	COMMITTED	NetQuestion DBCS Buildtime
Modules			
.			
.			
.			
bos.terminfo.wyse.data	5.2.0.0	COMMITTED	Wyse Terminal Definitions
bos.txt.spell.data	5.2.0.0	COMMITTED	Writer's Tools Data
bos.txt.tfs.data	5.2.0.0	COMMITTED	Text Formatting Services Data

To view the filesets installed in a system backup in SMIT, use the **lsippbackup** fast path.

## List Files in a System Image

You can list all the files and file sizes in a backup using the **lsmksysb** command or the **lssavevg** command. For example, to view the files and file sizes in a system backup, type the following:

```
# lsmksysb -f generic_sysb
```

Output similar to the following displays:

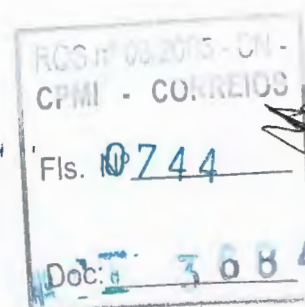
```
.
.
.
353218 ./smit.log
252 ./smit.script
0 ./tftpboot
0 ./tmp
5 ./u
21 ./unix
```

The total size is 629313078 bytes.

To view the files and file sizes in a user-volume group backup that contains only the user-volume group's structure information, type the following:

```
# lssavevg -f /vg_backup/paul_vg_data -l
```

Output similar to the following displays:





VOLUME GROUP: paul  
BACKUP DATE/TIME: Fri Feb 28 12:30:34 CST 2003  
UNAME INFO: AIX va06 2 5 000917184C00  
BACKUP OSLEVEL: 5.2.0.10  
MAINTENANCE LEVEL: 52010  
BACKUP SIZE (MB): 0  
SHRINK SIZE (MB): 0  
VG DATA ONLY: yes

paul:  
LV NAME TYPE LPs PPs PVs LV STATE MOUNT POINT

To view the files and file sizes in a system backup in SMIT, use the **lsmkysyb** fast path.

## Installing System Backups

This chapter describes how to install the Base Operating System (BOS) using a system backup image, also called a *mksysb image*. You can use a system backup to restore a corrupted operating system. But installing a system from a backup can also reduce (or even eliminate) repetitive installation and configuration tasks. For example, you can use a backup to transfer optional software installed on the *source* system (the machine from which you created the backup copy), in addition to the basic operating system. Also, the backup image can transfer many user configuration settings to the *target* system (a different machine on which you are installing the system backup).

The procedure you use to install from a system backup depends on whether you are installing on the source or target system and which interface you want to use:

- “Cloning a System Backup” on page 126 contains the procedure to install a system backup on a target machine to propagate a consistent operating system, optional software, and configuration settings.
- “Installing a System Backup on the Source Machine” on page 126 contains the Web-based System Manager and SMIT procedures to reinstall an operating system onto the same machine from which you created the backup.

You can install a system from a backup image that is stored on tape or CD, or in a file. If you want to install a backup stored in a directory on your network installation server, refer to “Using a mksysb Image to Install the Base Operating System (BOS) on a NIM Client (mksysb Installation)” on page 181.

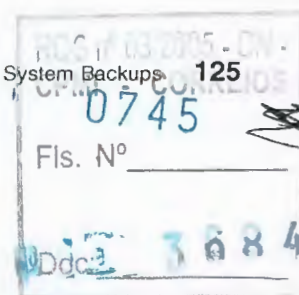
The procedures to install from backup operate either in prompted or nonprompted mode, depending on conditions set in the **/bosinst.data** file and on compatibility between the backup image and the installed machine. See Chapter 8, “Customized BOS Installations”, on page 57 for information on how to modify the **bosinst.data** file to preset installation parameters when you create a system backup.

When installing the backup image, the system checks whether the target system has enough disk space to create all the logical volumes stored on the backup. If there is enough space, the entire backup is recovered. Otherwise, the installation halts and the system prompts you to choose additional destination hard disks.

File systems are created on the target system at the same size as they were on the source system, unless the backup image was created with **SHRINK** set to **yes** in the **image.data** file (or you set it to **yes** in the BOS Install menus). An exception is the **/tmp** directory, which can be increased to allocate enough space for the **bosboot** command. For information about setting variables, refer to the **image.data** file in *AIX 5L Version 5.2 Files Reference*.

After installing the backup image, the installation program reconfigures the Object Data Manager (ODM) on the target system. If the target system does not have exactly the same hardware configuration as the source system, the program might modify device attributes in the following target system files:

- All files in **/etc/objrepos** beginning with **Cu**







- All files in the `/dev` directory

The settings in the bootlist of the target system are not restored. After a system backup restore, the bootlist is reset to the primary boot device.

## Cloning a System Backup

With a **mksysb** image, you can clone one system image onto multiple target systems. However, the target systems might not contain the same hardware devices or adapters, or require the same kernel (uniprocessor or microprocessor) as the source system. Beginning in AIX 5.2, all devices and kernels are automatically installed during a BOS installation. As a result, when you create a system backup, the **mksysb** image contains all the device and kernel support. For example, you can create a system backup from *System\_A* and install *System\_A*'s **mksysb** image onto *System\_B* without having to use product media to boot *System\_B*. For more information on installing all devices and kernels, see "Install All Device and Kernel Support Before the Backup is Created" on page 114.

Beginning in AIX 5.2, if you are performing a clone installation, device information will not be restored to the target system. During a clone installation, the BOS installation process verifies that the **mksysb** image is from the system you are trying to install. If the target system and the **mksysb** image are different, the device is not recovered.

If the source system does not have the correct passwords and network information, you can make modifications on the target system now. Also, some products (such as **grPHIGS**) ship device-specific files. If your graphics adapter is different on the target system, verify that the device-specific filesets for graphics-related LPPs are installed.

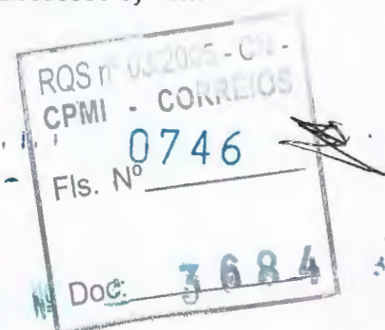
## Installing a System Backup on the Source Machine

You can use Web-based System Manager or SMIT to restore an operating system onto the same machine from which you created the backup. For either interface, the following conditions must be met before beginning the procedure:

- All hardware must already be installed, including external devices, such as tape and CD/DVD-ROM drives.
- Obtain the system key for the lock (if present) on your system unit.
- Obtain your system backup image from one of the following sources:

<b>CD or DVD</b>	BOS CDs, created in one of the following ways: <ul style="list-style-type: none"><li>• Using the Web-based System Manager <b>Backup and Restore</b> application. Select <b>System backup to writable CD</b>.</li><li>• Using the SMIT Back Up This System to CD menu.</li><li>• From the command line, using the <b>mkcd</b> command.</li></ul>
<b>Tape</b>	BOS tapes, created in one of the following ways: <ul style="list-style-type: none"><li>• Using the Web-based System Manager <b>Backup and Restore</b> application. Select <b>Back up the system</b>.</li><li>• Using the SMIT Back Up the System to Tape/File menu.</li><li>• From the command line, using the <b>mksysb -i Target</b> command.</li></ul>
<b>Network</b>	The path to your backup image file. For information about installing a backup across a network, refer to "Using a mksysb Image to Install the Base Operating System (BOS) on a NIM Client (mksysb Installation)" on page 181.

**Note:** Before you begin, select the tape or CD/DVD-ROM drive as the primary boot device. For additional information, refer to the section in your hardware documentation that discusses system management services.





### To use Web-based System Manager:

1. Start the Web-based System Manager by typing `wsm` on the command line as root user.
2. Expand **Software** in the Navigation Area, select **Overview and Tasks**, then select **Reinstall Operating System**.
3. Choose the installation device:
  - Network  
If you choose this option, your machine must either be a configured NIM client, or have access to a NIM environment. If your machine is not a NIM client, the Reinstall Base Operating System wizard leads you through the process. For more information on setting up a NIM environment, see "Using Installation Images to Install the Base Operating System (BOS) on a NIM Client" on page 180.
  - Tape or CD/DVD-ROM
4. Choose **Install a system backup image (mksysb)** as the installation type.
5. Follow the wizard prompts to complete the procedure.

### To use SMIT:

1. Verify that your system is shut down. If your machine is currently running, you must power it off now by following these steps:
  - a. Log in as the root user.
  - b. Enter the following command:  
`shutdown -F`
  - c. If your system does not automatically power off, place the power switch in the Off (0) position.

**Attention:** Do *not* turn on the system unit until Step 5 on page 128.

2. Turn on all attached external devices. These include:

- Terminals
- CD or DVD drives
- Tape drives
- Monitors
- External disk drives

Turning on the external devices first is necessary so that the system unit can identify them during the startup (boot) process.

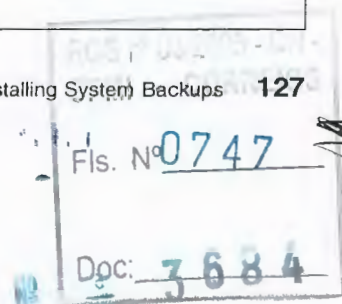
3. Insert the installation media into the tape or CD or DVD drive.

You might find that on certain tape drive units, the tape drive door does not open while the system is turned off. If you have this problem, use the following procedure:

- a. Turn on the system unit.
  - b. Insert the boot installation tape (insert Volume 1 if you received more than one volume).
  - c. Turn off the system unit and wait for 30 seconds.
4. If you are not using an ASCII terminal, skip to Step 6. If you are using an ASCII terminal, use the following criteria to set the communications, keyboard, and display options.

**Note:** If your terminal is an IBM 3151, 3161, or 3164, press the Ctrl+Setup keys to display the Setup Menu and follow the onscreen instructions to set these options. If you are using some other ASCII terminal, refer to the appropriate documents for information about how to set these options. Some terminals have different option names and settings than those listed here.

Communication Options	
Option	Setting
Line Speed (baud rate)	9600







Communication Options	
Option	Setting
Word Length (bits per character)	8
Parity	no (none)
Number of Stop Bits	1
Interface	RS-232C (or RS-422A)
Line Control	IPRTS

Keyboard and Display Options	
Option	Setting
Screen	normal
Row and Column	24x80
Scroll	jump
Auto LF (line feed)	off
Line Wrap	on
Forcing Insert	line (or both)
Tab	field
Operating Mode	echo
Turnaround Character	CR
Enter	return
Return	new line
New Line	CR
Send	page
Insert Character	space

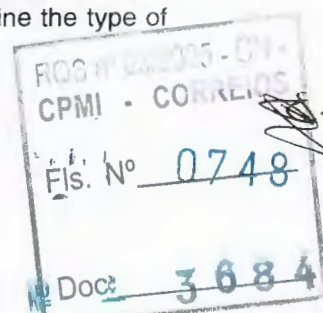
5. Turn the system unit power switch from Off (0) to On (I). The system begins booting from the backup media. If your system is booting from tape, it is normal for the tape to move back and forth. If your system has an LED display, the three-digit LED should display c31.

**Note:** You can boot from production media (tape or CD) if your backup media fails to boot. The initial Welcome screen includes an option to enter a maintenance mode in which you can continue the installation from your backup media. Refer to "Troubleshooting an Installation from a System Backup" on page 143 for more information.

If you have more than one console, each terminal and directly attached display device (or console) might display a screen that directs you to press a key to identify your system console. A different key is specified for each terminal displaying this screen. If this screen is displayed, then press the specified key *only* on the device to be used as the system console. (The system console is the keyboard and display device used for installation and system administration.) Press a key on only one console.

**Note:** If the **bosinst.data** file lists a valid display device for the **CONSOLE** variable, you do not manually choose a system console. Read Chapter 8, "Customized BOS Installations", on page 57 for more information about the **bosinst.data** file.

6. The type of installation that begins is determined by the settings of the **PROMPT** field in the control\_flow stanza of the **bosinst.data** file. Use the following criteria to determine the type of







installation you will be using:

- PROMPT = no      Nonprompted Installation. This installation method is used if the backup image is configured to install automatically, without having to respond to the installation program. Go to step 8.
- PROMPT = yes      Prompted Installation. This installation method is used if you need to use menu prompts to install the backup image. Also, use this installation method if a nonprompted installation halts and the Welcome to Base Operating System Installation and Maintenance screen displays. Go to step 9.

7. A successful nonprompted installation requires no further instructions because the installation is automatic.

**Note:** If the backup image holds source system-configuration information that is incompatible with the target system, the nonprompted installation stops and a prompted installation begins.

The Installing Base Operating System screen displays before the installation starts. The nonprompted installation pauses for approximately five seconds before beginning. After this time, the non-prompted installation continues to completion.

However, if you decide to interrupt the automatic installation and start a prompted session, type 000 (three zeros) at the terminal and follow the remaining steps in this procedure.

8. The Welcome to the Base Operating System Installation and Maintenance screen displays.

**Note:** You can view Help information at each screen of this installation process by typing 88.

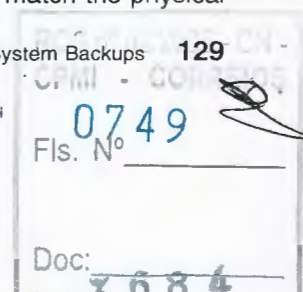
Choose the **Change/Show Installation Settings and Install** option.

9. The System Backup Installation and Settings displays. This screen shows current settings for the system. An ellipsis follows the disk listed in the first line if there is more than one disk selected.
10. Either accept the settings or change them. For more information on using map files, see "Creating System Backups" on page 113.
- To accept the settings and begin the installation, skip to step 16.
- To change the settings, continue with step 11.
11. Type 1 in the System Backup Installation and Settings screen to specify disks where you want to install the backup image. The Change Disk(s) Where You Want to Install screen displays. This screen lists all available disks on which you can install the system backup image. Three greater-than signs (>>>) mark each selected disk.
- Type the number and press Enter for each disk you choose. Type the number of a selected disk to deselect it. You can select more than one disk.

**Note:** You can also specify a supplemental disk by typing 66 and pressing the Enter key for the **Disks not known to Base Operating System Installation** option. This option opens a new menu that prompts for a device support media for the supplemental disk. BOS installation configures the system for the disk and then returns to the Change Disk(s) Where You Want to Install screen.

12. After you have finished selecting disks, press the Enter key.
- The screen that displays after you press the Enter key is dependent on the availability of map files for all of the selected disks. The criteria for this is as follows:
- If one or more selected disks have no maps, BOS installation returns directly to the System Backup Installation and Settings screen. Skip to step 15.
  - If all selected disks have maps, the Change Use Maps Status screen displays, where you choose whether to use maps for installation. Continue with step 14.

To preserve the placement of files during a future restoration of the backup, you can create map files before backing up a system. Map files, stored in the `/tmp/vgdata/rootvg` directory, match the physical







partitions on a drive to its logical partitions. Create map files either with the SMIT Backup the System menu, using Web-based System Manager, or using the **-m** option when you run the **mksysb** command.

For more information about map files, see *Using Map Files for Precise Allocation in AIX 5L Version 5.2 System Management Concepts: Operating System and Devices*.

13. Type either 1 or 2 in the Change Use Maps Status screen to specify whether the installation program is to use maps.

When you complete this choice, BOS installation returns to the System Backup Installation and Settings screen.

14. Decide whether BOS installation is to shrink file systems on the disks where you install the system. When you choose this option, the logical volumes and file systems within a volume group are re-created to the minimum size required to contain the data. This reduces wasted free space in a file system.

File systems on your backup image might be larger than required for the installed files. Press the 2 key to toggle the **Shrink File Systems** option between **Yes** and **No** in the System Backup Installation and Settings screen. The default setting is **No**.

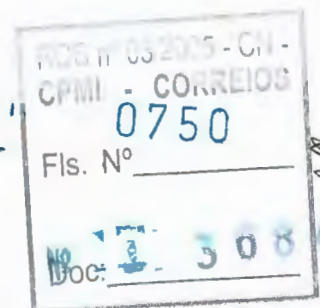
**Note:** Shrinking the file system disables the use of maps.

15. Type 0 to accept the settings in the System Backup Installation and Settings screen.

The Installing Base Operating System screen displays the rate of completion and duration.

If you specified a supplemental disk in step 12, an untitled screen temporarily replaces the Installing Base Operating System screen. When this screen displays, it prompts you to place the device-support media in the drive and press the Enter key. BOS installation reconfigures the supplemental disk, then returns to the Installing Base Operating System screen.

The system reboots automatically when the installation completes.





## Chapter 13. Alternate Disk Installation

Alternate disk installation lets you install the operating system while it is still up and running, which reduces installation or upgrade downtime considerably. It also allows large facilities to better manage an upgrade because systems can be installed over a longer period of time. While the systems are still running at the previous version, the switch to the newer version can happen at the same time.

Alternate disk installation can be used in the following ways:

- Installing a **mksysb** image on another disk. For further information, see "Alternate mksysb Disk Installation".
- Cloning the current running **rootvg** to an alternate disk. For further information, see "Alternate Disk rootvg Cloning" on page 132.
- Using the Network Installation Management (NIM) environment to perform a alternate disk migration installation of a NIM client. For further information, see "Alternate Disk Migration Installation" on page 133.

### Filesets to Install

An alternate disk installation uses the following filesets:

**bos.alt\_disk\_install.boot\_images**  
**bos.alt\_disk\_install.rte**

Must be installed for alternate disk **mksysb** installations.  
Must be installed for **rootvg** cloning and alternate disk **mksysb** installations.

### Alternate mksysb Disk Installation

Alternate **mksysb** installation involves installing a **mksysb** image that has already been created from a system, onto an alternate disk of the target system. The alternate disk or disks cannot contain a volume group. The **mksysb** image is created on a system that either was the same hardware configuration as the target system, or had all the device and kernel support installed for a different machine type or platform, or different devices. The installed device and kernel support would be as follows:

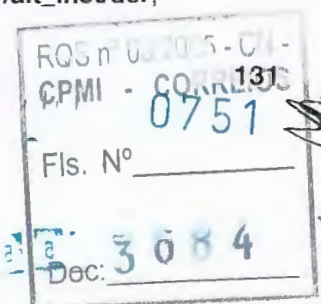
- **devices.\***
- **bos.mp**
- **bos.up**
- **bos.mp64**, if necessary

**Note:** Beginning in AIX 5.2, all device and kernel support is automatically installed during a base operating system installation.

When the **alt\_disk\_install** command is run, the **image.data** file from the **mksysb** image is used by default (unless a customized **image.data** is given) to create the logical volumes and file systems. The prefix **alt\_** is added to the logical volume names, and the file systems are created with a prefix of **/alt\_inst**. For example, **hd2** would be created as **alt\_hd2**, and its file system, **/usr**, would be created as **/alt\_inst/usr**. These names are changed back to their original names at the end of the alternate disk installation process.

The **mksysb** image is then restored into the alternate file system. A prepopulated boot image is then copied to the boot logical volume of the **altinst\_rootvg**, and the boot record of the boot disk is modified to allow booting from the disk.

At this point, a script can be run to allow for any customization before the system is rebooted. The alternate file systems are still mounted as **/alt\_inst/real\_file\_system** (for example: **/alt\_inst/usr**,





/alt\_inst/home). Files can be accessed at this point, but nothing can be installed into the alternate file system because the kernels and libraries of the **mksysb** image may not match those of the running system.

After the optional script is run, the file systems are unmounted, and the logical volume and file system names are changed to match the **image.data** file's names (for example, **alt\_inst\_hd6** is changed to **hd6** in the volume group descriptor area). The logical volumes are exported from the Object Data Manager (ODM), but the **altinst\_rootvg** is only varied off. It is left in the ODM as a placeholder so the disk is not accidentally overwritten. The default action of the **alt\_disk\_install** command is to set the bootlist so that the next time the system boots, it boots from this newly installed volume group. This default action can be turned off. If specified, the system reboots at this point, and the system reboots from the new **rootvg**. The boot process proceeds to a certain point, with the new **rootvg**'s file systems mounted, and the **bosboot** command is called to rebuild a "normal" boot logical volume. The system then reboots.

After rebooting from the new alternate disk, the former **rootvg** volume group is contained in an **lspv** listing as **old\_rootvg**, and includes all disk(s) in the original **rootvg**. This former **rootvg** volume group is set to not varyon at reboot and should *only* be removed with the **-X** flag. For example:

```
alt_disk_install -X old_rootvg
```

If a return to the original **rootvg** is necessary, the **bootlist** command is used to change the bootlist to reboot from the original **rootvg**.

If it is unclear which disk is the boot disk for a specific volume group, use the **-q** flag to determine the boot disk. This flag can be useful when a volume group comprises multiple disks and a change in the bootlist is necessary.

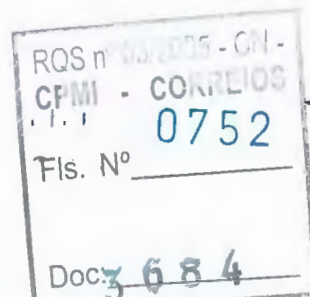
---

## Alternate Disk rootvg Cloning

Cloning the **rootvg** to an alternate disk has many advantages. One advantage is having an online backup available, in case of a disk crash. Keeping an online backup requires an extra disk or disks to be available on the system. Another benefit of **rootvg** cloning occurs when applying new maintenance levels or updates. A copy of the **rootvg** is made to an alternate disk, then updates are applied to that copy. The system runs uninterrupted during this time. When it is rebooted, the system boots from the newly updated **rootvg** for testing. If updates cause problems, the **old\_rootvg** can be retrieved by resetting the bootlist and then rebooting.

By default, calling the **alt\_disk\_install** command does the following:

1. Creates an **/image.data** file based on the current **rootvg**'s configuration. A customized **image.data** file can be used.
2. Creates an alternate **rootvg** (**altinst\_rootvg**).
3. Creates logical volumes and file systems with the **alt\_inst** prefix.
4. Generates a backup file list from the **rootvg**, and if an **exclude.list** file is given, those files are excluded from the list.
5. Copies the final list to the **altinst\_rootvg**'s file systems.
6. If specified, the **installp** command installs updates, fixes, or new filesets into the alternate file system.
7. The **bosboot** command creates a boot logical volume on the alternate boot disk.
8. If a customization script is specified, it runs at this point.
9. The file systems are then unmounted, and the logical volumes and file systems are renamed.
10. The logical volume definitions are exported from the system to avoid confusion with identical ODM names, but the **altinst\_rootvg** definition is left as an ODM placeholder.
11. By default, the bootlist is set to the new cloned **rootvg** for the next reboot.







## Phased Alternate Disk Installation

For AIX 4.3.1 and later, alternate disk installation can be performed in stages. The installation itself is broken down into three phases. The default is to perform all three phases in the same invocation. The phases are as follows:

- |                |   |
|----------------|---|
| <b>Phase 1</b> | Creates the <b>altinst_rootvg</b> volume group, the <b>alt_</b> logical volumes, and the <b>/alt_inst</b> file systems. Also restores the <b>mksysb</b> or <b>rootvg</b> data.  |
| <b>Phase 2</b> | Runs any specified customization script. For cloning only, installs updates, new filesets, fixes, or bundles. Also copies a <b>resolv.conf</b> file (if specified) and necessary files to remain a NIM client (if specified).                     |
| <b>Phase 3</b> | Unmounts the <b>/alt_inst</b> file systems, renames the file systems and logical volumes, removes the <b>alt_</b> logical volume names from ODM, and varies off the <b>altinst_rootvg</b> . It also sets the bootlist and reboots (if specified). |

As an alternative to running all three phases, the phases can be completed by one of the following methods:

- Each phase separately
- Phases 1 and 2 together
- Phases 2 and 3 together (Phase 2 can be run multiple times before Phase 3 is run.)

You must run Phase 3 to obtain a usable **rootvg**. Running Phases 1 and 2 leave the **/alt\_inst** file systems mounted. Any time during the phase process and before rebooting, the **altinst\_rootvg** can be removed, and disk cleanup occurs using the following command:

```
alt_disk_install -X
```

---

## Alternate Disk Migration Installation

Alternate disk migration installation allows the user to create a copy of **rootvg** to a free disk (or disks) and simultaneously migrate it through Network Installation Management (NIM) to a new release level. Using alternate disk migration installation over a conventional migration provides the following advantages:

- Reduced downtime (the migration is performed while the system is up normally and there is no need to boot from any media).
- Quick recovery in case of migration failure.
- High degree of flexibility and customization.

**Reduced downtime.** The migration is performed while the system is up and functioning. There is no requirement to boot from install media, and the majority of processing occurs on the NIM master.

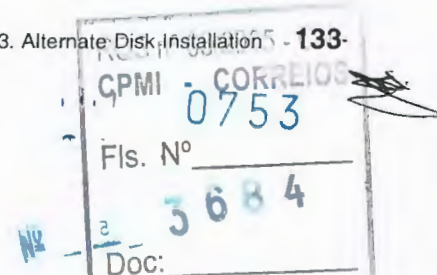
**Quick recovery in the event of migration failure.** Because you are creating a copy of **rootvg**, all changes are performed to the copy (**altinst\_rootvg**). In the event of serious migration installation failure, the failed migration is cleaned up, and there is no need for the administrator to take further action. In the event of a problem with the new (migrated) level of AIX, the system can be quickly returned to the premigration operating system by booting from the original disk.

**High degree of flexibility and customization in the migration process.** This is done with the use of optional NIM customization resources: **image\_data**, **bosinst\_data**, **exclude\_files**, premigration script, **installp\_bundle**, and post-migration script.

## Requirements

Alternate disk migration installation has the following requirements:

- Configured NIM master running AIX 5.1 or later with AIX recommended maintenance level 5100-03 or later.







- The NIM master must have **bos.alt\_disk\_install.rte** installed in its **rootvg** and the **SPOT** which will be used.
- The level of the NIM master **rootvg**, **lpp\_source**, and **SPOT** must be at the same level.
- The client (the system to be migrated) must be at AIX 4.3.3 or later.
- The client must have a disk (or disks) large enough to clone the **rootvg** and an additional 500 MB (approximately) of free space for the migration. The total amount of required space will depend on original system configuration and migration customization.
- The client must be a registered NIM client to the master.
- The nim master must be able to execute remote commands on the client using the **rshd** protocol.
- The client must have a minimum of 128 MBs of memory.
- A reliable network, which can facilitate large amounts of NFS traffic, must exist between the NIM master and the client.
- The client's hardware should support the level it is migrating to and meet all other conventional migration requirements.

**Note:** If you cannot meet the alternate disk migration installation requirements 1-10, perform a conventional migration. For information on the conventional migration installation method, see Chapter 6, "Migration Installation", on page 47. If you cannot meet requirement 11, no migration installation is possible.

Before performing an alternate disk migration installation, you are required to agree to all software license agreements for software to be installed. You can do this by specifying the **-Y** flag as an argument to the alternate disk migration command or setting the **ADM\_ACCEPT\_LICENSES** environment variable to **yes**.

## Limitations

The following limitations apply to alternate disk migration installation:

- If the client's **rootvg** has the Trusted Computing Base option enabled, either disable it (permanently) or perform a conventional migration. TCB must access file metadata that is not visible over NFS.
- All NIM resources used must be local to the NIM master.
- During the migration, the client's active **rootvg** may experience a small performance decrease due to increased disk I/O, **nfsd** activity, and some CPU usage associated with **alt\_disk\_install** cloning.
- NFS tuning may be required to optimize performance.

## Alternate Disk Migration Installation Usage

The syntax for the alternate disk migration installation command is the following:

```
nimadm -l lpp_source -c NIMclient -s SPOT -d Targetdisks  
[ -a PreMigrationScript ] [ -b installp_bundle ] [ -z PostMigrationScript ]  
[ -e exclude_files ] [ -i image_data ] [ -m NFSMountOptions ] [ -o bosinst_data ]  
[ -P Phases ] [ -Y ] [ -F ] [ -D ] [ -E ] [ -V ] [ { -B | -r } ]
```

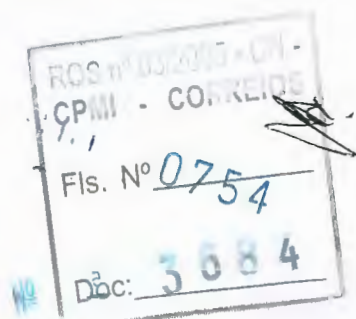
Use the **nimadm** command to target the **aix1** NIM client, using the **spot1** NIM **SPOT** resource, the **lpp1** NIM **lpp\_source** resource, and **hdisk1** and **hdisk2** target disks, by typing the following:

```
nimadm -c aix1 -s spot1 -l lpp1 -d "hdisk1 hdisk2" -Y
```

Use the **-Y** flag to agree to all required software license agreements for the software being installed

## Alternate Disk Migration Installation Process

The **nimadm** command performs a migration in 12 phases. Each phase can be executed individually using the **-P** flag. Before performing a migration in phases, the user should have a good understanding of the **nimadm** process. The **nimadm** phases are as follows:







1. The master issues the **alt\_disk\_install** command to the client, which makes a copy of the **rootvg** to the target disks (this is Phase 1 of the **alt\_disk\_install** process). In this phase, **altinst\_rootvg** (alternate **rootvg**) is created.
2. The master runs remote client commands to export all of the **/alt\_inst** file systems to the master. The file systems are exported as read/write with root access to the master.
3. The master NFS mounts the file systems exported in Phase 2.
4. If a premigration script resource has been specified, it is executed at this time.
5. System configuration files are saved. Initial migration space is calculated and appropriate file system expansions are made. The **bos** image is restored and the device database is merged (similar to a conventional migration). All of the migration merge methods are executed and some miscellaneous processing takes place.
6. All system filesets are migrated using **installp**. Any required RPM images are also installed during this phase.
7. If a **post-migration** script resource has been specified, it is executed at this time.
8. The **bosboot** command is run to create a client boot image, which is written to the client's boot logical volume (**hd5**).
9. All mounts made on the master in phase 3 are removed.
10. All client exports created in phase 2 are removed.
11. The **alt\_disk\_install** command is called again (phase 3 of **alt\_disk\_install**) to make final adjustments and put **altinst\_rootvg** to sleep. The bootlist is set to the target disk (unless the **-B** flag is used).
12. Cleanup is executed to end the migration. The client is rebooted, if the **-r** flag is specified.

**Note:** The **nimadm** command supports migrating several clients at the same time.

For more information about the **nimadm** command, refer to the *AIX 5L Version 5.2 Commands Reference*.

## Data Access Between the Original rootvg and the New Alternate Disk

You can initiate data access between the original **rootvg** and the new alternate disk. A volume group "wake-up" can be accomplished, on the non-booted volume group. The "wake-up" puts the volume group in a **post alt\_disk\_install** Phase 1 state. For example, the **/alt\_inst** file system is then mounted.

The volume group that experiences the "wake-up" is renamed **altinst\_rootvg**. When data access is no longer needed, the volume group can be "put to sleep."

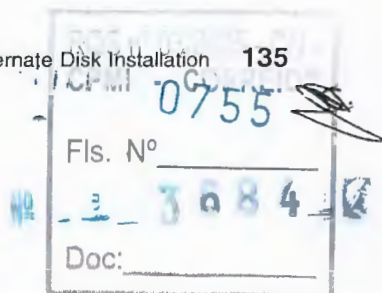
### Notes:

1. The running operating system's version must be greater than or equal to the version of the volume group that undergoes the "wake-up." This might mean that it is necessary to boot from the **altinst\_rootvg** and "wake-up" the **old\_rootvg**. For example, an alternate disk is created from an **alt\_disk\_install** AIX 5.2 **mksysb**, on a AIX 4.3.0 system. It is then necessary to boot from the AIX 5.2 alternate disk and "wake-up" the AIX 4.3.0 **old\_rootvg** volume group to access data between the two volume groups.

This limitation is caused by a journaled file system (JFS) log entry incompatibility. It is possible to "wake-up" a volume group that contains a more recent version, but the volume group cannot have ever been the system **rootvg**. If this was true, the volume group would have made JFS log entries that could not be interpreted by an older version **rootvg**, when the volume group was experiencing a "wake-up."

The **alt\_disk\_install** command does not allow a "wake-up" to occur on a volume group with a more recent version, unless the **FORCE** environment variable is set to **yes**.

2. The volume group that experiences a "wake-up" *must* be put to sleep before it can be booted and used as the **rootvg**.







**Attention:** If a FORCE "wake-up" is attempted on a volume group that contains a more recent version of the running operating system, and the "waking" volume group has been a system **rootvg** errors occur.

---

## Installing to an Alternate Disk using Web-based System Manager

The graphical interface provides access to Web-based System Manager options for installing a **mksysb** to an alternate disk and for cloning a **rootvg** to the alternate disk. At any time during the following procedures, you can view extended help by selecting **Contents** from the Help menu.

To install a **mksysb** to an alternate disk, do the following:

1. Start the Web-based System Manager by typing **wsm** on the command line.
2. Select the **Software** container.
3. From the pulldown, select **Alternate Disk Install—>Install Mksysb on an Alternate Disk**.

To clone the **rootvg** to an alternate disk, do the following:

1. Start the Web-based System Manager by typing **wsm** on the command line.
2. Select the **Software** container.
3. From the pulldown, select **Alternate Disk Install—>Clone the Rootvg to an Alternate Disk**.

---

## Running Alternate Disk Installation Using SMIT

To run alternate disk **mksysb** installation, do the following:

1. At the system prompt, type the **smit alt\_mksysb** fast path.
2. Type or select values in the entry fields. Press Enter after making all desired changes.

To run alternate disk **rootvg** cloning, do the following:

1. At the system prompt, type the **smit alt\_clone** fast path.
2. Type or select values in the entry fields. Press Enter after making all desired changes.

---

## Alternate Disk Installation and Dynamic Logical Partitioning

On a system that supports dynamic logical partitioning (DLPAR), you can dynamically add an adapter with disks to a running logical partition (LPAR). You can then install a new **rootvg** volume group to these newly added target disks using the **alt\_disk\_install** command with either the clone or **mksysb** option. If you are running the **alt\_disk\_install** command with dynamically added target disks on an LPAR system, the following flags might be used:

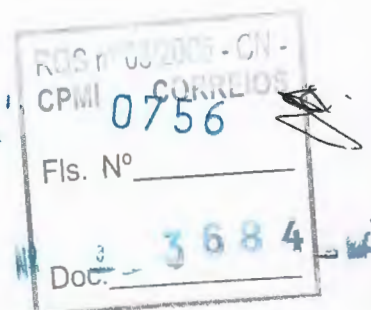
- O If the target disk will be used to boot an LPAR other than the one where the operation is being executed, use the **-O** flag to reset the device information.
- B This flag prevents the **bootlist** command from being run. A general limitation of dynamically added disks is that you can not specify them as a boot device (before an initial reboot operation). If you are attempting to boot an LPAR from dynamically added disks, set the boot list in the system management services (SMS) menus.
- g This flag causes the **alt\_disk\_install** command to run without checking if the disk is bootable. Dynamically added disks do not appear bootable to AIX until after a reboot operation. The user will need to verify that the newly added adapter and disks are bootable.

---

## Examples

1. To clone the **rootvg** running 4.3.2.0 to **hdisk1** and update that clone with the latest maintenance level 4.3.3.0 that is on **cd0**, run the following command:  

```
alt_disk_install -C -b update_all -l /dev/cd0 hdisk1
```







In SMIT, use the **smit alt\_clone** fast path and select **hdisk1** from the listing for Target Disk(s) to install, select the **update\_all** bundle from the listings in the **Bundle to Install** field, and **/dev/cd0** from the listing in the **Directory or Device with images** field.

2. To clone the **rootvg** running 4.3.2 to **hdisk3**, then update to the latest fixes that are mounted from another system on **/433fixes**, and run a customized script named **/tmp/finish\_alt\_install**, run the following command:

```
alt_disk_install -C -b update_all -l /433fixes \  
-s /tmp/finish_alt_install hdisk3
```

In SMIT, use the **smit alt\_clone** fast path and select **hdisk3** from the listing for Target Disk(s) to install, select the **update\_all** bundle from the listings in the **Bundle to Install** field, type **/433fixes** in the **Directory or Device with images** field, and type **/tmp/finish\_alt\_install** in the **Customization script** field.

3. To install an AIX 5.2 **mksysb** tape that was created from a machine with the same hardware configuration as the target, to **hdisk1**, run the following command:

```
alt_disk_install -d /dev/rmt0 hdisk1
```

In SMIT, use the **smit alt\_mksysb** fast path and select **hdisk1** from the listing for **Target Disk(s)** to install field and select **/dev/rmt0** from the listing for **Device** or image name field.

4. To install an AIX 5.2 **mksysb** image that is NFS mounted on file system **/mksysbs** to the alternate disk **hdisk2** using a customized **image.data** file and an exclude file containing **^./tmp/**, type the following command:

```
alt_disk_install -d /mksysbs/my_52_mksysb -i /mksysbs/my_52_image.data \  
-e /mksysbs/my_exclude_file hdisk2
```

Using the **^./tmp/** pattern does not backup files in the **/tmp** directory, but does backup files in the **/var/tmp** directory.

**Note:** All files are backed up relative to the current directory. This directory is represented by a . (dot character). If it is important that the search match the string at the beginning of the line when excluding a file or directory, it is necessary to use a ^ (caret followed by a dot character) as the first part of the search string, followed by the filename or directory to be excluded. The form is as follows:

**^./filename**

If the file name or directory being excluded is a substring of another file name or directory, use a ^ (caret followed by a dot character) for the search to start at the beginning of the line and the \$ (dollar symbol) to have the search finish at the end of the line.

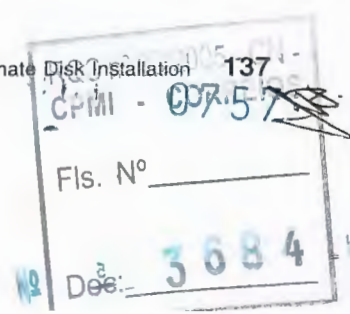
In SMIT, use the **smit alt\_mksysb** fast path and select **hdisk2** in the **Target Disk(s)** to install field. Next, type **/mksysbs/my\_52\_mksysb** in the **Device** or image name field, **/mksysbs/my\_52\_image.data** in the **image.data** file field, and **/mksysbs/my\_exclude\_file** in the **Exclude** list field.

5. To "wake-up" an original **rootvg**, after booting from the new alternate disk, run the following command:

```
alt_disk_install -W hdisk0
```

The following example illustrates the output that might display when running the command discussed above:

```
# lspv  
hdisk0      000040445043d9f3    old_rootvg  
hdisk1      00076443210a72ea    rootvg  
  
# alt_disk_install -W hdisk0  
  
# lspv  
hdisk0      000040445043d9f3    altinst_rootvg  
hdisk1      00076443210a72ea    rootvg
```







At this point, the **altinst\_rootvg** volume group is varied-on and the **/alt\_inst** file systems are mounted.

6. To "put-to-sleep" a volume group that had experienced a "wake-up," type the following command:

```
alt_disk_install -S
```

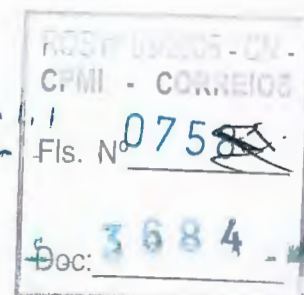
The following example illustrates the output that might display when running the command previously discussed:

```
# lspv
hdisk0      000040445043d9f3  altinst_rootvg
hdisk1      00076443210a72ea  rootvg
```

```
# alt_disk_install -S
```

```
# lspv
hdisk0      000040445043d9f3  altinst_rootvg
hdisk1      00076443210a72ea  rootvg
```

The **altinst\_rootvg** is no longer varied on and the **/alt\_inst** file systems are no longer mounted. If necessary for the **altinst\_rootvg** volume group name to be changed back to **old\_rootvg**, do this task with the **-v** flag.





## Chapter 14. Software Product Packaging Concepts

This chapter discusses concepts regarding additional software product packaging. This chapter includes information on the following topics:

- "Software Package Formats"
- "Fileset Installation Packaging" on page 140
- "Creating Software Packages" on page 140
- "Bundle Packaging" on page 141

### Software Package Formats

Beginning in AIX 5.1, you can install RPM Package Manager (**RPM**) and **InstallShield MultiPlatform (ISMP)** formatted packages in addition to **installp** formatted packages. Use the Web-based System Manager, SMIT, or the **geninstall** command to install and uninstall these types of packages. The **geninstall** command can detect the format type of a specified package and run the appropriate installation command.

Beginning in AIX 5.1, the AIX product media contains **installp** packages and **RPM** packages that are installed during a base operating system (BOS) installation. The **installp** packages are located in the following path:

```
/mount_point/installp/ppc
```

The **RPM** packages are located in the following path:

```
/mount_point/RPMS/ppc
```

If you have media that contains **ISMP** packages for AIX 5.1 and later, the **ISMP** packages are located in the following path:

```
/mount_point/ISMP/ppc
```

If you are using the **geninstall** command to install **RPM** or **ISMP** packages, use the prefix type to indicate to the **geninstall** command the type of package that you are installing. In AIX 5.1, the package prefix types are the following:

**I:** **installp** format

**R:** **RPM** format

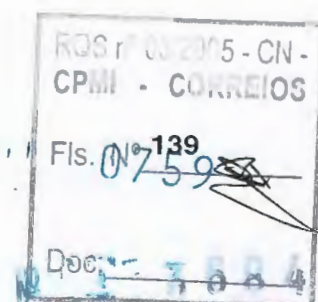
**J:** **ISMP** format

For example, to install the **cdrecord RPM** package and the **bos.games installp** package, type the following:

```
# geninstall -d/dev/cd0 R:cdrecord I:bos.games
```

The **geninstall** command detects that the **cdrecord** package is an **RPM** package type and runs the **rpm** command to install the **cdrecord** package. The **geninstall** command then detects that **bos.games** is an **installp** package type and runs the **installp** command to install the **bos.games** package. The process for uninstallation is similar to the installation process.

In Web-based System Manager and SMIT, if you are selecting the packages from a software list, you need not specify the prefix type.







## Fileset Installation Packaging

The installation packaging of each fileset in a product can be divided into three parts. These parts include the **usr**, **root**, and **share** parts. Although this can add further complexity to the understanding of the packaging, this parceling of a software product is necessary for the product to be used by diskless and dataless clients in AIX 5.1 and later. Because they are parceled, a product can be installed on one machine (called the *server*) and then be used remotely by other machines on a network (called the *clients*).

**Note:** The **usr** and **root** parts of a product are packaged in the same installable package.

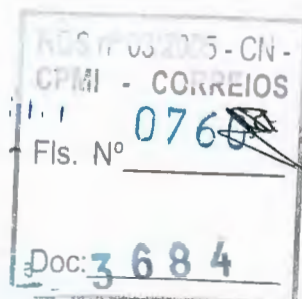
<b>usr part</b>	<p>The <b>usr</b> part of a software product contains the part of the product that can be shared by machines that have the same hardware architecture. Most of the software that is part of a product usually falls into this category.</p> <p>In a standard system, the <b>usr</b> parts of products are stored in the <b>/usr</b> file tree. For example, the <b>ls</b> command would be in the <b>/usr/bin/ls</b> file.</p>
<b>root part</b>	<p>Every product has a <b>usr</b> part. The <b>root</b> part of a software product contains the part of the product that cannot be shared. The <b>root</b> part of a product is optional because many products may not have any files that need to be specific to each individual machine.</p> <p>In a client/server environment, these are the files for which there must be a unique copy for each client of a server. Most of the <b>root</b> software is associated with the configuration of the machine or product.</p> <p>In a standard system, the <b>root</b> parts of a product are stored in the <b>root (/)</b> file tree. The <b>/etc/objrepos</b> directory contains the <b>root</b> part of an installable software product's vital product data (VPD).</p>
<b>share part</b>	<p>The <b>share</b> part of a software product contains the part of the product that can be shared among machines, even if they have different hardware architectures, which can include nonexecutable text or data files. For example, the <b>share</b> part of a product might contain documentation written in ASCII text or data files containing special fonts.</p> <p>The <b>share</b> part of a product is optional because many products might not have any files that can be shared among different hardware platforms. The <b>share</b> part of a product is always packaged in a separately installable package.</p> <p>In a standard system, the <b>share</b> parts of products are usually stored in the <b>/usr/share</b> file tree. For example, a dictionary database might be stored in the <b>/usr/share/dict/words</b> file.</p>

## Creating Software Packages

The **mkinstallp** command is a tool that allows users to create their own software packages for AIX. Packages created with the **mkinstallp** command are in **installp** format and are installed or removed with the **installp** command.

Files to be packaged by the **mkinstallp** command must be in a directory structure such that the location of the file relative to the root build directory is the same as the destination of the file after installation. For example, if the **/usr/bin/somecommand** command is to be installed by a **mkinstallp** package, the **somecommand** parameter must be in the **buildroot/usr/bin** directory when the **mkinstallp** command is invoked.

When the contents of a package are in the correct directory structure, the **mkinstallp** command prompts for basic package data through the command line. This data includes the package name, requisites, descriptions of files to be packaged, and more. The **mkinstallp** command then generates a template file based on responses given by the user. To prevent command line prompting when using a template file, create and edit the template file directly and use the **mkinstallp** command with the **-T** flag.







For example, to package the `/usr/bin/foo` command using the `/tmp/packages` directory as the build root, make sure the following directory structure exists by typing the following at the command line:

```
mkdir /tmp/packages
touch /tmp/packages/usr/bin/foo
```

Then type the following:

```
mkinstallp -d /tmp/packages
```

For more examples, refer to the `/usr/lpp/bos/README.MKINSTALLP` file.

## Bundle Packaging

The Web-based System Manager and the SMIT Install application look for bundles in `/usr/sys/inst.data/sys_bundles` and in `/usr/sys/inst.data/user_bundles`. The `sys_bundles` location is typically reserved for system-defined bundles (those which come with AIX). Users can create their own bundle files in the `user_bundles` directory.

The bundle definition file name must end in `.bnd`, because the AIX installation interfaces that process bundles recognize only bundle files that end in `.bnd`. Use any editor to create bundle files, which can contain comments and fileset names. Lines beginning with the pound sign (`#`) are recognized as comments and are ignored by the bundle processing code. When you have completed your list of filesets, save the file and make sure the file has the appropriate read permission. Invoking a bundle installation interface displays your bundle without the `.bnd` extension.

The following are examples of the predefined bundles:

- *Server Bundle*. A collection of software packages for machines running AIX in a multiuser standalone or networked environment. This bundle emphasizes functionality over disk utilization.
- *Graphics Bundle*. A collection of software packages that provides support of graphical environments. Graphical support may be automatically installed on some systems during BOS installation.
- *Migration Bundle*. This bundle is created when there was not enough disk space available to complete a migration installation during the BOS installation process. The bundle consists of a collection of software packages that must be installed to complete your migration. You must install this bundle to complete the migration installation. Install the bundle using the `smit update_all` fast path.

You may also need to install the *Graphics Bundle*.

Some system bundles might refer to installation images that are spread across multiple media. If you see errors indicating that filesets could not be found on the media you are using, insert the media containing the missing filesets and retry the bundle installation.

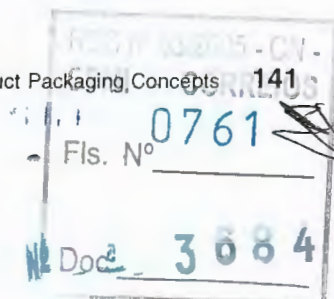
The system bundles are located in the `/usr/sys/inst.data/sys_bundles` directory. To list the system bundles, type the following:

```
ls /usr/sys/inst.data/sys_bundles/*.bnd
```

You can also use the SMIT `list_bundle` fast path to list the system bundles.

Beginning in AIX 5L Version 5.2 with the 5200-01 Recommended Maintenance package, the `geninstall` and `gencopy` commands handle multiple software sources to be specified when a bundle file is used. This is accomplished by grouping software images together under `#MEDIA=` headings in the bundle file. Any images listed under such a heading must reside on the specified media. Media can be specified as the name of a CD (such as *Base Install Media Volume 1* or *AIX Linux Toolbox CD*) or as a local directory (such as the `/usr/sys/inst.images` directory).

The `#MEDIA=` heading is used to designate the location of the filesets or packages in the bundle. For example, the *BaseAndLinuxCD Bundle* might contain the following information:







```
# BaseAndLinuxCDBundle contains packages on volume 1 of base media and on the AIX
# Linux Toolbox CD
```

```
#MEDIA=Base Install Media Volume 1
I:bos.adt.prof
```

```
#MEDIA=AIX Linux Toolbox CD
R:mttools
R:vim-common
```

When the **geninstall** and **gencopy** commands prompt for the additional media, they use the words provided in the **#MEDIA=** line. In the previous examples, the **geninstall** and the **gencopy** commands display a message informing you that the **bos.adt.prof installp** package is located on *Base Install Media Volume 1*, and the **mttools** and **vim-common RPM** packages are located on the *AIX Linux Toolbox CD*.

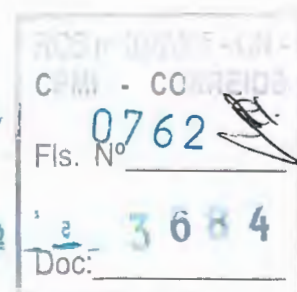
The **#MEDIA=** heading can also be used to indicate a directory. For example, the *CD\_Directory Bundle* might contain the following information:

```
# CD_DirectoryBundle contains packages on volume 1 of base install media
# and in /usr/sys/inst.images
```

```
#MEDIA=/usr/sys/inst.images
I:bos.games
```

```
#MEDIA=Base Install Media Volume 1
I:bos.adt.prof
R:cdrecord-1.9-4
```

This informs the **geninstall** and the **gencopy** commands that the **bos.games installp** package is located in the **/usr/sys/inst.images** directory, and the **bos.adt.prof installp** package and the **cdrecord-1.9-4 RPM** package are located on *Base Install Media Volume 1*.





## Chapter 15. Troubleshooting Operating System and Optional Software Installation

This chapter provides problem-determination tactics and solutions for installation and configuration problems. Topics include:

- "Troubleshooting an Installation from a System Backup"
- "Troubleshooting a Migration Installation" on page 145
- "Troubleshooting an Alternate Disk Installation" on page 146
- "Troubleshooting After an Installation" on page 146
- "Accessing a System That Does Not Boot" on page 147
- "Troubleshooting a Full /usr File System" on page 149
- "Viewing BOS Installation Logs" on page 150
- "Handling System and Error Messages" on page 150.

### Troubleshooting an Installation from a System Backup

This section describes solutions for common problems when installing from a system image created with the **mksysb** command.

#### Bootup Failure

If a backup tape fails to boot, you can still install by using a **mksysb** image stored on the tape.

Boot the machine from the product media (Volume 1 if there is more than one volume), then install the backup from Maintenance mode. For instructions on booting, refer to Chapter 3, "Introduction to Base Operating System Installation", on page 33. Follow the instructions to the point when the Welcome to the Base Operating System Installation and Maintenance screen displays.

#### Booting from the Product CD-ROM

Complete the following steps when the Welcome screen is displayed:

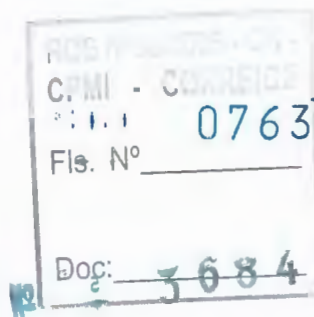
1. Choose the **Start Maintenance Mode for System Recovery** option.
2. Choose the **Install from a System Backup** option.
3. Choose the drive containing the backup tape.  
The system reads the tape and begins the installation.
4. Do not remove the CD from the CD-ROM drive.  
The system installs the kernel and device support required on the target system from the CD.
5. Return to step 8 on page 129 in the Installing a System Backup on the Source Machine procedure and continue the instructions for installing the backup.

**Note:** The **Use Maps** option is not supported in Maintenance Mode. For more information on the maps options in Maintenance Mode, refer to "Installing a System Backup on the Source Machine" on page 126.

### Problems with mksysb Image Configuration on System Backup Tapes

Bootable **mksysb** tapes comprise the following images:

- Boot image
- BOS Installation/Maintenance image
- Table of contents image







- System backup image

The system backup image is the actual backup of the files in the rootvg in all JFS-mounted file systems.

The boot image, BOS Installation/Maintenance image, and the table of contents image must be created with a tape **block\_size** value of 512. The **mksysb** command ensures that the block size is 512 when these images are created. There are no restrictions on the block size used for the fourth (system backup image) on the tape. The block size of the system, before it was temporarily set to 512, is used for the fourth image on the tape.

The value of the block size must be saved in the **/tapeblksz** file in the second image on the tape. The second and fourth images are stored in backup/restore format. Again, **mksysb** ensures the correctness of the tapes created by using the **mksysb** command.

If there are problems with the **bosinst.data** file, the **image.data** file, or the **tapeblksz** file, these files can be restored from the second image on the tape and checked. These files, as well as commands necessary for execution in the RAM file system (when running in maintenance mode after booting from the tape), are stored in the second image.

### Restoring a File from the Second Image or Tape

To restore a file from the second image, follow these steps:

1. Be sure the tape block size is 512 by entering the following command:

```
# lsattr -E -l rmt0
```

If the block size is not correct, use the following command to set it to 512:

```
# chdev -l rmt0 -a block_size=512
```

2. Make sure the tape is rewound. If the tape is not rewound, enter the following command:

```
# tctl -f /dev/rmt0 rewind
```

3. Extract the necessary files by entering:

```
# restore -xvq -s2 -f /dev/rmt0.1 .filename
```

**Note:** The filename should be the full path, and always preceded with a **.** (dot character), such as **./tapeblksz**.

4. Rewind the tape by entering:

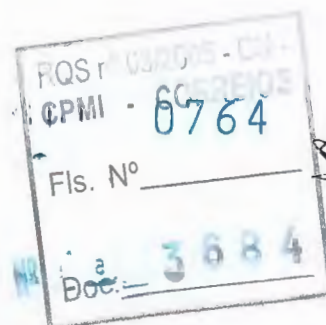
```
# tctl -f /dev/rmt0 rewind
```

5. Change the block size back to its original value, if necessary.

### Troubleshooting Reported Problems with mksysb Backup Installations

The following troubleshooting tips apply to reported problems with installations from a **mksysb** image:

- Check that you have sufficient free blocks in the file systems to write temporary files.
- Check that each file system has at least 500 blocks free when the **mksysb** backup image is made. The system needs work space in each file system when installing from a **mksysb** backup image.
- Check that you are using the correct tape type for the density setting that you selected.
- Check that the tape is *not* write-protected.
- Clean the tape drive at the recommended intervals and use only approved data-grade tapes (not video tapes for 8 mm).
- Check that 7206 4-mm Digital Audio Tape (DAT) tape drives are using only DAT tapes marked with the Dataphone Digital Services (DDS) symbol. Any other DAT tapes (for example, voice grade) cannot be used.
- Check the **/smit.log** file for any errors from SMIT.







- Check that your **mksysb** backup image contains an **image.data** file. If you create the **mksysb** backup image through Web-based System Manager or SMIT, it is done automatically. If you run **mksysb** from the command line, you must either run the **mkszfile** command first, or use the **-i** flag with the **mksysb** command.

## Troubleshooting a Migration Installation

The following sections offer solutions for problems that can occur during a migration installation.

### Boot Logical Volume Not Large Enough

If you receive errors indicating the boot logical volume is not large enough, see "Handling System and Error Messages" on page 150.

### Insufficient Disk Space for Migration

At the beginning of a migration installation, the system verifies that there will be enough space to attempt the migration. If there is not enough disk space, a message explains how much is needed. You must now reboot the machine from the media containing your current version of AIX, and make more space available in the **rootvg** volume group. After you do this, attempt the migration again.

You can use the following options for adding additional disk space for the migration installation:

- Add another disk to the **rootvg** volume group, using either the SMIT **smit extendvg** fast path or the **extendvg** command.
- Move any user-data logical volumes from the **rootvg** volume group to another volume group. You can use either the SMIT **smit cplv** fast path or the **cplv** command to move individual logical volumes to another volume group's disk. It is a good idea to have only system logical volumes in the **rootvg**, and have user-data logical volumes in other volume groups.

After you use the **cplv** command, you must remove the original logical volumes with the **rmlv** command. If the moved logical volume contains a file system, you must modify its corresponding entries in the **/etc/filesystems** file to reflect the new logical volume name.

For more detailed information about manipulating logical volumes and volume groups, refer to Logical Volumes in *AIX 5L Version 5.2 System Management Guide: Operating System and Devices*.

- Remove unneeded logical volumes (and file systems) from the **rootvg**. Run the **lsvg -l rootvg** command to see all the logical volumes in the **rootvg** volume group. The only logical volumes that must be in the **rootvg** are: **hd2**, **hd3**, **hd4**, **hd5**, **hd8**, and **hd9var**. The **hd1 (/home)** logical volume can be located in another volume group if necessary.

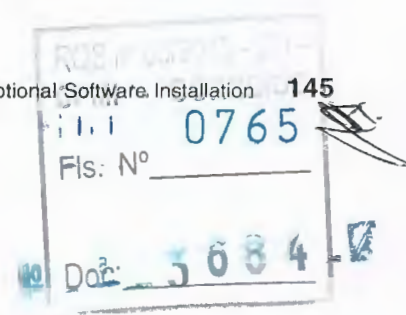
Beginning in AIX 5.1, the **hd7** (system dump) logical volume is not needed because the paging space logical volume (**hd6**) is used. The migration code automatically removes this logical volume if space is needed, but you can remove it ahead of time with the following commands:

```
sysdumpdev -P -p /dev/hd6  
rmlv -f hd7
```

- If you cannot find extra space in your **rootvg**, you might have to do a *preservation* installation instead of a migration installation to AIX. A preservation installation saves all the "non-system" logical volumes and file systems (for example, **/home**), but removes and re-creates the following logical volumes: **hd2**, **hd3**, **hd4**, **hd5** and **hd9var**.

If you do a preservation installation, you must reinstall any applications that were installed in your **rootvg** after the preservation installation has completed. You must also reconfigure devices, as well as re-create users and groups. For more information about a preservation installation, see Chapter 3, "Introduction to Base Operating System Installation", on page 33.

After you have released enough space, reboot from your installation media, and try the migration installation again. You must have at least 8 MB of free disk space to complete the migration installation.







If there is insufficient space to complete the migration installation during the BOS installation process, a message similar to the following is displayed at the end of the installation:

An error occurred while migrating packages.

Some packages have not been installed.

Please see `/var/adm/ras/devinst.log` for details or perform an overwrite or preservation install.

If space limitations prevent the migration of all software that is usually automatically migrated, the installation program attempts to install the software that is usually installed for a Preservation or Overwrite installation. If there is still not enough disk space available, the minimum set of software required to support the use of the system is installed.

If there is not enough space to migrate all of the usually migrated software, a collection of software called a Migration Bundle will be available when you install additional software later. If the minimum set of software is installed, or if the installation is not performed from a graphics console, a Graphics\_Startup Bundle is created. Before installing either of these bundles, create additional disk space on the machine you want to install. For more information about installing software bundles and migrating or installing optional software products, refer to Chapter 10, "Optional Software Products and Service Updates", on page 69. "Maintaining Optional Software Products and Service Updates" on page 75 describes how to remove software from the system to release disk space.

---

## Troubleshooting an Alternate Disk Installation

If you receive either of the following error messages, see "Handling System and Error Messages" on page 150.

- 0505-113 `alt_disk_install`: No target disk name provided.
- 0505-117 `alt_disk_install`: Error restoring image.data file from mksysb image.

## Other Problems

**Symptom:** You have run the `alt_disk_install` command or used the SMIT menus to either clone or install a `mksysb` image on an alternate disk. However, you now want to remove the definition so you can use the disk to run the `alt_disk_install` command again or use the disk for another purpose.

**Action:** Do not run the `exportvg` command. The `exportvg` examines the logical volumes on the disk (now called by their rootvg names: `hd1`, `hd2`, `hd3`, and so on) and tries to remove their corresponding entries from the `/etc/filesystems` file. This action removes the real file system stanzas from your running system and causes boot problems if you reboot with the missing stanzas.

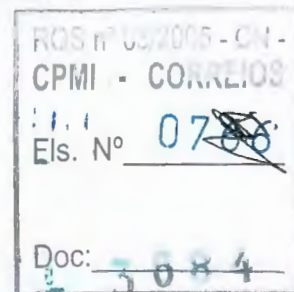
Use the `alt_disk_install -X` command to remove the `altinst_rootvg` name from the database. This removes only the ODM information from the CuDv database, so the `lspv` command shows the disk(s) as no longer belonging to `altinst_rootvg`. It also resets your bootlist to the boot disk on which the `hd5` boot logical volume resides. You can still boot from the `altinst_rootvg`, because the volume group, logical volume, and file system information remain on the disk. However, you must set your bootlist to the `altinst_rootvg` boot disk.

---

## Troubleshooting After an Installation

If your system was installed by a network installation server, Configuration Assistant or Installation Assistant will not display when the BOS installation program completes.

Configuration Assistant and Installation Assistant do not contain the tasks needed to configure your machine as a server. If you need to configure your system for a specific resource, refer to the documentation pertaining to that resource.







If your terminal type is not set, the first menu displayed by the ASCII Installation Assistant requires you to enter your terminal type (tty). If you enter a terminal type that is not valid, this menu redisplay until a valid type is entered.

If you enter a valid terminal type that does not match your terminal, the next screen displayed may be unreadable. In this case, press the break key sequence to return to the Set Terminal Type screen. For most terminal types, the break key sequence is Ctrl-C.

## Accessing a System That Does Not Boot

This section describes how to access a system that will not boot from the hard disk. If a **mksysb** backup tape fails to boot, read "Troubleshooting an Installation from a System Backup" on page 143 for instructions.

This procedure enables you to get a system prompt so that you can attempt to recover data from the system or perform corrective action that will enable the system to boot from the hard disk.

### Notes:

1. This procedure is intended only for experienced administrators who have knowledge of how to boot or recover data from a system that is unable to boot from the hard disk. Most administrators should not attempt this procedure but instead should follow local problem-reporting procedures.
2. This procedure is not intended for administrators who have just completed a New Installation, because the system will not contain data that needs to be recovered. If you are unable to boot from the hard disk after completing a New Installation, follow your local problem-reporting procedures.

The following steps summarize the procedure for accessing a system that will not boot.

1. Boot the system from Volume 1 of the BOS CD-ROM or a bootable tape.
2. Select **Maintenance Options**.
3. Recover data or perform corrective action using the system prompt.

## Prerequisites

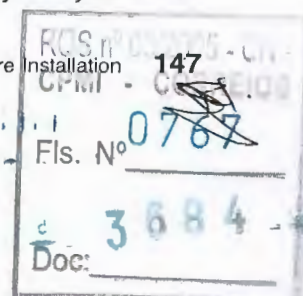
Before continuing with the procedure, confirm the following prerequisites have been met:

- Your system cannot be booted from the hard disk.
- All hardware is installed.
- AIX Base Operating System (BOS) is installed.
- Your system unit is set to Off.

## Accessing the System

Use this procedure if you are unable to boot from the hard disk. The beginning of this procedure is similar to the one you used to install the Base Operating System. You will, however, use the maintenance screens instead of the installation screens to complete this procedure.

1. Turn on all attached external devices, such as terminals, CD-ROM drives, tape drives, monitors, and external disk drives *before* turning on the system unit. Do not turn on the system unit until step 5. Turning on the external devices first is necessary so that the system unit can identify them during the startup (boot) process.
  - If you are booting from a network device, refer to Appendix A, "Network Boot", on page 323.
  - If you are not booting from a network device, go to step 3.
2. Insert Volume 1 of the installation media into the tape or CD-ROM drive. Some CD-ROM drives have a removable disc caddy, while others have a sliding drawer. If the CD-ROM drive on your system has







a sliding drawer, place the CD-ROM in the drawer and push the drawer in. If the CD-ROM drive on your system does not have a sliding drawer, insert the CD-ROM into the disc caddy and then insert the caddy into the CD-ROM drive.

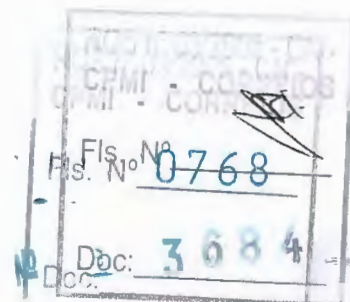
**Notes:**

- a. You may find that on specific hardware, the tape drive door will not open while the system unit is turned off. If you have trouble opening the tape drive door during installation, use the following procedure:
    - 1) Turn the system unit on.
    - 2) Insert the BOS tape (insert Volume 1 if you received more than one volume).
    - 3) Turn the system unit off and wait 30 seconds.
  - b. On some models that have a door to the tape drive, there may be a waiting period of up to three minutes before the tape drive door opens after you have pressed the button to open the tape drive. Some models also require that the button for the tape drive door be held in the pressed position for a few seconds before the tape drive door will open.
  - c. On some models, the eject button must be pressed for at least 2 seconds to eject a CD-ROM that is already in the disc caddy.
3. If you are not using an ASCII terminal, skip to step 5. If you are using an ASCII terminal, set the communications options as follows:
- Line Speed (baud rate) = 9600
  - Word Length (bits per character) = 8
  - Parity = no (none)
  - Number of Stop Bits = 1
  - Interface = RS-232C (or RS-422A)
  - Line Control = IPRTS

Set the keyboard and display options as follows:

- Screen = Normal
- Row and Column = 24x80
- Scroll = jump
- Auto LF (line feed) = off
- Line Wrap = on
- Forcing Insert = line (or both)
- Tab = field
- Operating Mode = echo
- Turnaround Character = CR
- Enter = return
- Return = new line
- New Line = CR
- Send = page
- Insert Character = space

**Note:** If your terminal is an IBM 3151, 3161, or 3164, press the Ctrl+Setup keys to display the Setup Menu and follow the onscreen instructions to set these options. If you are using some other ASCII terminal, refer to the appropriate documentation for information about how to set these options. Some terminals have different option names and settings than those listed here.





4. Turn the system unit power switch to the On position. The system begins booting from the installation media. If your system is booting from tape, it is normal for the tape to move back and forth. After several minutes, c31 is displayed in the LED.

If you have more than one console, each terminal and directly attached display device (or console) might display a screen that directs you to press a key to identify your system console. A different key is specified for each terminal displaying this screen. If this screen is displayed, then press the specified key on the device to be used as the system console. The system console is the keyboard and display device used for installation and system administration. Press a key on only one console.

5. Type 3 to select **Start Maintenance Mode for System Recovery** from the Welcome to the Base Operating System Installation and Maintenance screen when it displays.

**Note:** If you customized the **bosinst.data** file in your installation media to specify a nonprompted installation, the installation and maintenance screens are not displayed. The system instead reboots from the installation media using the settings already defined in the **bosinst.data** file. To access the installation and maintenance screens, override the nonprompted mode. You can do this when three zeros are displayed on the screen. When you observe the three zeros, type 000 (zeros) and press Enter at the terminal.

You can select 88 to display help on this or any subsequent screen.

After you have selected the **Start Maintenance Mode for System Recovery** option, the Maintenance screen displays.

6. Select option 1, **Access a Root Volume Group**, from the Maintenance screen. The Warning screen displays.
7. Read the information displayed on the Warning screen. When you are ready to continue, type 0 and press Enter. The Access a Root Volume Group screen displays.
8. Select the option for the root volume group whose logical volume information you want to display. The Access a Root Volume Group screen lists all of the volume groups (root and otherwise) on your system. After entering your selection, the Volume Group Information screen displays.

**Note:** Reviewing the disk and location code information on the Volume Group Information screen enables you to determine whether the volume group you selected was the root volume group. You can return to the Access a Root Volume Group screen if the choice you made was not the root volume group. If you have not chosen a root volume group, you cannot continue beyond the Volume Group Information screen.

9. Select one of the options from the Volume Group Information screen and press Enter. Each option does the following:

- |           |   |
|-----------|---|
| Choice 1  | <b>Access this volume group and start a shell.</b> Selecting this choice imports and activates the volume group and mounts the file systems for this root volume group before providing you with a shell and a system prompt.                             |
| Choice 2  | <b>Access this volume group and start a shell before mounting file systems.</b> Selecting this choice imports and activates the volume group and provides you with a shell and system prompt before mounting the file systems for this root volume group. |
| Choice 99 | Typing 99 returns you to the Access a Root Volume Group screen.   |

After you select either choice 1 or 2, a shell and system prompt display.

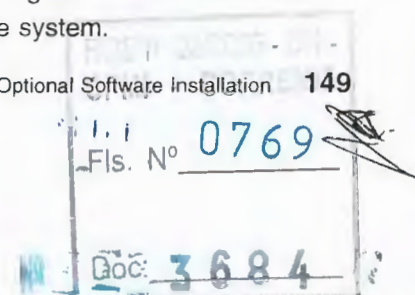
10. Take appropriate measures to recover data or take action (such as using the **bosboot** command) to enable the system to boot normally.

---

## Troubleshooting a Full /usr File System

To release space in a full /usr file system, complete one or more of the following tasks:

- Type **installp -c all** to commit all updates and release space in the /usr file system.







- If the system is not a Network Installation Management (NIM) system serving a Shared Product Object Tree (SPOT), enter `/usr/lib/inst1/inurid -r` to remove client information for **root** file system installations. For information about NIM and SPOTs, see "SPOT (Shared Product Object Tree) Resource" on page 260 in the NIM Resources section.
- Remove software that you do not need. See "Maintaining Optional Software Products and Service Updates" on page 75.

---

## Viewing BOS Installation Logs

Information saved in BOS installation log files may help you determine the cause of installation problems. To view BOS installation log files, type `cd /var/adm/ras` and view the files in this directory. One example is the **devinst.log**, which is a text file that can be viewed with any text editor or paged.

## Viewing Logs with SMIT

To view some logs in the `/var/adm/ras` directory, you can use the following SMIT fast path:

```
smit alog_show
```

The resulting list contains all logs that are viewable with the **alog** command. Select from the list by pressing the F4 key.

## Viewing Logs with the alog Command

To view some logs in the `/var/adm/ras` directory, type:

```
alog -o -f bosinstlog
```

---

## Handling System and Error Messages

This section lists messages that can appear during the installation of AIX 5.1 and later. Information about most messages is provided in the following format:

<b>System Message</b>	The system message is displayed in <b>bold</b> type.
<b>Explanation</b>	Describes what is likely to have caused the system message to be displayed.
<b>System Action</b>	Describes what the system does after the message is displayed.
<b>User Action</b>	Suggests a possible resolution to the problem suggested by the system message.

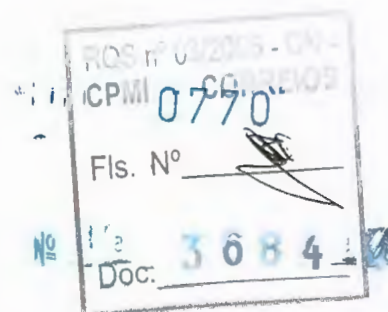
**Note:** Multiple messages can have the same explanation, system action, and user action.

**0516-404 allocp: Not enough resources available to fulfill allocation. Either not enough free partitions or not enough physical volumes to keep strictness. Try again with different allocation characteristics.**

**0516-788: extendlv: Unable to extend logical volume**

**0503-008 installp: There is not enough free disk space in file system /usr (506935 more 512-byte blocks are required.) An attempt to extend this file system was unsuccessful. Make more space available, then retry this operation.**

<b>Explanation</b>	There is not enough space to complete the installation.
<b>System Action</b>	The installation cannot begin until the problem is resolved.





User Action	<p>You have several options:</p> <ul style="list-style-type: none"><li>• Select fewer filesets than the number originally selected for installation.</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Extend the root volume group to another disk. Type: <code>extendvg rootvg hdiskNumber</code>, where <i>Number</i> is the number of the specified disk.</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Remove user-defined file systems to release space in the <b>rootvg</b> file system.</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Follow the instructions in "Troubleshooting a Full /usr File System" on page 149.</li></ul>
-------------	---

**BOS Install:** After saving all the data from the previous system into **/tmp**, it was discovered that there will not be enough free space in **/tmp** to make the boot image. Please reboot in normal mode and increase the size of **/tmp** or reduce the number of files to save as listed in the **/etc/preserve.list** file.

Explanation	During a preservation installation, files listed in the <b>/etc/preserve.list</b> file were copied to the <b>/tmp</b> file. After doing so, there was not enough room in <b>/tmp</b> to create the boot image.
System Action	Installation cannot continue.
User Action	Reboot in normal mode and increase the size of <b>/tmp</b> or reduce the number of files to be saved.

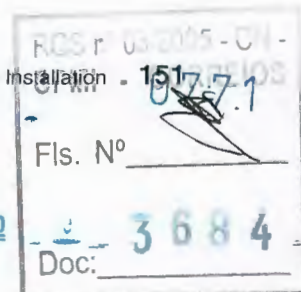
**BOS Install:** You chose to create logical volumes mapped exactly as they were on the previous disks, but there are no map files specified in the **image.data** file.

Explanation	On system backup restore, <b>EXACT_FIT = yes</b> was specified in the <b>image.data</b> file, but no map files were specified in the <b>image.data</b> file.
System Action	Nonprompted mode is terminated. The user is prompted.
User Action	<p>Run the <b>mkszfile</b> command with the <b>-m</b> option before creating the system backup tape.</p> <p>OR</p> <p>Do not specify <b>EXACT_FIT = yes</b> in the <b>image.data</b> file.</p>

The boot logical volume (**hd5**) must be at least 12 MB. The system you are installing has a boot logical volume smaller than this, and the system does not have enough free contiguous physical partitions on *diskname* to increase the size of the boot logical volume. Please reboot in normal mode and correct this problem, or restart the installation and choose an overwrite install. Use the **lspv -M diskname** command to see the current allocation map of the disk.

OR

**Error:** No space available to create a larger boot logical volume. In order to proceed with this installation the size of the boot logical volume (**hd5**) must be increased to 12 MB. At this time there are not *N* contiguous physical partitions available on the boot disk (*diskname*) for recreating the larger boot logical volume. You must free up this space by removing or relocating one or more logical volumes or file systems from *diskname*. Use **lspv -M diskname** to see its current partition allocation map.







<b>Explanation</b>	Starting with AIX 5.2, the boot logical volume ( <b>blv</b> ), logical volume hd5, must be greater than 12 megabytes. If your system had disks less than 4 gigabytes in size in the root volume group, or was originally installed with a version of AIX earlier than AIX 4.3.2 your boot logical volume may only be 4 megabytes. You might experience this failure during preservation or migration installations. Overwrite installations create the boot logical volume with a minimum size of 12 megabytes. If free partitions contiguous to hd5 are available or if another location on the disk contains hd5 is identified, the installation process increases the size of hd5 and continues. Only the disk that currently contains the boot logical volume is checked for additional partitions in order to increase the size of the boot logical volume. Other disks in the rootvg are not checked.
<b>System Action</b>	You will be prompted to reboot in normal mode from the existing rootvg and increase the boot logical volume, or restart the installation and choose an overwrite install.
<b>User Action</b>	<p>Only a system administrator with root authority should attempt to increase the boot logical volume. To increase the boot logical volume, follow the process described below:</p> <p>If you received this error, then your partition size is less than 8 megabytes, and you must increase the number of partitions in hd5 (boot logical volume). You can check your partition size as follows:</p> <ol style="list-style-type: none"><li>1. Type the following: # lsvg rootvg</li><li>2. Look for the field: PP SIZE:</li><li>3. Obtain the current number of partitions in hd5, as follows: # lslv hd5</li><li>4. Look for the field: LPs:</li><li>5. Your boot logical volume must contain enough partitions such that:<ul style="list-style-type: none"><li>• PP SIZE multiplied by LPs is greater than or equal to 8.</li><li>• The partitions for the boot logical volume must be contiguous.</li></ul></li></ol> <p>If there were free partitions available next to hd5 or at some other location on the disk that contains hd5, the installation process would have increased the size of hd5, and continued.</p> <p>To view the current allocation map (free and used partitions) of a disk, use the command: # lspv -M diskname</p>

RCSP 02-0001-1211
CPMI - CC-109
Pls. NO 0772
Doc: 3684



#### User Action, continued

If there are not enough contiguous free partitions, you must increase the size of the boot logical volume (hd5) using one of the options described below, and rerun the installer. The options for increasing the boot logical volume size are as follows:

- If a user-created logical volume or file system follows hd5 on the disk (check the allocation map), and has free partitions, you can back up, remove, re-create, and restore the logical volume.
- If there is another disk in the rootvg, that has enough contiguous free partitions, then you could move hd5 to the other disk with the following steps:
  1. Verify that the disk you plan to move hd5 to is bootable by using the command:  
`bosinfo -B diskname`
    - If 1 is returned, the disk is bootable.
    - If 0 is returned, the disk is not bootable.
  2. Find the free contiguous partitions you need on the other disk by viewing the allocation map with the command:  
`lspv -M diskname`
  3. Create a map file to use when re-creating hd5. For example, if you want to re-create hd5 on hdisk2, on partitions 88 and 89, use the command:  
`echo "hdisk2:88-89" > your_MAP_file`
  4. Remove the existing hd5:  
`rmlv -f hd5`
  5. Create the new hd5:  
`mkiv -y hd5 -t boot -m your_MAP_file rootvg 2`

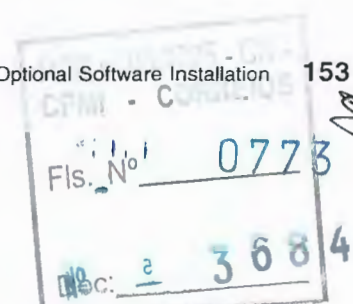
The 2 represents the number of partitions and can vary as needed.

**Note:** If the **mkiv** command moves hd5 to a new location, you must run the following command:

```
echo ":C:C:C" | /usr/lpp/bosinst/blvset -d /dev/hdiskN
```

Where *C* is the message, locale, and keyboard (respectively) and *hdiskN* is the disk that contains hd5.

6. Run the **mkboot** command to clear the boot record from the disk that previously contained hd5 (boot logical volume). For example, if hd5 was previously on hdisk0, use the command:  
`mkboot -d /dev/hdisk0 -c`
7. Use the **bosboot** command to re-create the boot image and boot record on the new disk. For example, if hd5 was re-created on hdisk2, use the command:  
`bosboot -a -d /dev/hdisk2`







User Action, continued	<p>8. Change the bootlist of your system to boot from the new disk. To see the current bootlist, use the command:</p> <pre>bootlist -m normal -o</pre> <p>OR</p> <p>If your previous hd5 was on hdisk0, the output might be:</p> <pre>hdisk0</pre> <p>To change the bootlist to use hdisk2, use the command:</p> <pre>bootlist -m normal hdisk2</pre> <p>If there were additional items in your bootlist, add them after hdisk2, with spaces separating each item.</p>
	<p>9. If there were no errors, reboot your system.</p> <p>10. If you encountered this error when installing a <b>mksysb</b> on a system other than the system it was created on (cloning), then you might be able to use a customized <b>image.data</b> file to increase the size of hd5.</p> <p>The <b>vg_data</b> stanza contains the size of the physical partitions in the <b>PPSIZE</b> field. Use this information to determine how many partitions are needed for hd5. The <b>lv_data</b> stanza for hd5 contains the fields for the number of logical partitions (<b>LPs</b>), the number of physical partitions (<b>PP</b>), and the minimum number of logical partitions required for the logical volume (<b>LV_MIN_LPS</b>). These fields must be set to the number of partitions needed.</p> <p>See "Create and Use a Supplementary Diskette" on page 58 for information on putting an <b>image.data</b> file on diskette and a <b>bosinst.data</b> file.</p> <p>If the source machine had no free partitions, and the target machine has the same disk size, then you might need to install using the shrink option, as well as the customized <b>image.data</b> file.</p>

#### BOS Install: Could not create boot image.

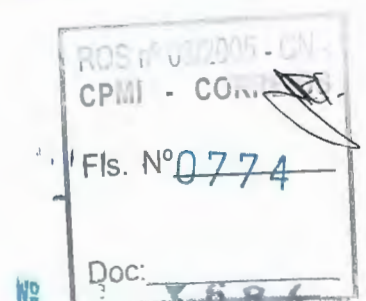
Explanation	The <b>bosboot</b> command failed.
System Action	The boot image was not created.
User Action	Check the <b>/var/adm/ras/bosinst.log</b> file for errors ( <b>alog -o -f bosinst.log   pg</b> ). This log is updated by appending, so make sure you check the last entry.

#### The bosinst.data file does not specify any bootable disks.

Explanation	The <b>bosinst.data</b> file does not specify any bootable disks.
System Action	Nonprompted mode is terminated. The user is prompted.
User Action	When the system prompts, select bootable disks to install on.  OR  Add a bootable disk to the <b>bosinst.data</b> file <b>target_disk_data</b> stanzas.

#### The bosinst.data file specified doing a migration install, but there is no existing root volume group of level 4.2, 4.3, or 5.1.

Explanation	A BOS installation method of <b>migration</b> was specified in the <b>bosinst.data</b> file, but the existing volume group is at level 3.1 or 5.2.
-------------	--





System Action	This error only occurs during a nonprompted BOS installation. The installation menus are displayed.
User Action	Respond to the menu prompts to complete the installation.

The **bosinst.data** file specified doing either a migration or a preservation install, but there is no existing root volume group.

Explanation	A BOS installation method of <b>migrate</b> or <b>preserve</b> was specified in the <b>bosinst.data</b> file, but no root volume group was found.
System Action	This error only occurs during a nonprompted BOS installation. The installation menus are displayed.
User Action	Respond to the menu prompts to complete the installation.

The data file did not specify enough disk space to contain the operating system.

Explanation	Nonprompted mode was specified, and there were not enough disks specified in the <b>bosinst.data</b> file to hold the operating system.
System Action	Nonprompted mode is terminated. The user is prompted.
User Action	When the system prompts, select disks to install on.  OR  Add more <b>target_disk_data</b> stanzas to <b>bosinst.data</b> file.

Duplicate **lv\_data** stanzas specified in the **image.data** file. The installation cannot continue because data may be lost.

Explanation	An <b>lv_data</b> stanza was duplicated in the <b>image.data</b> file.
System Action	Installation cannot continue.
User Action	Correct the problem and try the installation again.

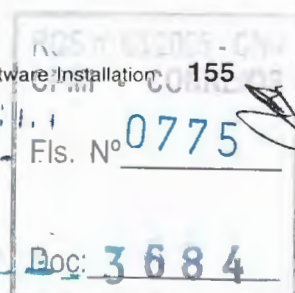
Duplicate **fs\_data** stanzas specified in the **image.data** file. The installation cannot continue because data may be lost.

Explanation	An <b>fs_data</b> stanza was duplicated in the <b>image.data</b> file.
System Action	Installation cannot continue.
User Action	Correct the problem and try the installation again.

The following disks failed the preliminary diagnostic tests: <disk name>

**bosset:** No hard disks can be accessed.

Explanation	The listed disks failed pretest.
System Action	The system initiated a diagnostic pretest on the specified disk.
User Action	Run full diagnostics on the specified disks.







**Disks specified in bosinst.data do not define a root volume group.**

<b>Explanation</b>	Nonprompted mode was specified. The install method was set to <b>preserve</b> or <b>migrate</b> , and the disks specified in <b>bosinst.data</b> do not define a root volume group.
<b>System Action</b>	Nonprompted mode is terminated. The user is prompted.
<b>User Action</b>	When the system prompts, select a root volume group to install on.  OR  Specify disks in the <b>bosinst.data</b> file that define a root volume group.

**Encountered an unrecoverable error.**

<b>Explanation</b>	The menus subsystem encountered an unrecoverable error.
<b>System Action</b>	The menu is restarted.
<b>User Action</b>	None

**The image.data file contains no vg\_data stanza for rootvg. The installation cannot continue.**

<b>Explanation</b>	The <b>image.data</b> file is incomplete.
<b>System Action</b>	Installation cannot continue.
<b>User Action</b>	Use the default <b>image.data</b> file supplied with product media.

**image.data has invalid logical volume data. Cannot continue.**

<b>Explanation</b>	The system could not parse the logical volume data stanzas in the <b>image.data</b> file.
<b>System Action</b>	Installation cannot continue.
<b>User Action</b>	Use the default <b>image.data</b> file supplied with product media.

**image.data has invalid file system data. Cannot continue.**

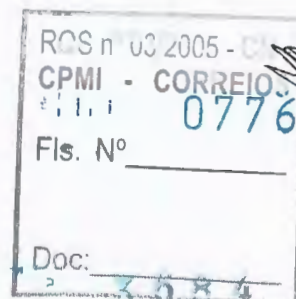
<b>Explanation</b>	The system detected invalid file system data stanzas in the <b>image.data</b> file.
<b>System Action</b>	Installation cannot continue.
<b>User Action</b>	Use the default <b>image.data</b> file supplied with product media.

**0516-366 putlvodm: Volume group rootvg is locked. Try again.**

**0516-788: extendlv: Unable to extend logical volume.**

<b>Explanation</b>	You interrupted the installation of your optional software.
<b>System Action</b>	When an installation is interrupted, the system sometimes locks the root volume group.
<b>User Action</b>	Unlock the root volume group. Then attempt the installation procedure again.  To unlock a root volume group: 1. Log in with root authority. 2. Type <code>chvg -u rootvg</code> 3. Type <code>smit_install</code> and attempt to install your optional software products again.

**installp: An error occurred during bosboot processing.**





Please correct the problem and rerun.

0301-52 bosboot: not enough file space to create: /tmp/disk.image.

OR

0301-152 bosboot: not enough file space to create: /tmp/unix.

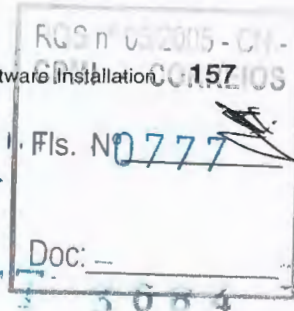
Explanation	The <b>bosboot</b> command was unable to finish processing because of insufficient space in <b>/tmp</b> .
System Action	The bosboot process is interrupted. The error message, the amount of disk space required, and the available disk space are displayed. The disk space displayed indicates the number of 1024 KB blocks required.
User Action	<p>Release space in the <b>/tmp</b> file system or extend the <b>/tmp</b> file system. Continue or restart the installation process.</p> <p>To resize the <b>/tmp</b> file system and complete the installation, do the following:</p> <ol style="list-style-type: none"><li>1. Note the error message preceding this one. Either the message bosboot verification starting or bosboot process starting will precede this message.</li><li>2. Change directories to <b>/tmp</b>. List the files and determine which files can be deleted. If there is sufficient space available, go to step 6. If you need to expand the <b>/tmp</b> file system, continue with this procedure.</li><li>3. Type <b>smit chfs</b></li><li>4. Select the <b>/tmp</b> file system from the displayed list.</li><li>5. Add the additional block space required. The <b>smit chfs</b> command requires disk space to be defined in 512-KB blocks. Double the required disk space displayed in the system message.</li><li>6. If the message <b>installp: An error occurred during bosboot processing</b> was displayed after the message bosboot verification starting, rerun the installation procedure.</li></ol> <p>OR</p> <p>If the message <b>installp: An error occurred during bosboot processing</b> was displayed after the message bosboot process starting, enter <b>installp -C</b>.</p> <ol style="list-style-type: none"><li>7. Continue the installation process.</li></ol>

**installp: An error occurred during bosboot processing.**

Please correct the problem and rerun.

301-155 bosboot: Invalid or no boot device specified.

Explanation	A device specified with the <b>bosboot -d</b> command is not valid. The <b>bosboot</b> command was unable to finish processing because it could not locate the required boot device. The <b>installp</b> command calls the <b>bosboot</b> command with <b>/dev/ipldevice</b> . If this error does occur, it is probably because <b>/dev/ipldevice</b> does not exist. <b>/dev/ipldevice</b> is a link to the boot disk.
System Action	The bosboot process is interrupted.







<b>User Action</b>	<p>Determine if the link to the boot device is missing or incorrect, correct the error and complete the installation process.</p> <p>To identify the boot device and complete the installation:</p> <ol style="list-style-type: none"> <li>1. To identify the boot disk, enter <code>lslv -m hd5</code>. The boot disk name displays.</li> <li>2. Create a link between the boot device indicated and the <code>/dev/ipldevice</code> file. Enter:  <code>ln /dev/boot_device_name /dev/ipldevice</code></li> </ol> <p>(An example of <code>boot_device_name</code> is <code>rhdisk0</code>.)</p> <ol style="list-style-type: none"> <li>3. If the message <code>installp: An error occurred during bosboot processing was displayed after the message bosboot verification starting</code>, rerun the installation procedure.</li> </ol> <p>OR</p> <p>If the message <code>installp: An error occurred during bosboot processing was displayed after the message bosboot process starting</code>, enter <code>installp -C</code>. Continue the installation process.</p>
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**Missing image.data file. The tape does not contain a valid install image.**

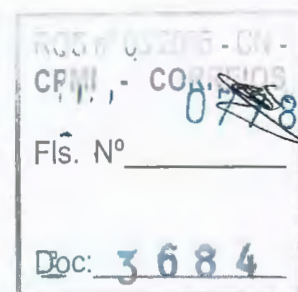
<b>Explanation</b>	The system could not find an <b>image.data</b> file.
<b>System Action</b>	Installation cannot continue.
<b>User Action</b>	The most likely cause of this error is the tape is bad. Try a different tape.

**0512-0016 mksysb: Attempt to create a bootable tape failed: bosboot -d /dev/device -a failed with return code xxx.**

OR

**0512-0016 mksysb: Attempt to create a bootable tape failed: mkinsttape /dev/device failed with return code xxx.**

<b>Explanation</b>	<p>The xxx return code indicates the error:</p> <p>5 OR 1 Not enough space in one or more of three file systems:</p> <ul style="list-style-type: none"> <li>• <code>/</code> must have at least 500 1KB blocks.</li> <li>• <code>/tmp</code> must have at least 7400 1KB blocks.</li> <li>• <code>/usr</code> must have at least 4000 1KB blocks.</li> </ul> <p>11 Defective tape.</p> <p>42 OR 45 Either the <code>/usr/lib/boot/unix</code> file is corrupted (may be 0 length) or the link to <code>/unix</code> is missing.</p> <p>48 Cannot write to the tape drive or cannot read <code>/dev/blv</code>. This is probably caused by an incorrect density setting for the tape drive. It could also be caused by either a hardware problem with the tape drive or by dirty heads on the drive.</p>
<b>System Action</b>	The <b>mksysb</b> command failed to make a bootable tape.

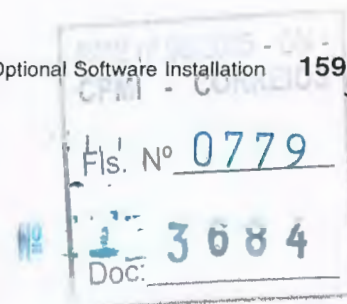




<b>User Action</b>	The return code xxx indicates the action required:
	5 OR 1 Check the <code>/</code> , <code>/tmp</code> , and <code>/usr</code> file systems and create more space as required.
	11 Replace the defective tape.
	42 OR 45 Either restore the <code>/usr/lib/boot/unix</code> file from the original tape or create the missing link.
	48 Check the tape drive settings and clean the heads.

**There are no disks available on this system.**

<b>Explanation</b>	No hard disks are configured on the system. Consequently, the only functioning menu option is the maintenance option.
<b>System Action</b>	Installation cannot begin until the problem is resolved.
<b>User Action</b>	<p>You have several options:</p> <ul style="list-style-type: none"><li>• Select <b>Maintenance</b> (option 3) from the Welcome to Base Operating System Install Menu, and select the <b>Limited Function Maintenance Shell</b>. Verify that no disks were configured by entering the following command: <code>lsdev -Cc disk</code></li></ul> <p>To determine if there were configuration errors, enter the command: <code>cfgmgr -v 2&gt;1   tee /tmp/cfgmgr.out</code></p> <p>You can use the <b>cat</b> command to view the <code>/tmp/cfgmgr.out</code> file, and look specifically for errors in configuration of disks. The file can be copied to diskette media using either the <b>dd</b> or <b>pax</b> commands, and moved to a running system for ease of viewing.</p> <p>OR</p> <ul style="list-style-type: none"><li>• Turn off the system and check the following on systems with SCSI devices:<ul style="list-style-type: none"><li>– Check all SCSI devices to ensure that all SCSI addresses are unique.</li><li>– Make sure the SCSI cards are properly terminated.</li><li>– If external SCSI devices are in use, make sure that the SCSI chain is terminated and that the devices are turned on.</li><li>– Check the SCSI cabling and connections.</li><li>– Reboot and attempt the installation again.</li></ul></li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Turn off the system and check the following on systems with IDE devices:<ul style="list-style-type: none"><li>– Check all IDE devices to ensure that all IDE master and slave settings are unique per controller. If only one IDE device is connected to a controller, it must be set to master. If an ATA device (disk) and an ATAPI device (CD-ROM or tape) are connected to the same controller, the ATA device must be set to the master device and the ATAPI device must be set as the slave device.</li><li>– Check the IDE cabling and connections.</li><li>– Reboot and attempt the installation again.</li></ul></li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Boot from the diagnostics and check the hard disks.</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Follow your local problem-reporting procedures.</li></ul>







There are no disks on this system which can be booted.

Explanation	The system could not find any bootable disks on the system.
System Action	Installation cannot continue.
User Action	Some third-party disks are not bootable. If a disk should be bootable but is not, run diagnostics.

You chose to install only onto disks in the existing root volume group and those not in any volume group. There are not enough of those disks to contain the mksysb image.

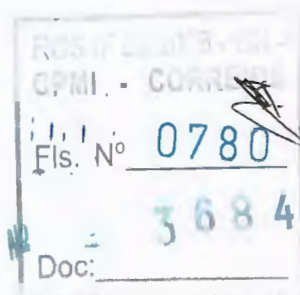
Explanation	The EXISTING_SYSTEM_OVERWRITE field in <b>bosinst.data</b> was set to <b>yes</b> , and prompt was set to <b>no</b> , and there were not enough disks on the system that contained the root volume group or contained no volume group.
System Action	Nonprompted mode is terminated. The user is prompted.
User Action	Use <b>target_disk_data</b> stanzas to specify the disks to install on, set SHRINK to yes in the <b>image.data</b> file, or at the BOS Install prompt set the EXISTING_SYSTEM_OVERWRITE in the <b>bosinst.data</b> file to <b>any</b> . This allows any disks to be used for the installation.  <b>Attention:</b> If EXISTING_SYSTEM_OVERWRITE is set to <b>any</b> , user volume groups might be overwritten.  OR  When the system prompts, select disks on which to install or select to shrink the file systems.

You chose to install only onto disks which are not contained in a volume group, but there are not enough of those disks to contain the mksysb image.

Explanation	The EXISTING_SYSTEM_OVERWRITE field in <b>bosinst.data</b> was set to <b>no</b> , and prompt was set to <b>no</b> , and there were not enough disks on the system that contained a volume group.
System Action	Nonprompted mode is terminated. The user is prompted.
User Action	If you want the system to select the disk to install on, use the <b>target_disk_data</b> stanzas to specify the target disks and set the appropriate setting for EXISTING_SYSTEM_OVERWRITE, leave EXISTING_SYSTEM_OVERWRITE blank in the <b>bosinst.data</b> file, or set SHRINK to yes in the <b>image.data</b> file and retry the installation.  OR  When the system prompts, select disks on which to install.

0505-113 alt\_disk\_install: No target disk name provided.

Explanation	This message is displayed in the following situations: <ul style="list-style-type: none"><li>• You did not enter a target disk.</li><li>• The disk that was specified as the target disk has a volume group already associated with it. Running the <b>lspv</b> command should show the word None by disks that do not have a volume group associated with them, which is what the <b>alt_disk_install</b> command checks.</li><li>• The target disk (or disks) specified are not bootable. The <b>alt_disk_install</b> command runs <b>bootinfo -B disk_name</b> on each disk specified in the target disk list. If any one <b>bootinfo -B</b> command returns a 0, then the disk is not bootable, and it cannot be used as a target disk for the <b>alt_disk_install</b> operation.</li></ul>
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## Part 3. Network Installation

Part 3 provides information about installing and configuring AIX in a networked environment using the Network Installation Management (NIM) environment.

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## Chapter 16. What's New in Network Installation Management (NIM)?

This chapter provides an overview of the new features in the Network Installation Management (NIM) interface for AIX 5.2.

### Working with EZNIM

The SMIT EZNIM menu helps the system administrator by organizing the commonly used NIM operations and simplifies frequently used advanced NIM operations.

Features of SMIT EZNIM include:

- Task-oriented menus
- Automatic resource naming that includes the level of the software used to create NIM resources.
- The user can review what steps will take place *before* executing a task, whenever possible.

For information about EZNIM, see Chapter 19, "EZNIM", on page 171.

### Creating Resources Simultaneously

Previously, when NIM ran a process that calculated and consumed file system space, such as creating a **SPOT**, **lpp\_source** and **mksysb** resource, it would lock a server for the duration of the process. Because these operations calculate free space and enlarge the size of a file system, NIM limited servers to one of these operations at a time. Other operations could occur on the locked server that did not interfere with the operation that was calculating free space and enlarging a file system.

Beginning in AIX 5.2, you can use NIM to simultaneously create multiple **lpp\_source** and **mksysb** resources in separate file systems on the same server. You cannot simultaneously create multiple **SPOT** resources, but you can simultaneously create a **SPOT**, **lpp\_source**, and **mksysb** resource. The locking mechanism is set for each file system instead of for each server.

However, if you know that you have enough space in a file system to create multiple resources simultaneously, you can use the force option (**-F** flag) to prevent the locking mechanism from being used. This allows you to create multiple resources simultaneously in the same file system.

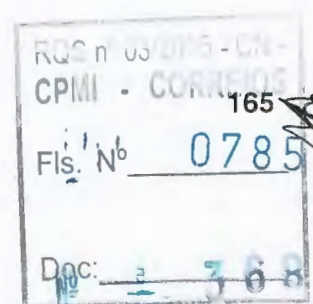
### LPP Source Enhancements

Enhancements to the management of **lpp\_source** resources include the following:

- The **lpp\_source** resource is no longer a *required* for **mksysb** installations.
- The **update** operation, which allows you to update an **lpp\_source** resource by adding and removing packages. Previously, you could copy packages into an **lpp\_source** directory or remove packages from an **lpp\_source** directory and run **nim -o check** to update the **lpp\_source** attributes. Previously, SMIT allowed you to add packages to a **lpp\_source** through the **smit nim\_bffcreate** fast path. However, this SMIT function does not check to see if the **lpp\_source** is allocated or locked, nor does it update the **images** attribute when finished.

The **update** operation has been created to address this situation. For more information, see "update" on page 282.

- The **lppmgr** operation is available to help you manage your **lpp\_source** resources. The **lppmgr** operation is available through the command line and through SMIT. For more information, see "lppmgr" on page 276.







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## Resource Groups

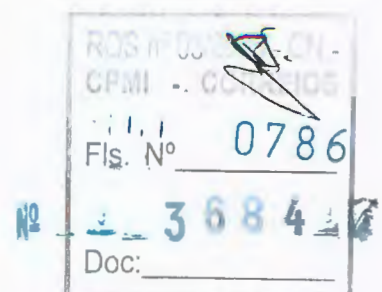
Resource groups allow you to create a group of resources and specify clients (or a group of clients) as defaults. Previously, every time a NIM operation occurred, the NIM resources had to be specified. A default resource group can be created containing the required resources, so when a NIM operation is performed, the resources are already associated to the client by the default resource group.

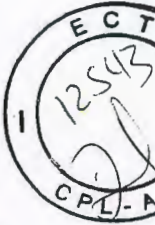
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## NIM Commands

The following NIM commands have been added to AIX:

- The **nim\_master\_setup** command. For further information, see "Network Installation Management Commands Reference" on page 196.
- The **nim\_clients\_setup** command. For further information, see "Network Installation Management Commands Reference" on page 196.





## Chapter 17. Network Installation Management Introduction

This chapter provides an introduction to AIX Network Installation Management (NIM) and the operations you can perform to manage the installation of the Base Operating System (BOS) and optional software on one or more machines.

The types of machines you can manage are *standalone*, *diskless*, and *dataless*. A *standalone* machine is one that can boot (start up) by itself. *Diskless* and *dataless* systems cannot boot by themselves. They must use remote resources to boot. *Diskless* systems have no disk drive. *Dataless* systems have a local disk drive but they cannot boot from it. This section provides concepts and procedures for setting up the NIM environment, initiating the installation of standalone machines, and initializing resources for diskless and dataless machines.

Using NIM, you can install a group of machines with a common configuration or customize an installation for the specific needs of a given machine. The number of machines you can install simultaneously depends on the throughput of your network, the disk access throughput of the installation servers, and the platform type of your servers.

The NIM environment comprises client and server machines. A *server* provides resources (for example, files and programs required for installation) to another machine. A machine that is dependent on a server to provide resources is known as a *client*. In this guide and reference, any machine that receives NIM resources is a client, although the same machine can also be a server in the overall network environment.

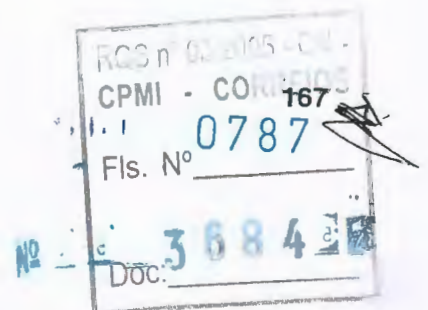
All operations on clients in the NIM environment require one or more resources. NIM resource objects represent files and directories that are used to support some type of NIM operation. Because NIM resources are ordinary file system objects in the AIX operating system, most of them are provided to clients with standard Network File System (NFS) software. This means that many resources must reside locally on the servers providing these resources, because NFS can only export file system objects that are stored on local media in the machines from which they are exported.

Most installation tasks in the NIM environment are performed from one server, called the *master*. A set of installation tasks can also be performed from NIM clients. Once the network installation setup is complete, users of standalone clients can, from the client, install software that is available on NIM servers.

The machines you want to manage in the NIM environment, their resources, and the networks through which the machines communicate are all represented as *objects* within a central database that resides on the master. Network objects and their attributes reflect the physical characteristics of the network environment. This information does not affect the running of a physical network but is used internally by NIM for configuration information.

Each object in the NIM environment has a unique name that you specify when the object is defined. The NIM name is independent of any of the physical characteristics of the object it identifies and is only used for NIM operations. The benefit of unique names is that an operation can be performed using the NIM name without having to specify which physical attribute should be used. NIM determines which object attributes to use. For example, to easily identify NIM clients, the host name of the system can be used as the NIM object name, but these names are independent of each other. When an operation is performed on a machine, the NIM name is used, and all other data for the machine (including the host name) is retrieved from the NIM database.

For more information about NIM concepts, see Chapter 24, "Network Installation Management Concepts", on page 239. For information on a particular NIM task, refer to Chapter 18, "NIM Task Roadmap", on page 169.





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## Chapter 18. NIM Task Roadmap

The NIM Task Roadmap provides an overview of NIM configuration tasks and installation tasks and where they can be found in this guide. Also provided is a brief description of the task. Where appropriate, the SMIT fast path is provided.

Table 4. NIM Task Roadmap

NIM Task	SMIT Fast Path	Description
Chapter 19, "EZNIM", on page 171	smit eznim	Configure the NIM environment using EZNIM. Allows you to configure your system as a NIM master or a NIM client. If you configure your system as a NIM master, EZNIM also creates the minimum basic installation resources.
"Configuring the NIM Master and Creating Basic Installation Resources" on page 174	smit nim_config_env	Configure the NIM master, create the minimum basic installation resources required to install NIM client machines, and manage the resources for diskless and dataless clients.
"Adding a Standalone NIM Client to the NIM Environment" on page 177	smit nim_mkmac	Describes how to add standalone clients to the NIM environment.
"Using Installation Images to Install the Base Operating System (BOS) on a NIM Client" on page 180	smit nim_bosinst	Describes how to perform a BOS installation on a NIM client.
"Using a mksysb Image to Install the Base Operating System (BOS) on a NIM Client (mksysb Installation)" on page 181	smit nim_bosinst	Describes how to restore a <b>mksysb</b> image and additional software to a target NIM client from a <b>mksysb</b> resource in the NIM environment.
"Performing a Nonprompted BOS Installation" on page 184	<ul style="list-style-type: none"><li>smit nim_mkres</li><li>smit nim_bosinst</li></ul>	Provides information about how to perform a nonprompted NIM BOS installation using a <b>bosinst_data</b> resource.
"Installing to Clients on ATM Networks" on page 186		Provides information about how to configure NIM to work with ATM adapters.
"Customizing NIM Clients and SPOT Resources" on page 187	smit nim_task_inst	Describes how to use NIM to install software packages, updates, and maintenance levels on running, configured NIM clients and <b>SPOT</b> resources.
Remove Installed Software from a NIM Client or a SPOT Resource.	smit nim_remove	From the NIM master, you can uninstall software that resides on client machines. NIM also gives you the capability of committing and rejecting updates over the network.
Perform Maintenance Operations on NIM Client Machines	smit nim_mac_op	Hardware diagnostics can be performed on NIM clients using a diagnostic boot image from a NIM server, rather than booting from a diagnostic tape or CD-ROM. Not only does this eliminate the need for diagnostic boot media, it eliminates the need to have diagnostics installed on the local disks of machines.  For maintenance operations, you can boot a NIM client into maintenance mode from the boot image on a NIM server instead of using a bootable tape or CD-ROM.
Perform Maintenance Operations on NIM Resources	smit nim_res	Allows you to list NIM resources; change characteristics of a resource; show the contents of a resource; and verify resources.

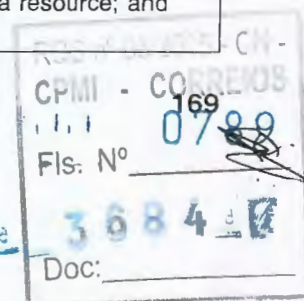
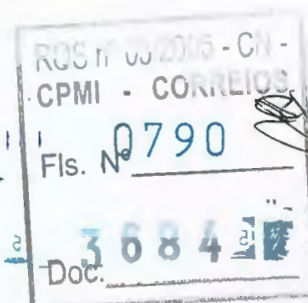






Table 4. NIM Task Roadmap (continued)

Software Maintenance and Utilities	smit nim_task_maint	Provides information about how to commit, reject, remove, copy, verify, and clean up software.
"Adding a Diskless or Dataless Client to the NIM Environment" on page 191	smit nim_task_dd	Provides information about how to add diskless and dataless systems to your NIM environment. You can also manage resources for diskless and dataless clients from the NIM master.
"Installing to an Alternate Disk on a NIM Client (cloning or mksysb)" on page 195	smit nim_alt_install	NIM can be used to clone the running of <b>rootvg</b> (root volume group) to an alternate disk, or install a <b>mksysb</b> image to an alternate disk.
"Alternate Disk Migration Installation" on page 133	smit nimadm	NIM can be used to perform an alternate disk migration installation to a NIM client.





## Chapter 19. EZNIM

The SMIT EZNIM feature helps the system administrator by organizing the commonly used NIM operations and simplifies frequently used advanced NIM operations.

Features of SMIT EZNIM include:

- Task-oriented menus
- Automatic resource naming that includes the level of the software used to create NIM resources.
- The user can review what steps will take place *before* executing a task, whenever possible.

Use the SMIT **eznim** fast path to open the EZNIM main menu. If the NIM environment has not been set up on your system, the EZNIM main menu displays the following options:

- Configure as a NIM Master
- Configure as a NIM Client

### EZNIM Master Operations

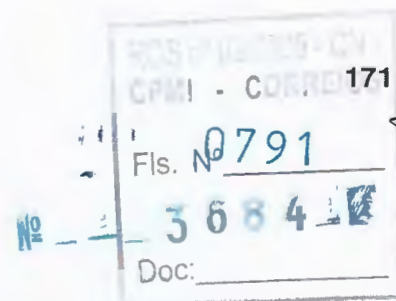
If you select **Configure as a NIM Master**, the following options display:

Setup the NIM Master environment  
Add fixes to the NIM Master environment  
Add client to the NIM environment

Update clients  
Backup a client  
Reinstall clients  
Reset clients

Show the NIM environment  
Verify the NIM environment  
Remove NIM environment

- To configure your current system as a NIM master, select **Setup the NIM Master environment**. You can select the software source to configure from, select the volume group to use for the NIM resources, and select the file system to use for the NIM resources. When the NIM master environment is configured, the basic NIM resources are created. To view the NIM resources created by EZNIM, select **Show the NIM environment**, or run the **lsnim** command on the NIM master.
- To install updates and maintenance level packages to the NIM master, select **Add fixes to the NIM Master environment**. This option performs an update installation of a specified set of fixes onto the default **SPOT** resource. A second **SPOT** resource containing the newly installed fixes is created by this operation. You can optionally select to update all your NIM clients during this operation.
- To update a client using EZNIM, select **Update clients**. The Update clients option allows you to perform an **update\_all** operation on a selected client (or clients) using an **lpp\_source** resource.
- To back up a client using EZNIM, select **Backup a client**. The Backup a client option allows you to create a system backup image of a selected client and store the backup image on the NIM master.
- To reinstall a client using EZNIM, select **Reinstall clients**. The Reinstall clients option performs a **mksysb** restore on a selected client (or clients). You must select a system backup image to restore, and decide whether to reboot and install the client now.
- To reset a NIM client to the *ready* state, select **Reset clients**. This option resets the state of a client or clients in the NIM environment. Use this option after a NIM operation has failed, and you want to return the client to the *ready* state.





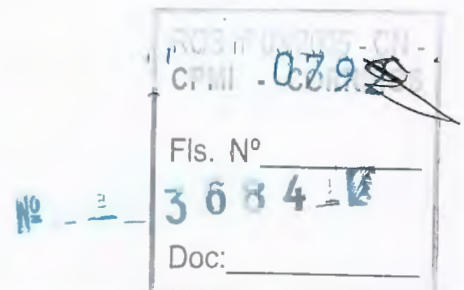


## EZNIM Client Operations

EZNIM also allows you to manage a NIM client. On a client system, use the SMIT **eznim** fast path. Select **Configure as a NIM Client**, and the following options display:

Add this system to a NIM environment  
Update this system  
Reinstall this system  
Reset this system

- To define your client in the NIM environment, select **Add this system to a NIM environment**.
- To update your client, select **Update this system**. This option allows you to perform an **update\_all** operation on your client using an **lpp\_source** resource.
- To reinstall your client, select **Reinstall this system**. This option performs a **mksysb** restore on the client. You must select a system backup image to restore, and decide whether to reboot and install the client now.
- To reset your client in the NIM environment, select **Reset this system**. This option resets the state of the client in the NIM environment. Use this option after a NIM operation has failed, and you want to return the client to the *ready* state.





## Chapter 20. Basic NIM Operations and Configuration

**Note:** AIX 5.2 provides the **cdromd** CD and DVD automount facility, which is included in the **bos.cdmount** fileset. To determine if the **cdromd** daemon is enabled on your system, run the following command:

```
# lssrc -s cdromd
```

The **cdromd** daemon can interfere with scripts, applications, or instructions that attempt to mount the CD or DVD device without first checking to see if the device is already enabled. A resource or device busy error occurs in such a condition. Use the **cdumount** or **cdeject** command to unmount the device. Then mount the device as specified in the program or instructions. Alternatively, use the **cdcheck -m** or **mount** command to determine the current mount point of the device. For further information, see the **cdromd** command documentation in the *AIX 5L Version 5.2 Commands Reference*.

The installation code allows for this automatic mounting. If **cdromd** is enabled and the **mkcd** command is run, the CD-R or DVD-RAM is ejected after the image is completed. If you do not want to have the media ejected, then the **cdromd** daemon should be put in the inoperative state with the following command:

```
# stopsrc -s cdromd
```

This chapter describes the following procedures for performing basic NIM operations and simple configuration tasks using the Web-based System Manager NIM interface or the System Management Interface Tool (SMIT), as well as from the command line. The procedures in this chapter identify prerequisite tasks or conditions that must be met before performing the task.

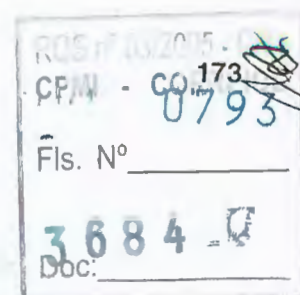
- "Configuring the NIM Master and Creating Basic Installation Resources" on page 174
- "Adding a Standalone NIM Client to the NIM Environment" on page 177
- "Using Installation Images to Install the Base Operating System (BOS) on a NIM Client" on page 180
- "Using a mksysb Image to Install the Base Operating System (BOS) on a NIM Client (mksysb Installation)" on page 181
- "Performing a Nonprompted BOS Installation" on page 184
- "Installing to Clients on ATM Networks" on page 186
- "Customizing NIM Clients and SPOT Resources" on page 187
- "Configuring the NIM Master and Creating Resources to Support Diskless and Dataless Clients Only" on page 189
- "Adding a Diskless or Dataless Client to the NIM Environment" on page 191
- "Initializing and Booting a Diskless or Dataless Machine" on page 193
- "Uninitializing Diskless and Dataless Machines" on page 194
- "Installing to an Alternate Disk on a NIM Client (cloning or mksysb)" on page 195
- "Network Installation Management Commands Reference" on page 196

To start the Web-based System Manager NIM interface from an X-Windows session on the NIM master, type:

```
wsn
```

### Notes:

1. For additional information about NIM operations and the required and optional attributes to customize operations, see Chapter 24, "Network Installation Management Concepts", on page 239.







2. Using an AIX Version 5 **lpp\_source** to install filesets on an AIX Version 4 client through NIM, is not supported. If installing Version 5 filesets on a Version 4 system is necessary, the user can NFS export the **lpp\_source**, mount it on the client, and then use the **installp** command or **geninstall** command to perform the installation procedures.
3. For assistance, use the online contextual help available for both the Web-based System Manager and SMIT interfaces.  
Extended help is available in the Web-based System Manager interface, offering guidance for tasks you may need to do in NIM. To view extended help, select **Contents** from the Help menu in the NIM container.
4. For tasks performed at the command line, the root user must be using **ksh**. Unexpected results can occur if the root user is set to another shell, such as **csch**.
5. If errors occur, it may be necessary to reset the machine before retrying the operation. For information about testing a NIM client, see "Resetting Machines" on page 200.

## Configuring the NIM Master and Creating Basic Installation Resources

Using this procedure, you can configure the NIM master, create the minimum basic installation resources required to install NIM client machines, and manage the resources for diskless and dataless clients.

**Note:** This procedure produces a large amount of output, especially when creating the **SPOT** resource. Be sure to scan through the output to look for nonfatal errors and warnings that may not be evident from a successful return code.

### Prerequisites

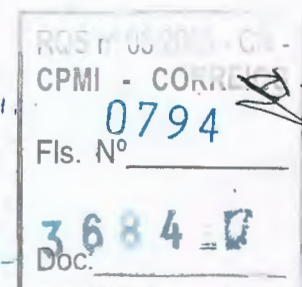
The NIM master must have at least 1 GB of available disk space. If such space is not available, see "Using Client Machines as Resource Servers" on page 201, and "Defining an **lpp\_source** on CD-ROM versus Disk" on page 219.

### From Web-based System Manager

1. Insert the *AIX 5.2 Volume 1* CD into the appropriate drive of the designated master machine.
2. Start the Web-based System Manager Software application by entering **wsm**.
3. In the navigation area, expand and select the NIM container, then follow the directions in the wizard.

### From SMIT

1. Insert the *AIX 5.2 Volume 1* CD into the appropriate drive of the designated master machine.
2. To install the **bos.sysmgt.nim.master** fileset, enter the **smit install\_latest** fast path.
3. Using the LIST option, select **/dev/cd0** for the INPUT device / directory for software.
4. Specify **bos.sysmgt.nim.master** as the SOFTWARE to install.
5. Accept the default values for all other fields on this screen. After successful completion of this installation, exit SMIT.
6. To configure the NIM master, enter the **smit nim\_config\_env** fast path.
7. Using the LIST option, select the Primary Network Interface for the NIM Master.
8. Using the LIST option, select **/dev/cd0** or **/dev/rmt0** for the **Input device for installation / images** field.
9. If you will be supporting diskless and dataless clients, select **yes** at the **Create Diskless/Dataless Machine Resources?** field, and supply names for the resources to be created.
10. Select **yes** at the **Remove all newly added NIM definitions and file systems if any part of this operation fails?** field. This will make it easier to restart this procedure if failures occur.
11. Accept the default values for all other fields on this screen.







#### Notes:

1. Depending on the speed of your machine, creating the basic NIM resources could be a lengthy process.
2. This procedure provides the capability for much more than just configuring the NIM master and creating the **lpp\_source** and **SPOT** resources. However, for this simple configuration, only a subset of the available functions will be used. Advanced NIM administrators can use the SMIT screens accessed through this procedure to create a more complex environment.
3. As you develop a better understanding of configuration tasks, you may prefer to not automatically undo all configuration when failures occur (as in step 10 in the previous procedure). Continuing from the last point of failure results in faster configuration for experienced administrators.

### From the Command Line

1. Insert the *AIX 5.2 Volume 1* CD into the appropriate drive of the designated master machine.
2. To install the **bos.sysmgt.nim.master** fileset from the CD, enter:

```
# installp -agXd /dev/cd0 bos.sysmgt.nim.master
```

To install the **bos.sysmgt.nim.master** fileset from a tape, enter:

```
# installp -agXd /dev/rmt0 bos.sysmgt.nim.master
```

3. To configure the NIM master using the **nimconfig** command, enter:

```
# nimconfig -a attr1=value1 \  
-a attr2=value2 \  
...
```

For example, to configure a NIM master with the following configuration:

```
master host name = master1  
primary network interface = tr0  
ring speed = 16  
platform = chrp  
kernel type = mp
```

Enter the following command sequence:

```
# nimconfig -a netname=network1 -a pif_name=tr0 \  
-a ring_speed=16 -a platform=chrp -a netboot_kernel=mp
```

**Note:** For additional attribute information, see the **nimconfig** command.

4. To create a file system in the rootvg volume group with 400 MB of space with a mount point of **/export/lpp\_source**, enter:

```
# crfs -v jfs -g rootvg -a size=$((2000*400)) \  
-m /export/lpp_source -A yes -p rw -t no \  
-a frag=4096 -a nbpi=4096 -a compress=no
```

5. To mount the file system, enter:

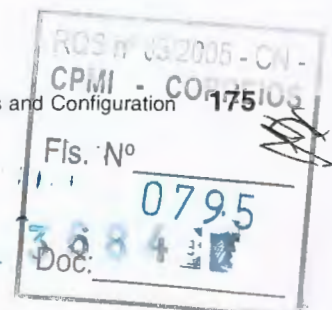
```
# mount /export/lpp_source
```

6. The **lpp\_source** contains the installation images copied from the source device (in this example, the CD-ROM). The server of the **lpp\_source** will be the NIM master. The images will be stored in the **/export/lpp\_source/lpp\_source1** directory. To create the **lpp\_source** resource named **lpp\_source1**, enter:

```
# nim -o define -t lpp_source -a source=/dev/cd0 \  
-a server=master -a location=/export/lpp_source/lpp_source1 \  
lpp_source1
```

7. To create a file system in the rootvg volume group with 200 MB of space with a mount point of **/export/spot**, enter:

```
# crfs -v jfs -g rootvg -a size=$((2000*200)) \  
-m /export/spot -A yes -p rw -t no \  
-a frag=4096 -a nbpi=4096 -a compress=no
```







8. To mount the file system, enter:

```
# mount /export/spot
```

9. The **SPOT** resource will be installed from images in the image source (in this case, the **lpp\_source** that was created in step 6). The server of the resource will be the NIM master, and the **SPOT** will be stored in the **/export/spot/spot1** directory. To create the **SPOT** resource named **spot1**, enter:

```
# nim -o define -t spot -a source=lpp_source1 \
-a server=master -a location=/export/spot spot1
```

10. If you are not supporting diskless and dataless clients, you do not need to continue with this procedure. If you are supporting diskless and dataless clients, create and mount a file system for their resources.

To create a file system in the rootvg volume group with 150 MB of space and a mount point of **/export/dd\_resource**, enter:

```
# crfs -v jfs -g rootvg -a size=$((2000*150)) \
-m /export/dd_resource -A yes -p rw -t no \
-a frag=4096 -a nbpi=4096 -a compress=no
```

11. To mount the file system, enter:

```
# mount /export/dd_resource
```

12. Create the diskless and dataless client resources in subdirectories of the **/export/dd\_resource** directory. Not all resources are required. Create only the resources to be used in your environment.

To create the **root** resource named **root1** (required for diskless and dataless clients), enter:

```
# nim -o define -t root -a server=master \
-a location=/export/dd_resource/root1 root1
```

To create the **dump** resource named **dump1** (required for diskless and dataless clients), enter:

```
# nim -o define -t dump -a server=master \
-a location=/export/dd_resource/dump1 dump1
```

To create the **paging** resource named **paging1** (required for diskless clients), enter:

```
# nim -o define -t paging -a server=master \
-a location=/export/dd_resource/paging1 paging1
```

To create the **home** resource named **home1** (optional), enter:

```
# nim -o define -t home -a server=master \
-a location=/export/dd_resource/home1 home1
```

To create the **shared\_home** resource named **shared\_home1** (optional), enter:

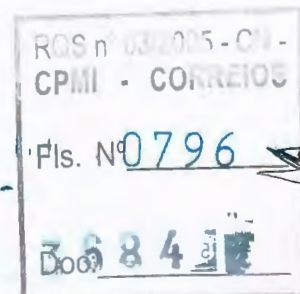
```
# nim -o define -t shared-home -a server=master \
-a location=/export/dd_resource/shared_home1 shared_home1
```

To create the **tmp** resource named **tmp1** (optional), enter:

```
# nim -o define -t tmp -a server=master \
-a location=/export/dd_resource/tmp1 tmp1
```

#### Notes:

1. The file systems created for the NIM resources are not required, but they can be beneficial for storage management.
2. A **SPOT** resource is required for supporting diskless and dataless clients. The **SPOT** created in step 13 can be used for this purpose, so there is no need to create another **SPOT** specifically for diskless and dataless clients.
3. For more information about NIM resources, see "NIM Resources" on page 248.





## Adding a Standalone NIM Client to the NIM Environment

This procedure describes how to add standalone clients to the NIM environment. Standalone clients are machines that, once installed, can obtain a boot image and mount all file systems from the local hard disk, unlike diskless and dataless clients which depend on remote servers.

From one of the following interfaces, use Method A if the client machine is not running or if the client does not have AIX installed. Method A can also be used if BOS is to be installed on the client and the client is to be network-booted manually or to initiate the installation from a **force-push** operation. This procedure automatically adds NIM networks when needed.

From one of the following interfaces, use Method B if the client machine has AIX already installed.

If the NIM client being defined is on a network that is not currently defined in the NIM environment, the **niminit** command will fail. If this is the case, use "Method A:" of this procedure to define the client on the NIM master, and then follow the steps in "Method B:" to complete the configuration.

### Prerequisites

1. The NIM master must be configured. For more information, see "Configuring the NIM Master and Creating Basic Installation Resources" on page 174.
2. You must know the subnet mask, the default gateway for the client machine, and the default gateway for the NIM master.

### From Web-based System Manager

1. To start the Web-based System Manager Software application, type:  
`wsm`
2. In the navigation area, expand and select the NIM container.
3. Select the Machines container.
4. From the Machines menu, select **New** → **Machine**.
5. Use the wizard to complete the task.

### From SMIT

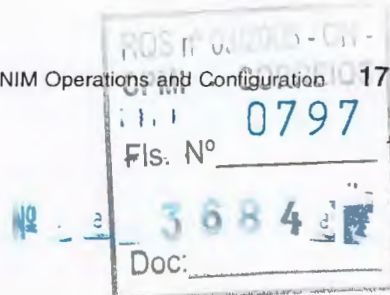
To add a standalone NIM client to the NIM environment using SMIT, choose between the following methods:

#### Method A:

1. On the NIM master, add a standalone client to the NIM environment by typing the **smit nim\_mkmac** fast path.
2. Specify the host name of the client.
3. The next SMIT screen displayed depends on whether NIM already has information about the client's network. Supply the values for the required fields or accept the defaults. Use the help information and the LIST option to help you specify the correct values to add the client machine.

#### Method B:

1. On a system that you have chosen to be a NIM client, verify that if the **bos.sysmgt.nim.client** fileset is installed by typing the following:  
`# lsipp -L bos.sysmgt.nim.client`
2. If the **bos.sysmgt.nim.client** fileset is not installed, then install the fileset from the **AIX Volume 1 CD** by typing the following:  
`# installp -acXd /dev/cd0 bos.sysmgt.nim.client`
3. Enter the **smit niminit** fast path.







4. Supply the values for the required fields or accept the defaults. Use the help information and the LIST option to help you specify the correct values for defining your client machine.

**Note:** In AIX 5.2, if the LIST option is used to display valid platforms for the client definition, only **chrp** is displayed as a selectable platform.

## From the Command Line

To add a standalone NIM client to the NIM environment from the command line, choose between the following methods:

### Method A:

On the NIM master, type:

```
# nim -o define -t standalone -a platform=PlatformType \  
-a netboot_kernel=NetbootKernelType \  
-a if1=InterfaceDescription \  
-a net_definition=DefinitionName -a ring_speed1=SpeedValue \  
-a cable_type1=TypeValue -a iplrom_emu=DeviceName MachineName
```

### Example 1:

To add the machine with host name **machine1** with the following configuration:

```
host name=machine1  
platform=chrp  
kernel=up  
network type=ethernet  
subnet mask=255.255.240.0  
default gateway=gw1  
default gateway used by NIM master=gw_master  
cable type=bnc  
network boot capability=yes (no emulation needed)
```

enter the following command sequence:

```
# nim -o define -t standalone -a platform="chrp" \  
-a netboot_kernel="up" -a if1="find_net machine1 0" \  
-a cable_type1="bnc" \  
-a net_definition="ent 255.255.240.0 gw1 gw_master" machine1
```

### Example 2:

To add the machine with host name **machine2** with the following configuration:

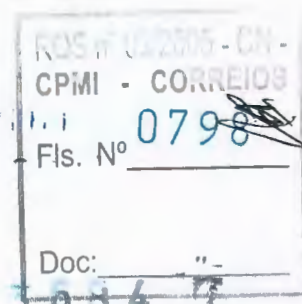
```
host name=machine2  
platform=chrp  
netboot_kernel=up  
network type=token ring  
subnet mask=255.255.225.0  
default gateway=gw2  
default gateway used by NIM master=gw_master  
ring_speed=16
```

enter the following command sequence:

```
# nim -o define -t standalone -a platform="chrp" \  
-a netboot_kernel="up" -a if1="find_net machine2 0" \  
-a ring_speed1="16" \  
-a net_definition="tok 255.255.225.0 gw2 gw_master" machine2
```

### Notes:

1. If the **find\_net** keyword in the **if** attribute causes NIM to successfully match a network definition to the client definition, the **net\_definition** attribute is ignored.





2. For more information about the attributes you can specify when defining NIM clients, see "Defining NIM Clients" on page 240.

### Method B:

1. Install the **bos.sysmgmt.nim.client** fileset on the client machine.
2. From the machine being defined as a client, enter:

```
# nimit -a name=ClientDefinitionName -a master=MasterName \  
-a pif_name=Interface -a platform=PlatformType \  
-a netboot_kernel=NetbootKernelType -a ring_speed1=SpeedValue \  
-a cable_type1=TypeValue -a iplrom_emu=DeviceName
```

**Note:** For detailed attribute information, see the **nimit** command.

### Example 1:

To add the machine with host name **machine1** with the following configuration:

```
host name=machine1  
NIM master's host name=master_mac  
primary interface adapter=en0  
platform=chrp  
kernel=up  
cable type=bnc  
network boot capability=yes (no emulation needed)
```

enter the following command sequence:

```
# nimit -a name=machine1 -a master=master_mac \  
-a pif_name=en0 -a platform=chrp -a netboot_kernel=up \  
-a cable_type1=bnc
```

### Example 2:

To add the machine with host name **machine2** with the following configuration:

```
host name=machine2  
NIM master's host name=master_mac  
primary interface adapter=tr0  
platform=chrp  
netboot_kernel=up  
ring speed1=16
```

enter the following command sequence:

```
# nimit -a name=machine2 -a master=master_mac \  
-a pif_name=tr0 -a platform=chrp -a netboot_kernel=up \  
-a ring_speed1=16
```

## Verifying the Status of Your Client Machine

To verify that the **nimit** command completed successfully, enter the following command at the NIM client:

```
# nimclient -l -l MachineObjectName
```

**Note:** There is neither a Web-based System Manager application nor a SMIT menu to do this task.

The system returns output similar to the following:

```
Standalone2:  
class          = machines  
type           = standalone  
Cstate         = ready for a NIM operation  
platform       = chrp  
netboot_kernel = up
```





```
ifl          = Network2 standalone2 08005acd536d
cable_type1  = bnc
iplrom_emu   = /dev/fd0
prev_state   = customization is being performed
cpuid        = 000247903100
Mstate       = currently running
Cstate_result = success
```

If the system output to this query indicates any errors, you must validate all of your data, checking for accurate spelling, nonduplication of NIM names, and so forth, and redo the **niminit** operation.

Be sure to coordinate this operation with the system administrator of the NIM master, and ensure that *all* NIM object names are unique in the entire NIM environment.

## Using Installation Images to Install the Base Operating System (BOS) on a NIM Client

Using installation images to install BOS on a NIM client is similar to the traditional BOS installation from a tape or CD-ROM device, because the BOS image is installed from the installation images in the **lpp\_source** resource.

### Prerequisites

- The NIM master must be configured, and **lpp\_source** and **SPOT** resources must be defined. See "Configuring the NIM Master and Creating Basic Installation Resources" on page 174.
- The NIM client to be installed must already exist in the NIM environment. To add the client to the NIM environment, see "Adding a Standalone NIM Client to the NIM Environment" on page 177.

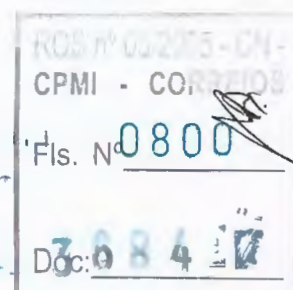
### From Web-based System Manager

1. From the NIM container, select the Machines container.
2. In the contents area, select a target standalone machine for the installation.
3. From the Selected menu, choose **Install Operating System**.
4. If the client machine being installed is not already a running, configured NIM client, NIM will not automatically reboot the machine over the network for installation. If the client was not rebooted automatically, initiate a network boot from the client to install it. For information about performing a network boot, see "Booting a Machine Over the Network" on page 323.
5. After the machine boots over the network, the display on the client machine will begin prompting for information about how to configure the machine during installation. Specify the requested information to continue with the installation.

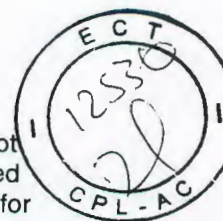
**Note:** To perform a nonprompted installation, follow the instructions in "Performing a Nonprompted BOS Installation" on page 184 to complete the prerequisite tasks.

### From SMIT

1. To install BOS on a NIM client using an **rte** installation, type `smit nim_bosinst` from the NIM master.
2. Select the **TARGET** for the operation.
3. Select **rte** as the installation TYPE.
4. Select the **SPOT** to use for the installation.
5. Select the **LPP\_SOURCE** to use for the installation.
6. In the displayed dialog fields, supply the correct values for the installation options or accept the default values. Use the help information and the **LIST** option to help you.







7. If the client machine being installed is not already a running, configured NIM client, NIM will not automatically reboot the machine over the network for installation. If the client was not rebooted automatically from SMIT, initiate a network boot from the client to install it. Use the procedure for "Booting a Machine Over the Network" on page 323 to initiate the network boot.
8. After the machine boots over the network, the display on the client machine will begin prompting for information about how the machine should be configured during installation. Specify the requested information to continue with the installation.

**Note:** To perform a nonprompted installation, follow the instructions in "Performing a Nonprompted BOS Installation" on page 184 to complete the prerequisite tasks.

## From the Command Line

1. To initiate the **bos\_inst** operation, type:

```
# nim -o bos_inst -a source=rte -a lpp_source=Lpp_Source \  
-a spot=SPOTName -a accept_licenses=yes -a boot_client=yes/no ClientName
```

Specify the resources to be used to support the installation and any additional options for customizing the installation. To perform a simple **rte** installation, specify the **lpp\_source** and **SPOT** resources.

If the client machine being installed is not already a running, configured NIM client, NIM will not automatically reboot the machine over the network for installation. A network boot must be performed manually on the machine. If that is the case, supply the **boot\_client=no** attribute to the **bos\_inst** command. If the **boot\_client** attribute value is not specified, it defaults to **boot\_client=yes**.

2. If the client was not rebooted automatically, initiate a network boot from the client to install it. Follow the "Booting a Machine Over the Network" on page 323 procedure to perform the network boot.
3. After the machine boots over the network, the display on the client machine will begin prompting for information about how to configure the machine during installation. Specify the requested information to continue with the installation.

### Example

The client machine, **machine1**, is not a running, configured NIM client. You should specify **boot\_client=no**. To install the client using the **lpp\_source** named **lpp\_source1** and the **SPOT** named **spot1**, enter:

```
# nim -o bos_inst -a source=rte -a lpp_source=lpp_source1 \  
-a spot=spot1 -a accept_licenses=yes -a boot_client=no machine1
```

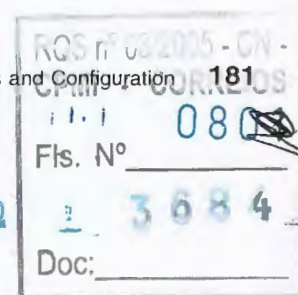
### Notes:

- a. The steps to perform an **rte** installation are almost identical to the steps to perform other types of BOS installations. The main difference is that **rte** must be specified in the **source** attribute of the **nim bos\_inst** command.
- b. To perform a nonprompted installation, follow the instructions in "Performing a Nonprompted BOS Installation" on page 184 to complete the prerequisite tasks.
- c. For a complete description of the different ways that a BOS installation can be customized by NIM, see "bos\_inst" on page 266.

## Using a mksysb Image to Install the Base Operating System (BOS) on a NIM Client (mksysb Installation)

A **mksysb** installation restores BOS and additional software to a target from a **mksysb** image in the NIM environment.

For a complete description of different ways to customize a BOS installation using NIM, see "bos\_inst" on page 266.







## Prerequisites

1. The NIM master must be configured, and **SPOT** and **mksysb** resources must be defined. See "Configuring the NIM Master and Creating Basic Installation Resources" on page 174.
2. The NIM client to be installed must already exist in the NIM environment. To add the client to the NIM environment, see "Adding a Standalone NIM Client to the NIM Environment" on page 177.
3. The **mksysb** must be available on the hard disk of the NIM master or a running NIM client, or the **mksysb** image is created during this procedure from either the NIM master or a running NIM client.
4. The **SPOT** and **mksysb** resources should be at the same level of AIX when used for NIM BOS installations.
5. Many applications, particularly databases, maintain data in *sparse files*. A sparse file is one with empty space, or gaps, left open for future addition of data. If the empty spaces are filled with the ASCII null character and the spaces are large enough, the file will be sparse, and disk blocks will not be allocated to it.

This situation creates an exposure in that a large file will be created, but the disk blocks will not be allocated. As data is then added to the file, the disk blocks will be allocated, but there may not be enough free disk blocks in the file system. The file system can become full, and writes to any file in the file system will fail.

It is recommended that you either have no sparse files on your system or that you ensure you have enough free space in the file system for future allocation of the blocks.

## Cloning Considerations

The **mksysb** images enable you to clone one system image onto multiple target systems. The target systems might not contain the same hardware devices or adapters, require the same kernel (uniprocessor or multiprocessor).

Because NIM configures TCP/IP at the end of an installation, it is recommended that a **bosinst\_data** resource be allocated for cloning **mksysb** installations with the **RECOVER\_DEVICES** field set to no. This will prevent the BOS installation process from attempting to configure the devices as they were on the source machine of the **mksysb** image.

Beginning in AIX 5.2, devices are not recovered if the **mksysb** image that is being installed was not created on the same system.

**Attention:** If the system you have cloned is using OpenGL or graPHIGS, there may be some device files from these LPPs that must be installed after a clone. OpenGL and graPHIGS have graphics adapter-specific files, so if you cloned onto a system with a different graphics adapter, you will need to create a bundle as follows:

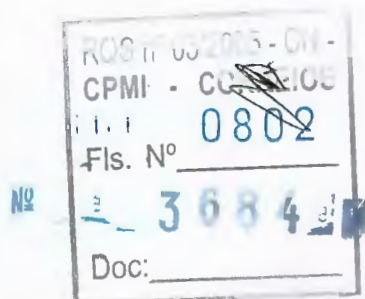
```
echo OpenGL.OpenGL_X.dev > /usr/sys/inst.data/user_bundles/graphic_dev.bnd
echo PEX_PHIGS.dev >> /usr/sys/inst.data/user_bundles/graphic_dev.bnd
```

You can allocate this bundle when you install the **mksysb**, and the device files will be installed automatically if OpenGL and graPHIGS are in your **lpp\_source**.

## From Web-based System Manager

1. In the NIM container, select the Resources container.
2. From the Resources menu, select **New** —> **Resource** —> **New Resources**.
3. Use the wizard to complete the task.

**Note:** To perform a nonprompted installation, follow the instructions in "Performing a Nonprompted BOS Installation" on page 184 to complete the prerequisite tasks.







## From SMIT

1. If the **mksysb** resource has already been created, skip to step 6. Otherwise, to create the **mksysb** resource, enter the **smit nim\_mkres** fast path.
2. Select **mksysb** from the list of resource types that can be defined.
3. In the displayed dialogs, supply the values for the required fields. Use the help information and the **LIST** option to help you specify the correct values for defining your **mksysb** resource.
4. If the **mksysb** image does not exist, create it by supplying the values for the fields under **System Backup Image Creation Options**.

**Note:** If the **mksysb** image already exists as a file on the hard disk of the NIM master or client, no additional information is needed to define your **mksysb** resource.

5. Upon successful completion of this task, exit SMIT.
6. To use the **mksysb** resource to install a NIM client, enter the **smit nim\_bosinst** fast path.
7. Select a **TARGET** for the operation.
8. Select **mksysb** as the installation **TYPE**.
9. Select the **MKSYSB** to use for the installation.
10. Select the **SPOT** to use for the installation.
11. In the displayed dialog fields, supply the correct values for the installation options or accept the default values. Use the help information or the **LIST** option to help you.
12. Run the SMIT dialog to install the NIM client.
13. If the client machine being installed is not already a running, configured NIM client, NIM will not automatically reboot the machine over the network for installation. If the client was not rebooted automatically from SMIT, initiate a network boot from the client to install it. For information about to initiating a network boot, see "Booting a Machine Over the Network" on page 323.
14. After the machine boots over the network, the display on the client machine will begin prompting for information about how to configure the machine during installation. Specify the requested information to continue with the installation.

**Note:** To perform a nonprompted installation, follow the instructions in "Performing a Nonprompted BOS Installation" on page 184 to complete the prerequisite tasks.

## From the Command Line

1. If the **mksysb** resource has already been created, skip to step 2. To create the **mksysb** resource, enter:

```
nim -o define -t mksysb -a server=ServerName \  
-a location=LocationName -a mk_image=yes \  
-a source=SourceMachine ResourceName
```

Specify the server name and location of the **mksysb** image. The **mk\_image** and **source** attributes are used to create the **mksysb** image if it does not already exist.

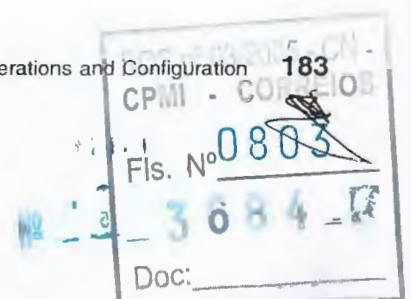
For a complete description of all the options that can be specified when creating a **mksysb** resource, see "mksysb Resource" on page 256.

### Example 1:

To define a **mksysb** resource, **mksysb\_res1**, from an existing **mksysb** image located in **/export/backups/client\_mksysb** on the master, enter:

```
nim -o define -t mksysb -a server=master \  
-a location=/export/backups/client_mksysb mksysb_res1
```

### Example 2:







To create a **mksysb** image of the client machine, **client1**, in **/export/resources/new\_mksysb** on the master, and to define a **mksysb** resource, **mksysb\_res2**, enter:

```
nim -o define -t mksysb -a server=master \  
-a location=export/resources/new_mksysb -a mk_image=yes \  
-a source=client1 mksysb_res2
```

2. To initiate the **bos\_inst** operation, enter:

```
nim -o bos_inst -a source=mksysb -a mksysb=mksysb \  
-a spot=SPOTName -a boot_client=yes/no ClientName
```

Specify the resources to be used to support the installation and any additional options for customizing the installation. To perform a simple **mksysb** installation, specify the **mksysb** and **SPOT** resources.

If the client machine being installed is not already a running, configured NIM client, NIM will not automatically reboot the machine over the network for installation. A network boot must be performed manually on the machine. If that is the case, supply the **boot\_client=no** attribute to the **bos\_inst** command. If the **boot\_client** attribute value is not specified, it defaults to **boot\_client=yes**.

3. If the client was not rebooted automatically, initiate a network boot from the client to install it. For information about performing a network boot, see "Booting a Machine Over the Network" on page 323.
4. After the machine boots over the network, the display on the client machine will begin prompting for information about how to configure the machine during installation. Specify the requested information to continue with the installation.

#### Example 3:

To perform a **mksysb** installation using the **mksysb**, **mksysb1**, an optional **lpp\_source**, **lpp\_source1**, and the **SPOT**, **spot1**, on client machine, **machine1**, which is not a running, configured NIM client, enter:

```
nim -o bos_inst -a source=mksysb -a mksysb=mksysb1 \  
-a lpp_source=lpp_source1 -a spot=spot1 -a boot_client=no machine1
```

#### Notes:

1. The steps to perform a **mksysb** installation are almost identical to the steps to perform other types of BOS installations. The main differences are that **mksysb** must be specified in the **source** attribute of the **nim bos\_inst** command, and a **mksysb** resource must be allocated for the operation.
2. To perform a nonprompted installation, follow the instructions in "Performing a Nonprompted BOS Installation" to complete the prerequisite tasks.

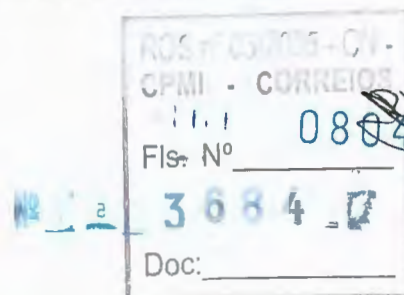
## Performing a Nonprompted BOS Installation

This procedure provides information about how to create a **bosinst\_data** resource to use for a nonprompted BOS installation. After you have created the **bosinst\_data** resource, refer to the following procedures to perform the nonprompted installation:

- "Using Installation Images to Install the Base Operating System (BOS) on a NIM Client" on page 180
- "Using a mksysb Image to Install the Base Operating System (BOS) on a NIM Client (mksysb Installation)" on page 181

## Prerequisites

1. The NIM master must be configured, and **lpp\_source** and **SPOT** resources must be defined. See "Configuring the NIM Master and Creating Basic Installation Resources" on page 174.
2. The NIM client to be installed must already exist in the NIM environment. To add the client to the NIM environment, use the procedure "Adding a Standalone NIM Client to the NIM Environment" on page 177.
3. If any of the software to be installed during the BOS installation requires acceptance of a license agreement, determine whether to accept the license agreement during BOS installation or defer





acceptance until after the client has booted. Note that license acceptance takes place at the client. For a sample **bosinst.data** file that specifies the syntax to control license acceptance, see "bosinst.data File Example" on page 68.



## From Web-based System Manager

You can use the Install Base OS wizard to create a **bosinst\_data** resource. The **bosinst\_data** resource can be used for a **rte** installation or a **mksysb** installation.

If you want to create the **bosinst\_data** resource, continue with the following steps:

1. In the Resources container, from the Resources menu, select **New** → **Resource**. The Add New Resource wizard displays.
2. Follow the wizard instructions to create a **bosinst\_data** resource. The wizard creates a basic **bosinst.data** file, which can be used "as is" or can be enhanced according to sample files. For a sample **bosinst.data** file, see "Nonprompted Network Installation" on page 68. To do a nonprompted installation, the **bosinst\_data** resource must be created first.

## From SMIT

1. On the NIM master or any running NIM client, create a **bosinst.data** file that describes how a machine should be configured during a BOS installation. For a sample **bosinst.data** file, see "bosinst.data File Example" on page 68.
2. To define the **bosinst.data** file as a **bosinst\_data** resource in the NIM environment, enter the **smit nim\_mkres** fast path.
3. Select **bosinst\_data** from the list of resource types displayed on your screen.
4. Supply the values for the required fields. Use the help information and the LIST option to help you specify the correct values for defining your **bosinst\_data** resource.
5. After the **bosinst\_data** resource has been defined, follow the procedures for performing an **rte** or **mksysb** installation on a standalone machine. Be sure to specify the **bosinst\_data** resource to use during the installation.

## From the Command Line

1. On the NIM master or any running NIM client, create a **bosinst.data** file that describes how a machine should be configured during a BOS installation.

**Note:** To accept license agreements for software to be installed during the BOS installation, specify **-a accept\_licenses=yes** on the **nim -o bos\_inst** command.

2. To define the **bosinst.data** file as a **bosinst\_data** resource, enter:

```
# nim -o define -t bosinst_data -a server=ServerName \  
-a location=LocationName NameValue
```

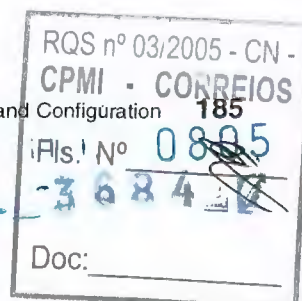
Using the **server** attribute, specify the name of the machine where the **bosinst.data** file is located.

Using the **location** attribute, specify the full path name of the **bosinst.data** file that is to be used as a resource.

3. After the **bosinst\_data** resource has been defined, follow the normal procedure for performing an **rte** or **mksysb** installation on standalone machines. Be sure to specify that the **bosinst\_data** resource be used for the installation.

For example, to perform a nonprompted **rte** installation of machine1 using the **lpp\_source1**, **spot1**, and **bosinst\_data1** resources, enter:

```
# nim -o bos_inst -a source=rte -a lpp_source=lpp_source1 \  
-a spot=spot1 -a accept_licenses=yes -a bosinst_data=bosinst_data1 \  
machine1
```







## Installing to Clients on ATM Networks

Unlike other network adapters, ATM adapters cannot be used to boot a machine. Installing a machine over an ATM network requires special processing.

### BOS Installation over Non-ATM Adapters

Normally when a machine performs a network boot over a specified adapter, the adapter is configured by IPL-ROM or firmware. Then a boot image is transferred from the boot server to the client using **tftp**. This boot image performs further configuration and mounts network installation resources before starting the BOS installation.

### BOS Installation over ATM Adapters

Because an ATM adapter cannot be configured by IPL-ROM or firmware, a boot image cannot be obtained over the network to perform a BOS installation. The NIM **bos\_inst** operation must copy a boot image to the hard disk of the client before the machine is rebooted. Some Object Data Manager (ODM) information is also saved on the client machine so that when the machine is rebooted, the ATM adapter can be configured properly.

NIM clients may not have the programs installed to support the special processing required for installation over ATM, so the **/usr/lib/boot/bin** and **/usr/lpp/bos.sysmgt/nim/methods** directories are mounted at the client from the NIM master. These directories contain the programs that run during the setup performed by the NIM **bos\_inst** operation.

After the initial setup completes, an **at** job is issued to reboot the machine after one minute has elapsed. When the machine reboots, the boot image that was copied to the hard disk configures the ATM adapter and mounts network installation resources for the BOS installation. The installation then proceeds as normal until the customization phase. During NIM customization, the ATM adapter is not reconfigured with a **mktcpip** command because the ODM already contains information carried over from before the machine was reinstalled. All other aspects of NIM customization are the same as for non-ATM clients.

## NIM Configuration Requirements for ATM Networks

- Machines that will have BOS installed over ATM must be running and configured NIM clients.

**Note:** Configured NIM clients have the **bos.sysmgt.nim.client** fileset installed, are registered in the NIM master database, and have a valid **/etc/niminfo** file.

- BOS installations over ATM adapters will always use the **at0** interface on the client.
- The NIM master fileset must be installed at AIX 4.3 or later with the update for ATM installation or any superseding level.
- The SPOT that will be used to install the clients must be at version AIX 4.3 or later with the update for ATM installation or any superseding level.

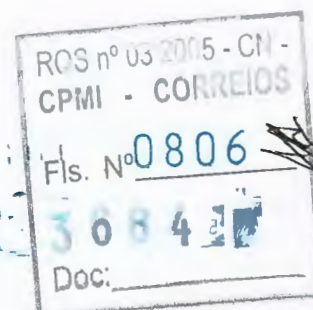
## Converting Generic Networks Into ATM Networks

Prior to the support of BOS installations over ATM, it was necessary to define ATM networks as "generic" networks for performing other types of NIM operations. To convert generic networks into ATM networks, enter the following command:

```
nim -o change -a new_type=atm (network)
```

The adapter names for the client interfaces on the ATM network will automatically be set to **at0** in the NIM database.

To change the name of the network, type the following:





`nim -o change -a new_name=new_network_name current_network_name`



## System Recovery After Boot Failure

Because BOS installation over ATM requires a special boot image to be written to the hard disk of the client, the original boot image on the machine will be lost. If the installation is stopped or fails before BOS is reinstalled, it will not be possible to perform a normal reboot of the client unless system maintenance is performed. By performing system maintenance, a new boot image can be created on the hard disk to allow the machine to be booted for normal use. Use the following procedure:

1. Boot the client from a CD.
2. When the installation options are displayed, select the option to perform system maintenance.
3. Make the necessary selections to access the machine's root volume group.
4. In the maintenance shell, run the following sequence of commands:
  - a. `bosboot -ad /dev/ipldevice`
  - b. `BLVDISK='lslv -l hd5 | grep hdisk | head -1 | cut -d' ' -f1'`
  - c. `bootlist -m normal $BLVDISK`
  - d. `sync`
  - e. `sync`
  - f. `sync`
  - g. `reboot -q`

If errors are detected during the NIM `bos_inst` operation and the client machine has not rebooted, it is possible to stop the machine from rebooting, and then execute the sequence of commands in the above step 4 on the running system. To stop the reboot, use the following procedure:

1. List the **at** jobs on the machine by entering the command: `at -l`  
The first name in the output field will be the name of the job. For example:  

```
$ at -l
root.884205595.a Wed Jan 7 14:39:55 1998
```
2. To remove the **at** job, enter the following command: `at -r name of job`  
For example:  

```
$ at -r root.884205595.a
at file: root.884205595.a deleted
```

**Note:** The reboot can also be prevented by removing the shutdown script that the **at** job was instructed to run by typing:  
`rm/tmp/_NIM_shutdown`

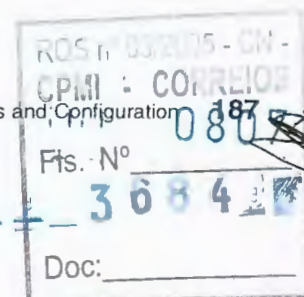
---

## Customizing NIM Clients and SPOT Resources

This procedure describes how to use NIM to install software on running, configured NIM clients and **SPOT** resources.

### Prerequisites

1. If the software is to be installed on a machine, the machine must be a running, configured NIM client with push permissions enabled for the NIM master. Push permissions are enabled by default when a client is configured or installed by NIM.
2. If the software is to be installed on a **SPOT** resource, the server of the **SPOT** must be running.







3. The installation image to be installed on the target is available in an **lpp\_source** resource, and a **check** operation was performed on the **lpp\_source** at some point after the image was first copied there. (The **check** operation updates the **.toc** file with information about the images present in the **lpp\_source**.)

## From Web-based System Manager

1. From the NIM container, select the Machines container.
2. In the contents area, select a target machine (master or standalone), or in the Resources container, select a target **SPOT**.
3. From the Selected menu, choose **Install/Update Software** —> **Install Additional Software (Custom)** to display the Install Software dialog.
4. Use the dialog to complete the task.

## From SMIT

The SMIT screens follow the same structure as those used for local installation operations performed on a system. When performing NIM customization operations, select the SMIT screen that most closely describes the installation you want to perform.

1. From the command line, enter the **smit nim\_task\_inst** fast path.
2. Select the SMIT menu item that matches the type of installation you want to perform.
3. Select a **TARGET** for the operation.
4. Select the **lpp\_source** that contains the installation images to be used.
5. Select any other required resources.
6. In the final SMIT dialog, supply the values for the required fields or accept the defaults. Use the help information and the **LIST** option to help you specify the correct values.

## From the Command Line

To perform the installation operation, enter:

```
nim -o cust -a lpp_source=Lpp_Source -a filesets=FilesetsList \  
-a installp_bundle=InstallpBundle \  
-a installp_flags=InstallpFlags TargetName
```

You will specify the resources to use to support the installation and any additional attributes for customization.

The software to be installed on the client can be specified on the command line using either the **filesets** attribute or by specifying an **installp\_bundle** resource that lists the software.

The default **installp** flags to be used to install the software are **-a**, **-g**, **-Q**, and **-X**. To specify a different set of **installp** flags, you can list them in the **installp\_flags** attribute.

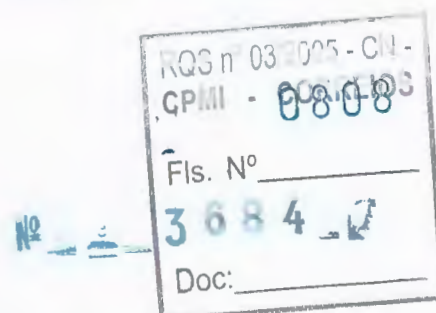
### Example 1:

To install the **bos.diag** and **bos.dosutil** filesets on the client, machine1, using the **lpp\_source** resource named **lpp\_source1**, enter:

```
nim -o cust -a lpp_source=lpp_source1 \  
-a filesets="bos.diag bos.dosutil" machine1
```

### Example 2:

To install software into the **SPOT** resource, spot1, using the **lpp\_source** resource, **lpp\_source1**, and the list of filesets specified in the **installp\_bundle** resource, **installp\_bundle1**, enter:



```
nim -o cust -a lpp_source=lpp_source1 \
-a installp_bundle=installp_bundle1 spot1
```



**Note:** Several other resources and attributes can be specified on the command line with the **cust** operation. For a complete description of the **cust** operation, see "NIM Operations" on page 263.

## Configuring the NIM Master and Creating Resources to Support Diskless and Dataless Clients Only

Use this procedure only if the NIM environment is to be used exclusively for diskless and dataless client management. If the NIM environment is also to be used for installing and maintaining software on standalone machines, follow the procedure for "Configuring the NIM Master and Creating Basic Installation Resources" on page 174.

**Note:** This procedure produces a large amount of output, especially when creating the **SPOT** resource. Be sure to scan through the output to look for nonfatal errors and warnings that may not be evident from a successful return code.

### Prerequisites

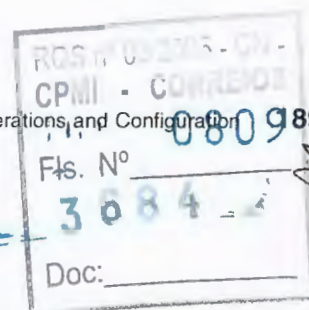
The NIM master must have at least 300 MB of available disk space. If such space is not available, see "Using Client Machines as Resource Servers" on page 201, and "Defining an lpp\_source on CD-ROM versus Disk" on page 219.

### From Web-based System Manager

1. Insert the AIX media into the appropriate drive of the designated master machine.
2. Start the Web-based System Manager application by typing **wsm**.
3. In the navigation area, select and expand the **Software** container.
4. While still in the navigation area, select the **Installed Software** container.
5. From the **Software** menu, choose **New Software (Install/Update)** → **Install Additional Software**.
6. In the **Install Software** dialog, select **/dev/cd0** as the software source.
7. Specify **bos.sysmgt.nim** as the software to install.
8. In the navigation area, select the **NIM** container.
9. From the **NIM** menu, select **Configure Environment**.
10. Follow the wizard instructions to guide you through the configuration.

### From SMIT

1. Insert the AIX media into the CD-ROM or tape drive of the designated master machine.
2. To install the **bos.sysmgt.nim** fileset, enter the **smit install\_latest** fast path.
3. Using the **LIST** option, select **/dev/cd0** or **/dev/rmt0** for the **INPUT device / directory** for software.
4. Specify **bos.sysmgt.nim** as the **SOFTWARE** to install.
5. Accept the default values for all other fields on this screen. After completion of this installation, exit **SMIT**.
6. To configure the NIM master, enter the **smit nimconfig** fast path.
7. Specify a name in the **Network Name** field to be assigned to the NIM master's network.
8. Using the **LIST** option, select the **Primary Network Interface** for the NIM Master.
9. Accept the default values for all other fields on this screen.
10. After the master is configured, exit **SMIT**.
11. Restart **SMIT** using the **smit nim\_mkres\_dd\_name\_server** fast path.







12. When prompted, select the NIM master as the server of the client resources.
13. Select **yes** in the Create a new SPOT? field, because there is not a **SPOT** currently defined in your environment.
14. Using the LIST option, select **/dev/cd0** or **/dev/rmt0** as the input device for installation images.
15. Specify a name in the SPOT Name field.
16. Specify names for the other resources to be created in the NIM environment. If a name is not specified, the resource will not be created.
17. Select **yes** at the Remove all newly added NIM definitions and file systems if any part of this operation fails? field. This will make it easier to restart this procedure if failures occur.
18. Accept the default values for all other fields on this screen.

**Note:** In most NIM environments, the **SPOT** will already exist to support base operating system installation operations on standalone machines. In such environments, it is not necessary to create a new **SPOT**.

## From the Command Line

1. Insert the AIX media into the CD-ROM or tape drive of the designated master machine.
2. If installing from a tape, skip to step 5. To create a mount point for the CD, type:  

```
mkdir /cdfs
```
3. To create a **cdrom** file system, type:  

```
crfs -v cdrfs -p ro -d'cd0' -m'/cdfs'
```
4. To mount the CD, type:  

```
mount /cdfs
```
5. To install the **bos.sysmgt.nim** fileset from the CD, type:  

```
installp -agX -d /cdfs/usr/sys/inst.images bos.sysmgt.nim
```

  
or to install the **bos.sysmgt.nim** fileset from a tape, type:  

```
installp -agX -d /dev/rmt0 bos.sysmgt.nim
```
6. If installing from CD, to unmount the **cdrom** file system, type:  

```
umount /cdfs
```
7. To configure the NIM master using the **nimconfig** command, type:  

```
nimconfig -a attr1=value1 \  
          -a attr2=value2 \  
          ...
```

For example, to configure a NIM master with the following configuration:

```
master host name = master1  
primary network interface = tr0  
ring speed = 16  
platform = chrp  
kernel type = mp
```

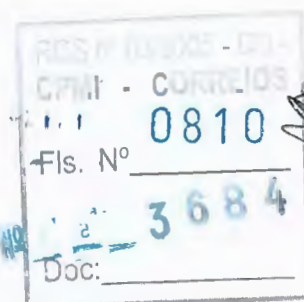
enter the following command sequence:

```
nimconfig -a netname=network1 -a pif_name=tr0 -a ring_speed=16 \  
-a platform=chrp -a netboot_kernel=mp
```

**Note:** For additional attribute information, see the **nimconfig** command.

8. To create a file system in the rootvg volume group with 200 MB of space and a mount point of **/export/spot**, enter:  

```
crfs -v jfs -g rootvg -a size=$((2000*200)) \  
-m /export/spot -A yes -p rw -t no \  
-a frag=4096 -a nbpi=4096 -a compress=no
```





9. To mount the file system, enter:  

```
mount /export/spot
```
10. The **SPOT** resource will be installed from images in the image source (in this example, the CD). The server of the resource will be the NIM master, and the **SPOT** will be stored in the `/export/spot/spot1` directory. To create the **SPOT** resource, enter:  

```
nim -o define -t spot -a source=/dev/cd0 -a server=master \  
-a location=/export/spot spot1
```
11. To create a file system in the rootvg volume group with 150 MB of space and a mount point of `/export/dd_resource`, enter:  

```
crfs -v jfs -g rootvg -a size=$((2000*150)) \  
-m /export/dd_resource -A yes -p rw -t no \  
-a frag=4096 -a nbpi=4096 -a compress=no
```
12. To mount the file system, enter:  

```
mount /export/dd_resource
```
13. Create the diskless and dataless client resources in subdirectories of the `/export/dd_resource` directory. Not all resources are required. Create only the resources to be used in your environment.  
To create the root resource named `root1` (required for diskless and dataless clients), enter:  

```
nim -o define -t root -a server=master \  
-a location=/export/dd_resource/root1 root1
```

  
To create the dump resource named `dump1` (required for diskless and dataless clients), enter:  

```
nim -o define -t dump -a server=master \  
-a location=/export/dd_resource/dump1 dump1
```

  
To create the paging resource named `paging1` (required for diskless clients), enter:  

```
nim -o define -t paging -a server=master \  
-a location=/export/dd_resource/paging1 paging1
```

  
To create the home resource named `home1` (optional), enter:  

```
nim -o define -t home -a server=master \  
-a location=/export/dd_resource/home1 home1
```

  
To create the shared\_home resource named `shared_home1` (optional), enter:  

```
nim -o define -t shared_home -a server=master \  
-a location=/export/dd_resource/shared_home1 shared_home1
```

  
To create the tmp resource named `tmp1` (optional), enter:  

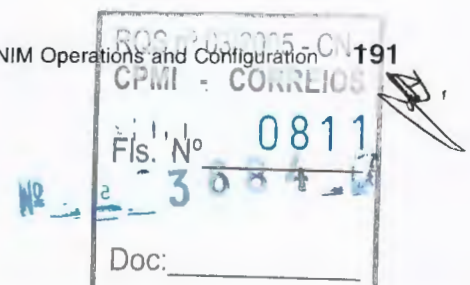
```
nim -o define -t tmp -a server=master \  
-a location=/export/dd_resource/tmp1 tmp1
```

#### Notes:

1. The file systems created for the NIM resources are not required, but they can be beneficial for storage management.
2. For more information about NIM resources, see "NIM Resources" on page 248.

## Adding a Diskless or Dataless Client to the NIM Environment

This procedure describes how to add diskless and dataless clients to the NIM environment by adding an entry for the client to the NIM database on the master. This provides NIM with the information required to satisfy boot requests from the client. However, resources for the diskless or dataless client machine must be initialized before the client will be able to successfully boot and configure. See "Initializing and Booting a Diskless or Dataless Machine" on page 193 for more information. Diskless clients must mount all file







systems from remote servers. Dataless clients can have paging space, as well as the `/tmp` and `/home` file systems on the local disk. Neither diskless nor dataless clients have a boot image on the local disk. Therefore, they must boot over the network.

## Prerequisites

1. The NIM master must be configured, and the resources for diskless or dataless clients must be defined. For more information, see "Configuring the NIM Master and Creating Resources to Support Diskless and Dataless Clients Only" on page 189.
2. You must know the subnet mask, the default gateway for the client machine, and the default gateway for the NIM master.

## From Web-based System Manager

1. In the Machines container, from the Machines menu, select **New** → **OK**. The Add New Machine wizard displays.
2. Follow the wizard instructions to add a diskless or dataless client to the NIM environment.

## From SMIT

1. To define a diskless or dataless client, enter the `smit nim_mkmac` fast path.
2. Specify the host name of the machine.
3. The SMIT screen displayed next depends on whether NIM already has information about the client's network. Supply the values for the required fields or accept the defaults. Use the help information and the LIST option to help you specify the correct values to define the client machine.

## From the Command Line

To define a diskless or dataless client, enter:

```
nim -o define -t Diskless/Dataless \  
-a platform=PlatformType -a netboot_kernel=NetbootKernelType \  
-a if1=InterfaceDescription -a net_definition=DefinitionName \  
-a ring_speed1=Speedvalue -a cable_type1=TypeValue \  
-a iplrom_emu=DeviceName MachineName
```

**Note:** For detailed attribute information, see the descriptions of diskless and dataless clients in "NIM Machines" on page 239.

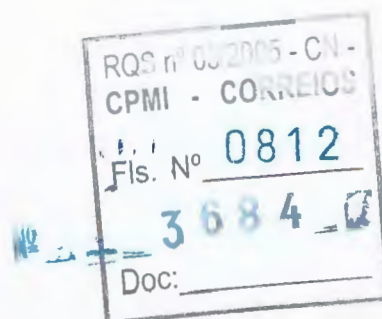
### Example 1:

To add the diskless client with the host name `diskless1` to the NIM environment with the following configuration:

```
host name=diskless1  
platform=rspc  
kernel=up  
network type=ethernet  
subnet mask=255.255.240.0  
default gateway=gw1  
default gateway used by NIM master=gw_master  
cable type=bnc  
network boot capability=yes (no emulation needed)
```

enter the following command sequence:

```
nim -o define -t diskless -a platform="rspc" \  
-a netboot_kernel="up" -a if1="find_net diskless1 0" \  
-a cable_type1="bnc" \  
-a net_definition="ent 255.255.240.0 gw1 gw_master" \  
diskless1
```





### Example 2:

To add the dataless client with the host name `dataless1` to the NIM environment with the following configuration:

```
host name=dataless1
platform=rs6k
netboot_kernel=up
network_type=token ring
subnet mask=255.255.225.0
default gateway=gw2
default gateway used by NIM master=gw_master
ring speed=16
network boot capability=no (use emulation on a diskette)
```

enter the following command sequence:

```
nim -o define -t dataless -a platform="rs6k" \
-a netboot_kernel="up" -a if1="find_net dataless1 0" \
-a ring_speed1="16" \
-a net_definition="tok 255.255.225.0 gw2 gw_master" \
-a iplrom_emu="/dev/fd0" dataless1
```

**Note:** If the `find_net` keyword in the `if` attribute causes NIM to successfully match a network definition to the client definition, the `net_definition` attribute is ignored.

## Initializing and Booting a Diskless or Dataless Machine

This procedure describes how to use NIM to configure and boot a machine as a diskless or dataless client in the NIM environment.

### Prerequisites

1. The NIM master must be configured, and the resources for diskless and dataless clients must be defined. See "Configuring the NIM Master and Creating Resources to Support Diskless and Dataless Clients Only" on page 189.
2. The NIM client must already exist in the NIM environment. To add the client to the NIM environment, use the "Adding a Diskless or Dataless Client to the NIM Environment" on page 191 procedure.

### From Web-based System Manager

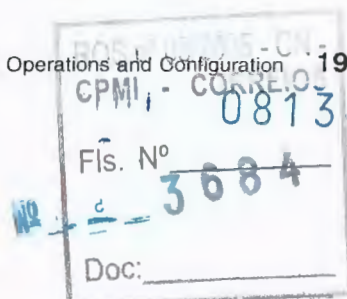
1. Select the Machines container.
2. In the contents area, select the diskless or dataless machine you want to initialize.
3. From the Selected menu, choose **Initialize Machine Resources**.
4. Use the dialog to specify or select the resources to use for initialization. You will specify either the Home resource or Shared Home resource for the machine, but not both.
5. After completion of the initialization operation, use the "Booting a Machine Over the Network" on page 323 procedure to boot the client machine over the network.

**Note:** On older model `rspc` systems, it may be necessary to permanently set the bootlist from the firmware menus to make the client always boot over the network. For other systems, the bootlist is automatically set the first time the machine is booted as a diskless/dataless client.

6. After the client boots over the network and performs some initialization, the client will display instructions for you to select the console for the machine.

### From SMIT

1. On the NIM master, enter the `smit nim_dd_init` fast path.
2. Select the client to be initialized from the list of clients displayed on your screen.







3. Supply the values for the required fields. Use the help information and the LIST option to help you specify the correct values for the initialization options.
4. After completion of the initialization operation, use the "Booting a Machine Over the Network" on page 323 procedure to boot the client machine over the network.

**Note:** On older model **rspc** systems, it may be necessary to permanently set the bootlist from the firmware menus to make the client always boot over the network. For other systems, the bootlist is automatically set the first time the machine is booted as a diskless/dataless client.

5. After the client boots over the network and performs some initialization, the client will display instructions for you to select the console for the machine.

## From the Command Line

1. To initialize the client resources for diskless clients, enter the following on the NIM master:

```
nim -o dkls_init -a spot=SPOTName -a root=RootName \  
-a dump=DumpName -a paging=PagingName ClientName
```

2. To initialize the client resources for dataless clients, enter the following on the NIM master:

```
nim -o dtls_init -a spot=SPOTName -a root=RootName \  
-a dump=DumpName ClientName
```

**Note:** For detailed information about other attributes you can specify for the **dkls\_init** and **dtls\_init** operations, see "dkls\_init" on page 274 and "dtls\_init" on page 275.

3. After completion of the initialization operation, use the "Booting a Machine Over the Network" on page 323 procedure to boot the client machine over the network.

**Note:** On older model **rspc** systems, it may be necessary to permanently set the bootlist from the firmware menus to make the client always boot over the network. For other systems, the bootlist is automatically set the first time the machine is booted as a diskless/dataless client.

4. After the client boots over the network and performs some initialization, the client will display instructions for you to select the console for the machine.

---

## Uninitializing Diskless and Dataless Machines

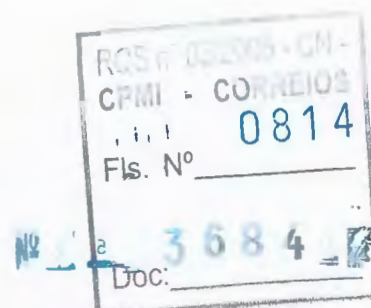
Diskless and dataless machines are uninitialized by performing the **reset** operation. This action also provides the option to deallocate all resources for the machine. Deallocating all resources from the diskless or dataless machine removes all root data for the machine. Without deallocating resources, the uninitialize operation deallocates just the network boot image.

## From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select the diskless or dataless machine you want to initialize.
3. From the Selected menu, choose **Uninitialize Machine Resources**.
4. Use the dialog to uninitialize and, if desired, deallocate all resources from the client.

## From SMIT

1. To uninitialize diskless and dataless machines, enter the **smit nim\_dd\_uninit** fast path.
2. Select the Target.
3. If you want to remove all root data, change the DEALLOCATE Resources field to **yes**.





## From the Command Line

1. To uninitialized the client machine, enter the following on the NIM master:  
`nim -F -o reset ClientName`
2. To deallocate all resources and remove root data, enter the following on the NIM master:  
`nim -o deallocate -a subclass=all ClientName`

---

## Installing to an Alternate Disk on a NIM Client (cloning or mksysb)

NIM allows you to install an AIX 4.3 or later **mksysb** image (mksysb resource) on a NIM client's alternate disk or to clone a NIM client's current disk onto an alternate disk and apply updates. Because the client system is running during installation, less time is required than for a normal installation.

**Note:** For information about the different ways NIM can customize an alternate disk installation, see "alt\_disk\_install" on page 265.

### Prerequisites

1. The NIM master must be configured. To install a **mksysb** image onto the alternate disk, the **mksysb** resource must be defined. See "Configuring the NIM Master and Creating Basic Installation Resources" on page 174.
2. The NIM client must already exist in the NIM environment and must be running. To add the client to the NIM environment, see "Adding a Standalone NIM Client to the NIM Environment" on page 177.
3. The **bos.alt\_disk\_install.rte** fileset must be installed on the NIM client. To install a new fileset on a NIM Client, see "Customizing NIM Clients and SPOT Resources" on page 187.

## From Web-based System Manager

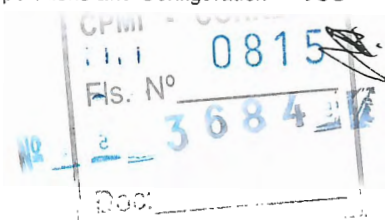
1. Select the Machines Container.
2. In the contents area, select the standalone machine for the alternate disk installation.
3. From the Selected menu, choose **Alternate Disk Installation** —> **Clone the Rootvg to an Alternate Disk** or **Install Mksysb on an Alternate Disk**.
4. Use the dialog to finish the installation.

## From SMIT

1. Enter the **smit nim\_alt\_mksysb** fast path from the NIM master.
2. Select the Target Machine or Target Group to Install.
3. Enter the Target Disk or Disks on the Target machine.
4. Accept the default installation options, or supply different ones in the displayed dialog fields. Use the help information and the LIST option for guidance.
5. The alternate disk installation will be initiated on the client, and progress can be seen with the **lsnim** command (**smit lsnim**). If the "Reboot when complete?" option is set to **yes** and the "Phase to execute" is **all** or includes Phase 3, the client will reboot from the newly installed disk when the **alt\_disk\_install** command is complete.
6. To clone a disk onto a NIM client's alternate disk, enter the **smit nim\_alt\_clone** fast path from the NIM master.

## From the Command Line

The **alt\_disk\_install** command is initiated on the target system, and progress is shown with the **lsnim** command. In addition, a log kept on the target system, **/var/adm/ras/alt\_disk\_inst.log**, contains progress messages and any error or warning messages that might occur. The **/var/adm/ras/nim.alt\_disk\_install** log will contain debug information, if requested.







## Installing mksysb on an Alternate Disk

Initiate the `alt_disk_install` operation by entering:

```
nim -o alt_disk_install -a source=mksysb -a mksysb=Mksysb \  
-a disk='diskname(s)' ClientName
```

Specify the **mksysb** resource to be used and any additional options for customizing the installation. To perform a simple alternate disk **mksysb** install, specify the **source**, **mksysb**, and **disk** resources.

**Note:** For detailed information about the mksysb resources, see "mksysb Resource" on page 256.

## Cloning the rootvg to an Alternate Disk

To clone a disk onto a NIM client's alternate disk, enter:

```
nim -o alt_disk_install -a source=rootvg -a disk=diskname(s) ClientName
```

Specify any additional options for customizing the installation.

## Examples

The client machine `machine1` is a running system with a disk, `hdisk2`, that is not currently occupied by a volume group.

- To install this disk with a **mksysb** resource named `51mksysb` enter:

```
nim -o alt_disk_install -a source=mksysb -a mksysb=51mksysb \  
-a disk=hdisk2 machine1
```

- To clone the `rootvg` to `hdisk2` enter:

```
nim -o alt_disk_install -a source=rootvg -a disk=hdisk2 machine1
```

---

## Network Installation Management Commands Reference

This section provides information on NIM commands and where to find more information on the NIM commands.

### The `nim_master_setup` Command

The `nim_master_setup` command installs the `bos.sysmgt.nim.master` fileset, configures the NIM master, and creates the required resources for installation, including a **mksysb** system backup.

The `nim_master_setup` command uses the `rootvg` volume group and creates an `/export/nim` file system, by default. You can change these defaults using the `volume_group` and `file_system` options. The `nim_master_setup` command also allows you to optionally not create a system backup, if you plan to use a **mksysb** image from another system. The `nim_master_setup` usage is as follows:

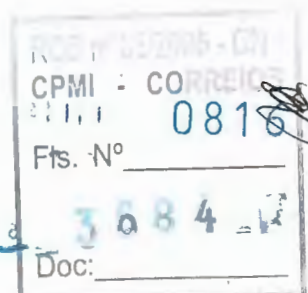
Usage `nim_master_setup`: Setup and configure NIM master.

```
nim_master_setup [-a mk_resource={yes|no}]  
[-a file_system=fs_name]  
[-a volume_group=vg_name]  
[-a disk=disk_name]  
[-a device=device]  
[-B] [-v]
```

-B Do not create mksysb resource.  
-v Enable debug output.

Default values:

```
mk_resource = yes  
file_system = /export/nim  
volume_group = rootvg  
device = /dev/cd0
```





## The `nim_clients_setup` Command

The `nim_clients_setup` command is used to define your NIM clients, allocate the installation resources, and initiate a NIM BOS installation on the clients. The `nim_clients_setup` command uses the definitions in the `basic_res_grp` resource to allocate the necessary NIM resources to perform a `mksysb` restore operation on the selected clients. The usage for `nim_clients_setup` is as follows:

Usage `nim_clients_setup`: Setup and Initialize BOS install for NIM clients.

```
nim_clients_setup [-m mksysb_resource]
[-c] [-r] [-v] client_objects
-m specify mksysb resource object name -OR- absolute file path.
-c define client objects from client.defs file.
-r reboot client objects for BOS install.
-v Enables debug output.
```

**Note:** If no client object names are given, all clients in the NIM environment are enabled for BOS installation; unless clients are defined using the `-c` option.

## Other NIM Commands Reference

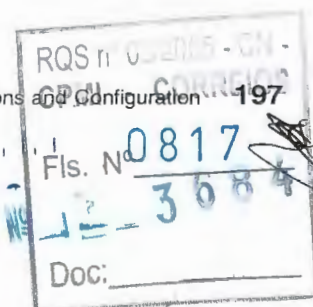
The *AIX 5L Version 5.2 Commands Reference* provides reference information about the NIM commands, AIX operating system commands, and commands for other licensed programs for end users, system administrators, and programmers. This set of books contains examples and descriptions of the commands and their available flags. The command entries are arranged in alphabetic order:

- *AIX 5L Version 5.2 Commands Reference, Volume 1* contains commands `ac` through `cx`
- *AIX 5L Version 5.2 Commands Reference, Volume 2* contains commands `da` through `hy`
- *AIX 5L Version 5.2 Commands Reference, Volume 3* contains commands `ib` through `mw`
- *AIX 5L Version 5.2 Commands Reference, Volume 4* contains commands `na` through `rw`
- *AIX 5L Version 5.2 Commands Reference, Volume 5* contains commands `sa` through `uu`
- *AIX 5L Version 5.2 Commands Reference, Volume 6* contains commands `va` through `yp`

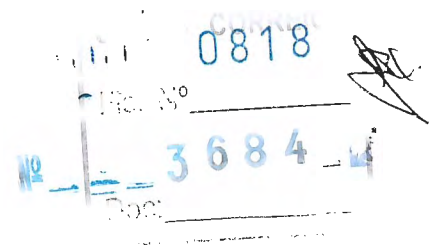
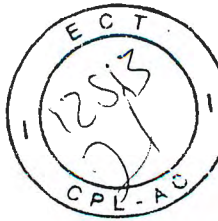
For example, *AIX 5L Version 5.2 Commands Reference, Volume 3* contains reference information for the NIM `lsnim` command. The *AIX 5L Version 5.2 Commands Reference, Volume 4* contains reference information for the NIM `nim`, `nimclient`, `nimconfig`, `nimdef`, and `niminit` commands.

You can access all of the documentation through the IBM eServer pSeries Information Center on the Internet at the following Web address:

[http://publib16.boulder.ibm.com/pseries/en\\_US/infocenter/base](http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base)









## Chapter 21. Advanced NIM Installation Tasks

This chapter describes the following procedures for performing advanced NIM installation tasks using the Web-based System Manager application or the System Management Interface Tool (SMIT), as well as from the command line:

- "Controlling the Master or Client"
- "Resetting Machines" on page 200
- "Using Client Machines as Resource Servers" on page 201
- "Defining a Machine Group" on page 202
- "Adding New Members to Machine Groups" on page 203
- "Removing Members from Machine Groups" on page 203
- "Including and Excluding a Group Member from Operations on the Group" on page 204
- "Using Resource Groups to Allocate Related Resources to NIM Machines" on page 205
- "Managing Software on Standalone Clients and SPOT Resources" on page 206
- "Rebuilding Network Boot Images for a SPOT" on page 209
- "Maintaining Software in an lpp\_source" on page 209
- "Viewing Installation, Configuration, and Boot Logs" on page 210
- "Verifying Installation with the lppchk Operation" on page 211
- "Using NIM to Install Clients Configured with Kerberos Authentication" on page 212
- "Concurrency Control" on page 213
- "Alternate Disk Migration Installation" on page 133

### Controlling the Master or Client

In the NIM environment, control is held by the NIM master or the standalone client. The system allocating the resources has control. The allocation of resources is the act of making resources available to clients for NIM operations. Normally, resources are allocated automatically as part of an operation, but they may also be allocated prior to the initiation of an operation. The control status acts like a locking mechanism and remains with the client or the master until the resources are deallocated. Using NIM, if the installation of a standalone client completes successfully, the resources are automatically deallocated.

When there are no resources allocated to the standalone client by the NIM master, the standalone client takes control by allocating resources or disabling the NIM master's push permissions. The **control** attribute is managed by the master and indicates whether the master or the standalone client has permission to perform operations on the standalone client.

The **control** attribute indicates four control states. You can display the **control** attribute from a NIM client by entering:

```
nimclient -l -l StandAloneClientName
```

The **control** attribute can be displayed from the NIM master by entering:

```
lsnim -l StandaloneClientName
```

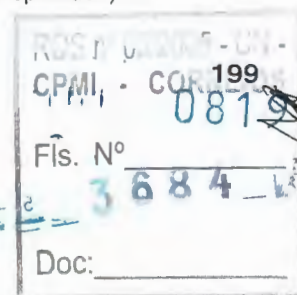
The control states are as follows:

**control attribute is not set**

If the **control** attribute is not displayed when listing the machine object attributes, then neither the master nor the standalone client has control.

**control = master**

The master has allocated resources to the client and is ready to initiate an operation (or has already initiated an operation).







**control** = *StandaloneClientName*

The standalone client has allocated resources and can now initiate NIM operations on itself.

**control** = *StandaloneClientName* **push\_off**

The standalone client has prohibited the NIM master from allocating resources or initiating operations on the client. The client itself can still control the allocation of NIM resources and the initiation of NIM operations.

## Disabling Master Push Permissions

The NIM master must have push permissions to perform push operations on the NIM clients. You can disable the NIM master's push permissions using Web-based System Manager, SMIT, or command line as follows:

### From Web-based System Manager

1. From the main Web-based System Manager container, select the Software icon.
2. From the Software menu, select **NIM Client** —> **Permissions**.
3. Select whether to grant or deny permission for the NIM master to initiate push installations.

### From SMIT

To disable the master's push permissions, enter the **smit nim\_perms** fast path from the client machine.

### From the Command Line

To set **control** on the client to **push\_off**, enter the following on the client machine:

```
nimclient -P
```

To re-enable push permission on the client, enter the following on the client machine:

```
nimclient -p
```

---

## Resetting Machines

The operations performed using NIM can be very complex. To help ensure that the operations can be completed successfully, NIM requires that a machine be in the **ready** state before operations can be run on it. While an operation is being performed, the state of the machine will reflect the current operation. After the operation completes, the machine returns to the **ready** state.

If an operation on a machine is interrupted, the machine state may continue to reflect the operation. If this occurs, the machine must be reset to the **ready** state before performing any further operations. To return a machine to the **ready** state, use the NIM **reset** operation.

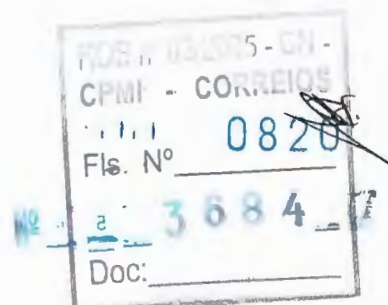
### From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a target standalone, diskless, or dataless machine to reset.
3. From the Selected menu, choose **Administration** —> **Reset NIM State**.
4. Use the dialog to reset the state of the machine.

You can also do this task from Troubleshooting. From the Selected menu, choose **Troubleshooting** —> **Clean Up Failed or Interrupted Installation**.

### From SMIT

1. To return a machine to the **ready** state, enter the **smit nim\_mac\_op** fast path.
2. Select the target machine for the operation.
3. Select **reset** as the Operation to Perform.





4. To deallocate resources, change the Deallocate All Resources? field to **yes**.
5. Change the Force field to **yes**.

### From the Command Line

1. To return a machine to the **ready** state, enter:

```
nim -Fo reset MachineName
```

2. To deallocate resources, enter:

```
nim -o deallocate -a ResourceType=ResourceName MachineName
```

where *ResourceType* is the type of the resource being deallocated (for example, **lpp\_source**, **SPOT**, **Script**, etc.), *ResourceName* is the name of the resource being deallocated, and *MachineName* is the name of the machine that has been allocated the resources.

**Note:** Resetting a machine will not automatically deallocate all the resources that were allocated for the operation. To deallocate resources, use the NIM **deallocate** operation.

---

## Using Client Machines as Resource Servers

Any machine in the NIM environment can be a resource server. In simple environments, the NIM master is usually used to serve all the NIM resources.

Defining resources on client machines can be beneficial for the following reasons:

- Disk space limitations on the NIM master may prohibit the storage of all the resources on a single machine.
- Resource usage may be heavy, and communications and data access bottlenecks could occur if all the resources were served by a single machine.

For example, if you use NIM to install 200 machines on 5 different subnets, you could have a set of resources created and available on each subnet. Each set of resources would be used to install the machines on the same subnet. In addition to distributing the workload among several resource servers, this would also reduce the network traffic across the gateways between the different subnets.

### From Web-based System Manager

1. Select the Resources container.
2. From the Resources menu, select **New Resources**.
3. Follow the wizard instructions to create the resource.

### From SMIT

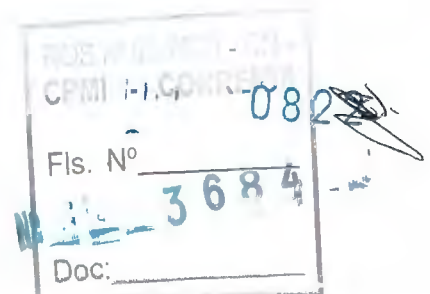
1. To create a resource on a NIM client, enter the **smit nim\_mkres** fast path.
2. Select the Resource Type.
3. In the displayed dialog fields, supply the correct values for the resource options. Be sure to specify the name of the client machine for the Server of the Resource field. Use the help information or the LIST option to help you. All attributes specified when the resource is defined (such as **location** and **source**) must be local to the server machine.

### From the Command Line

To create a resource on a NIM client, specify the client's NIM name for the **server** attribute when defining the resource.

Example:







## Adding New Members to Machine Groups

New members can be added to machine groups, however, the new member must be of the same machine type as existing members. Members can be added to machine groups using the Web-based System Manager NIM application.

### From Web-based System Manager

1. Select the Groups container.
2. In the contents area, select a group.
3. From the Selected menu, choose **Add/Remove Members....**
4. Select a machine from the list on the right, and click on the < button to add the machine to the new group. Continue with this step until all the desired members of the machine group are in the list on the left.
5. Click on **OK**.

### From SMIT

1. To add members to a machine group, enter the **smit nim\_chgrp** fast path.
2. Select the machine group to modify.
3. Specify members to add to the group. Use the LIST option to select members to add.

### From the Command Line

To add a member to a machine group, enter:

```
nim -o change -a add_member=MachineName GroupName
```

For example, to add the diskless client, diskless5, to the machine group, diskless\_grp, enter the following command:

```
nim -o change -a add_member=diskless5 diskless_grp
```

Alternatively, you could have specified group members in both the **define** and **change** operations by using sequenced member attributes, such as **-a member1=Standalone1 -a member2=Standalone2** and so forth.

## Removing Members from Machine Groups

Members can be removed from machine groups. Whenever the last member of a machine group is removed, the group definition is also removed.

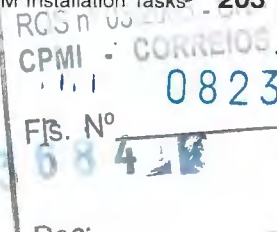
The Web-based System Manager NIM application can be used to remove members from machine groups.

### From Web-based System Manager

1. Select the Groups container.
2. From the Selected menu, choose **Add/Remove Members**.
3. Select a machine from the list on the left and click on the > button to add the machine to the list on the right. Continue with this step until all the desired members of the machine group have been removed.
4. Click on **OK**.

### From SMIT

1. To remove members from a machine group, enter the **smit nim\_chgrp** fast path.
2. Select the machine group to modify.
3. Specify members to remove from the group. Use the LIST option to select members to remove.







## From the Command Line

To remove a member from a machine group, enter the following command:

```
nim -o change -a rm_member=MachineName GroupName
```

For example, to remove machine, Standalone2, and add machine, Standalone4, to the group, MacGrp1, enter:

```
nim -o change -a rm_member=Standalone2 \  
-a add_member=Standalone4 MacGrp1
```

## Including and Excluding a Group Member from Operations on the Group

Group members may be included or excluded by using the Web-based System Manager NIM application, SMIT, or from the command line. Use the **select** operation from the command line to indicate that specific members of a machine group should be included or excluded from operations on that group. This capability is useful if an operation needs to be tried again on specific group members that failed during an initial operation on the group. When a group member is marked as being excluded, it remains so until it is included again.

### From Web-based System Manager

1. Select the Groups container.
2. In the contents area, expand a group container to view the members included in that group.
3. Select a machine from those listed in the container.
4. From the Selected menu, choose **Properties**.

### From SMIT

1. To include or exclude a group member from operations on the group, enter the **smit nim\_grp\_select** fast path.
2. Select the name of the group from which you want to include or exclude members.
3. Select the members to include or exclude.

## From the Command Line

To include or exclude a group member, enter the following:

```
nim -o select -a include_all=Value -a exclude_all=Value \  
-a include=MemberName -a exclude=MemberName GroupName
```

As an example, to exclude the machine, Standalone2, from further operations on machine group, MacGrp1 and to include a previously excluded machine, Standalone3, enter:

```
nim -o select -a exclude=Standalone2 -a include=Standalone3 MacGrp1
```

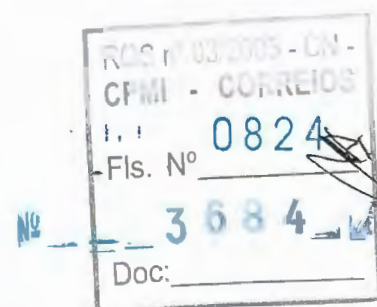
The special attributes **include\_all** and **exclude\_all**, when assigned a value of **yes**, can be used respectively to include or exclude all members in a group. The **select** operation evaluates command line attributes from left to right. The following example shows how to exclude all members except Standalone2 from subsequent operations on the MacGrp1 machine group:

```
nim -o select -a exclude_all=yes -a include=Standalone2 MacGrp1
```

Using the special **-g** option shows the excluded status of the group's members:

```
lsnim -g MacGrp1
```

Group member information similar to the following is displayed:





```
MacGrp1:
type = mac_group
member1=Standalone1;ready for a NIM operation,not running;EXCLUDED
member2=Standalone2;ready for a NIM operation; currently running;
member3=Standalone3;ready for a NIM operation,not running;EXCLUDED
```

## Using Resource Groups to Allocate Related Resources to NIM Machines

NIM resource groups allow association of resources so they can be allocated as a logical unit to machines prior to other NIM operations. Resource groups can only contain one of each resource type, except for **script** and **installp\_bundle** resources, which may occur multiple times in a given resource group.

### Defining a Resource Group

#### From SMIT

1. To define a resource group, enter the **smit nim\_mkgrp\_resource** fast path.
2. Enter the name of the group with member information.

#### From the Command Line

To define a resource group, enter:

```
nim -o define -t res_group -a ResourceType=ResourceName GroupName
```

As an example, to create a resource group named ResGrp1 containing previously defined resources, images1, spot1, bosinst\_data1, and bundle1, enter:

```
nim -o define -t res_group -a lpp_source=images1 -a spot=spot1 \
-a bosinst_data=bosinst_data1 -a installp_bundle=bundle1 \
-a comments="BOS Install Resources" ResGrp1
```

### Allocating a Resource Group

#### From SMIT

1. To allocate a resource group, enter the **smit nim\_alloc** fast path.
2. Select the machine or machine group from the list of defined machines (for example, Standalone1).
3. A list of resource groups is displayed. Select the resource group you want to allocate.

#### From the Command Line

To allocate a resource group, enter:

```
nim -o allocate -a group=ResGroupName TargetName
```

For example, to allocate a resource group named ResGrp1 to a machine named Standalone1, enter:

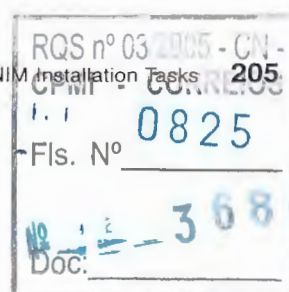
```
nim -o allocate -a group=ResGrp1 Standalone1
```

Alternatively, the group resource can be specified on the command line to the operation. For example, to allocate the resource group, ddResGrp, while performing the **dkls\_init** operation on a group of diskless machines named DklsMacs, enter:

```
nim -o dkls_init -a group=ddResGrp DklsMacs
```

### Defining Default Resource Groups

After a resource group is defined, you may want to specify the group as the set of defaults for all operations that require resources. Set the **default\_res** attribute on the master to the name of the resource group that you want to be the default.







### From SMIT

1. To define default resource groups, enter the **smit nim\_grp** fast path.
2. Choose Select/Unselect a Default Resource Group.
3. Fill in the name of the group that is to act as the default.

### From the Command Line

To define default resource groups, enter:

```
nim -o change -a default_res=ResGroupName master
```

For example, if the ResGrp1 resource group should be the set of default resources for all NIM operations, enter:

```
nim -o change -a default_res=ResGrp1 master
```

**Note:** All applicable resources are allocated from the group specified as the default for all operations, except for **installp\_bundle** for a **maint** operation.

A resource from the default group will only be allocated if a resource of the same type is not already allocated and if a resource of that type is not specified on the command line for automatic allocation. The exceptions are the **script** and **installp\_bundle** resources, of which all occurrences in the resource group and specified on the command line will be allocated.

Default members can be overridden by specifying a null value in the attribute assignment for that resource.

The following **bos\_inst** operation allocates all applicable **bos\_inst** resources from the resource group specified as the default, except for the **bosinst\_data** resource:

```
nim -o bos_inst -a bosinst_data=Standalone1
```

---

## Managing Software on Standalone Clients and SPOT Resources

The commands for managing software on standalone clients and **SPOT** resources are generally the same. Specify the name of the machine, group, or **SPOT** as the target of the option.

**Note:** If the **SPOT** is currently allocated to a NIM client, NIM prevents the change to the **SPOT**. Use the **Force (-F)** option to force the operation.

Software updates to a **SPOT** cause the **SPOT**'s network boot images to be rebuilt when necessary. If you think the boot images are bad, you can force them to be rebuilt using the NIM **check** operation.

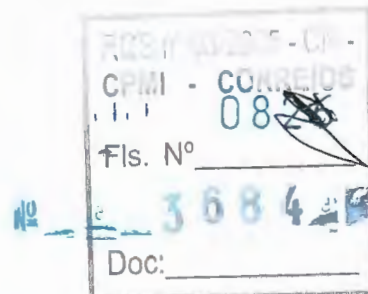
Software updates to a **SPOT** may also cause software updates to occur in the root parts of diskless and dataless clients of the **SPOT**. This will occur automatically. You can force a synchronization of the client root parts using the NIM **sync\_roots** operation on the **SPOT**.

For information on how to install additional software on standalone clients and SPOT resources, see "Customizing NIM Clients and SPOT Resources" on page 187.

## Listing Software Installed on a Standalone Client or SPOT

### From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a target machine (master or standalone), or in the Resources container, select a target **SPOT** resource.
3. From the Selected menu, choose **List Installed Software** —> **All Installed**.





### From SMIT

1. To list software installed on a standalone client or **SPOT**, enter the **smit nim\_list\_installed** fast path.
2. Select the menu item that describes the list operation you want to perform.
3. Select a target for the operation.
4. In the displayed dialog fields, supply the required values. Use the help information or the LIST option to help you.

### From the Command Line

Enter the following command:

```
nim -o lsipp [-a lsipp_flags=LsippFlags] TargetName
```

where *LsippFlags* are the flags to be passed to the **lsipp** command, and *TargetName* is the name of the client or **SPOT** object.

For example:

```
nim -o lsipp -a lsipp_flags=La spot1
```

## Listing Software Updates, Installed on a Standalone Client or SPOT, by Keyword

### From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a target machine (master or standalone), or in the Resources container, select a target **SPOT** resource.
3. From the Selected menu, choose **List Installed Software** —> **Fix (APAR) Status**.
4. Use the dialog to list the installation status of specific installed fixes.

### From SMIT

1. To list fixes installed on a standalone client or **SPOT** by APAR number or keyword, enter the **smit nim\_mac\_op** fast path for standalone clients, or enter the **smit nim\_res\_op** fast path for **SPOTS**.
2. Select the standalone client or **SPOT** resource object.
3. Select the **fix\_query** operation.
4. Select the desired **fix\_query** flags or accept the default settings. Specify the **fix\_bundle** object name; or to check the installation status of an APAR, specify the fix APAR numbers. If you leave both blank, all known fixes are displayed.

### From the Command Line

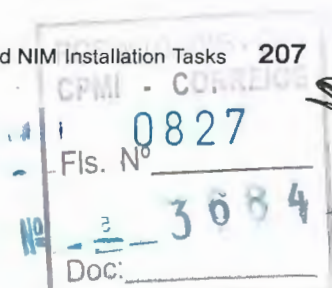
Enter the following command:

```
nim -o fix_query [ -afixes="FixKeywords" ] \  
[-afix_bundle=FixBundleName ] [ -afix_query_flags=FixQueryFlags ] \  
TargetName
```

where *FixKeywords* are APAR numbers; *FixBundleName* is the object name of the **fix\_bundle** resource; *FixQueryFlags* are optional flags to the **fix\_query** operation, and *TargetName* is the client, group, or **SPOT** for which to display fix information.

Valid *FixQueryFlags* are as follows:

- a Displays symptom text.
- c Displays output in colon-separated format.
- F Returns failure unless all filesets associated with a fix are installed.
- q Quiet option; if -q is specified, no heading is displayed.
- v Verbose option; gives information about each fileset associated with a fix (keyword).







For example:

- To query the fix database on `standalone1` to determine if all fileset updates for fix `IX12345` are installed, enter:  

```
nim -o fix_query -afixes=IX12345 standalone1
```
- To list fix information for all known fixes installed on `spot1`, with symptom text, enter:  

```
nim -o fix_query -afix_query_flags=a spot1
```

## Maintaining Software on Standalone Clients and SPOT Resources

NIM uses the **installp** command to construct a **SPOT** by installing in the **SPOT** the software products that each **SPOT** needs to support the NIM environment. Because the **installp** command also supports software maintenance tasks, you can perform these tasks on **SPOTs** as well. For example, you can remove previously installed optional software from a **SPOT** when they are no longer being used. This kind of task is accomplished by performing the NIM **maint** operation on a **SPOT** using the Web-based System Manager NIM application, SMIT, or command line interface. You interact with the **installp** command by supplying the **installp\_flags**, and either **filesets** or **installp\_bundle** attributes.

### From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a target standalone machine, or in the Resources container, select a target **SPOT** resource.
3. From the Selected menu, choose **Software Utilities** —> **Commit Applied Updates**, **Reject Applied Updates**, or **Remove Software**, depending upon the task you want to perform.

### From SMIT

1. To perform software maintenance, enter the **smit nim\_task\_maint** fast path.
2. Select the menu item that describes the maintenance that you want to perform.
3. Select the target for the operation.
4. In the displayed dialog fields, supply the required values. Use the help information or the LIST option to help you.

### From the Command Line

Enter the following command:

```
nim -o maint -a installp_flags="InstallpFlags" \  
[-a filesets="FileSetNames" | \  
-a installp_bundle=BundleResourceName ] [-F] TargetName
```

where *InstallpFlags* are the flags you want to pass to the **installp** command; *FileSetNames* are the names of the filesets or packages you want to maintain; *BundleResourceName* is the object name of the **installp\_bundle** resource; and *TargetName* is the object name of the standalone client, group, or **SPOT**.

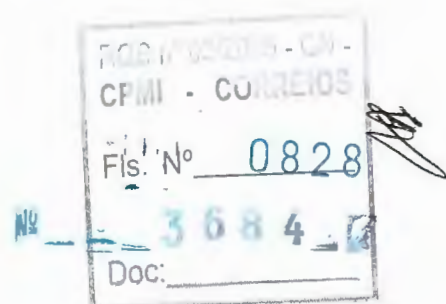
For example:

- To remove the `bos.adt` and `bos.INed` software packages from `standalone1`, enter:  

```
nim -o maint -a filesets="bos.adt bos.INed" -a \  
installp_flags="-u" standalone1
```
- To remove the `bos.INed` software package from `spot1`, which is allocated to diskless or dataless clients, without deallocating `spot1` first, enter:  

```
nim -o maint -F -a filesets=bos.INed -a installp_flags="-u" \  
spot1
```
- To remove the packages from `spot1` which are listed in the bundle pointed to by the **installp\_bundle** resource object, `bundle1`, enter:  

```
nim -o maint -a installp_flags="-u" -a installp_bundle=bundle1 \  
spot1
```





- To clean up from an interrupted software installation on `spot1`, enter:  
`nim -o maint -a installp_flags="-C" spot1`

---

## Rebuilding Network Boot Images for a SPOT

### From Web-based System Manager

1. Select the Resources container.
2. In the contents area, select a target **SPOT**.
3. From the Selected menu, choose **Check SPOT**.
4. Use the dialog to select the Build debug network boot images and/or the force option, if needed.

You can also perform this task from Troubleshooting. From the Selected menu, choose **Troubleshooting** —> **Build Non-Debug Network Boot Images**.

### From SMIT

1. To rebuild network boot images for a **SPOT**, enter the `smit nim_res_op` fast path.
2. Select the **SPOT**.
3. Select the **check** operation.
4. In the displayed dialog fields, set the Force option to **yes**.

### From the Command Line

To force the rebuild of the boot images, enter:

```
nim -Fo check SPOTName
```

For information on how to install additional software on standalone clients and SPOT resources, see "Customizing NIM Clients and SPOT Resources" on page 187.

---

## Maintaining Software in an lpp\_source

To add or remove software in an **lpp\_source**, add or remove the installation image from the **lpp\_source** directory, and then initiate the NIM **check** operation on the **lpp\_source**.

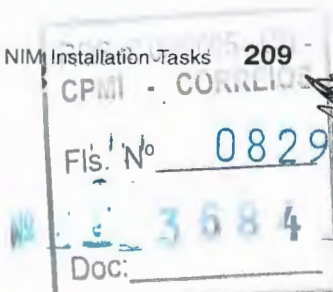
### Copying Software to an lpp\_source

#### From Web-based System Manager

1. Select the Resources container.
2. In the contents area, select an **lpp\_source**.
3. From the Selected menu, choose **Properties**. The General page of the properties notebook displays.
4. From the General page, identify the location of the resource. Close the notebook.
5. From the Resources menu, select **Copy Software to Directory**, and specify as the destination directory, the location of the resource identified in the notebook.
6. After the copy is completed, select the **lpp\_source** and from the Selected menu, choose **Check NIM State**. This action updates the table of contents (.toc) file for the **lpp\_source**.

#### From SMIT

1. To copy software from installation media to an **lpp\_source**, insert the installation media in the appropriate drive of the **lpp\_source** server.
2. To copy the software to the **lpp\_source** directory, enter `smit bffcreate` from the resource server.
3. Enter the INPUT device / directory for software.







4. In the displayed dialog fields, supply the correct values or accept the default values. Be sure to specify the **lpp\_source** location for the directory to store the installation images. Use the help information and the LIST option to help you.

### From the Command Line

1. Copy the software from the media to the **lpp\_source** directory.
2. Perform the NIM check operation on the **lpp\_source** by entering the following command:

```
nim -o check Lpp_sourceName
```

## Removing Software from an lpp\_source

To remove software from an **lpp\_source**, delete the installation image from the **lpp\_source** directory.

**Note:** This function is only available from the command line interface.

### From the Command Line

1. Remove the installation image from the **lpp\_source** directory.
2. Perform the NIM check operation on the **lpp\_source** by entering the following command:

```
nim -o check Lpp_sourceName
```

## Running the NIM check Operation

After adding or removing software, you must run the NIM **check** operation on the **lpp\_source** to update the installation table-of-contents file for the resource.

In addition to updating the table-of-contents for the **lpp\_source**, the **check** operation also updates the **simages** attribute for the **lpp\_source**, which indicates whether the **lpp\_source** contains the images necessary to install the Base Operating System images on a machine.

### From Web-based System Manager

1. Select the Resources container.
2. In the contents area, select a target **lpp\_source** resource.
3. From the Selected menu, choose **Check NIM State**.

### From SMIT

1. To run the NIM **check** operation, enter the **smit nim\_res\_op** fast path.
2. Select the **lpp\_source** for the operation.
3. Select **check** for the operation to be performed.

### From the Command Line

To initiate the NIM **check** operation on the **lpp\_source**, enter:

```
nim -o check Lpp_sourceName
```

If the **lpp\_source** is currently allocated to a client, use the **Force** option as follows:

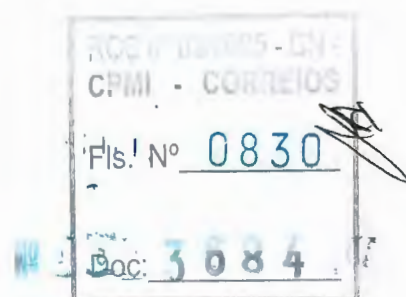
```
nim -F -o check Lpp_sourceName
```

---

## Viewing Installation, Configuration, and Boot Logs

After installing a standalone machine, use the **showlog** operation to check the installation results by viewing the installation, boot, and configuration logs. One of several log types can be viewed by specifying one of the following as the value of the **log\_type** attribute to the **showlog** operation:

**devinst**      Output from the installation of key system and device-driver software





<b>niminst</b>	Output from the installation of user-specified software (including installation of NIM client software during a <b>bos_inst</b> operation)
<b>bosinst</b>	Output from the BOS installation program
<b>boot</b>	The machine's boot log
<b>lppchk</b>	A log of the output from the <b>lppchk</b> operation executed on a standalone NIM client
<b>script</b>	Output from any configuration script resources allocated for a <b>bos_inst</b> operation
<b>nimerr</b>	Errors encountered during execution of the <b>nim</b> command.

By default, the **showlog** operation applied to a standalone machine displays the **niminst** log and shows the output logged when software was last installed on the machine using NIM. The last entry is also shown by default for the **script** and **lppchk** logs. The entire contents of the **niminst**, **script**, and **lppchk** logs can be displayed by assigning the **full\_log** attribute a value of yes when executing the **showlog** operation. The entire log is shown for all other log types.

## From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a target machine (master, standalone, diskless, or dataless), or in the Resources container, select a target **SPOT**.
3. From the Selected menu, choose **Troubleshooting** —> **Show NIM Logs**.
4. Use the dialog to select the log you want to examine.

## From SMIT

1. Enter the **smit nim\_mac\_op** fast path to view a machine's log, or enter **smit nim\_res\_op** to view a **SPOT**'s log.
2. Select the object name of the machine or **SPOT** whose log you want to view.
3. Select **showlog** from the list of operations.
4. Select the log type to be viewed.
5. Specify if the full log should be viewed (only applicable to **script**, **lppchk**, and **niminst** logs).

## From the Command Line

To view a log on a standalone machine or **SPOT**, enter:

```
nim -o showlog -a LogType=value ObjectName
```

where *LogType* represents the log you want to view, and *ObjectName* is the name of the machine or **SPOT** whose log will be viewed.

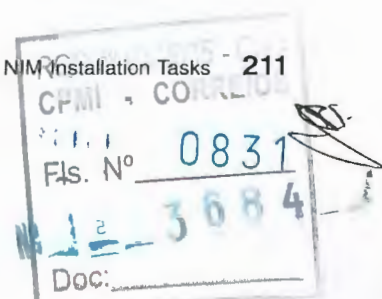
---

## Verifying Installation with the lppchk Operation

When investigating functional problems in software, you can use the **lppchk** operation to check the integrity of installed software.

## From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a target standalone machine, or in the Resources container, select a target **SPOT**.
3. From the Selected menu, choose **Troubleshooting** —> **Verify Installed Software**.
4. Use the dialog to select whether to verify all or some installed software on the selected machine or **SPOT**.







## From SMIT

1. Enter the **smit nim\_mac\_op** fast path to check software on a machine, or enter **smit nim\_res\_op** to check software on a **SPOT**.
2. Select the target of the **lppchk** operation.
3. Select the desired verification mode.

## From the Command Line

Enter the following command:

```
nim -o lppchk -a filesets=FilesetName \  
-a lppchk_flags="lppchkFlags" ObjectName
```

where *FilesetName* is the name of a single fileset (or a name with the \* wildcard character), and *ObjectName* is the name of the machine or **SPOT** which is the target of the **lppchk** operation. Valid **lppchk\_flags** are defined as follows:

- f Fast check (file existence, file length)
  - c Checksum verification
  - v Fileset version consistency check (default)
  - l File link verification
- Note:** Only one of the flags -f, -c, -v, or -l may be specified.
- u Update inventory (only valid with -c or -l)
  - mn Controls detail of messages. *n* equals 1 to 3, where 3 is the most verbose.

For example, to perform the **lppchk** operation while verifying checksums for all filesets on the machine named **Standalone1**, enter the following:

```
nim -o lppchk -a lppchk_flags="-c" Standalone1
```

---

## Using NIM to Install Clients Configured with Kerberos Authentication

Normally, NIM relies on Standard AIX authentication to allow the NIM master to remotely execute commands. Standard AIX authentication uses the **.rhosts** file to provide this capability. While NIM functionality depends on its ability to remotely execute commands, some system environments require stricter authentication controls. Kerberos authentication provides a higher level of authentication for executing remote commands on the system without disabling NIM's capabilities.

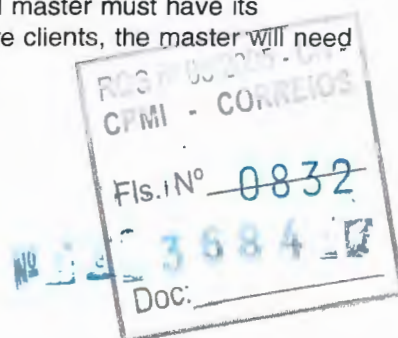
## Using NIM to Install Clients Configured with Kerberos 4 Authentication

In AIX 4.3.3 and later, NIM can be used to install machines in an RS/6000 SP environment configured for Kerberos 4 authentication. Clients configured for Kerberos 4 authentication will contain a **\$HOME/.klogin** file for the root user. This file will determine what ticket is required to allow remote command execution. The user must obtain the required ticket before attempting to execute remote commands through NIM.

The NIM master and all secure clients must have the IBM Parallel System Support Program for AIX 3.1 (or later) installed and configured.

If secure clients will be reinstalled with BOS (Base Operating System), the authentication methods on the NIM master should be set for both Kerberos 4 and Standard UNIX. Because NIM will not have configured Kerberos 4 on the client after the BOS is installed, NIM will therefore have to rely on a **.rhosts** file to guarantee that it can remotely execute commands on the client until the client can be configured with Kerberos 4 and made into a secure client.

If only software customization and maintenance will be performed, the NIM master must have its authentication methods set to match those of the clients. To manage secure clients, the master will need authentication methods set to include Standard UNIX.



For more information on installing and configuring Kerberos 4, see the *SP Administration Guide* (GC23-3897).



## Using NIM to Install Clients Configured with Kerberos 5 Authentication

In AIX 4.3.2 and later, NIM can be used to install machines in an environment configured for Kerberos 5 authentication. Clients configured for Kerberos 5 authentication will contain a **\$HOME/.k5login** file for the root user. This file will contain an entry that specifies what host token is required to allow remote command execution. This entry uses the following form:

```
hosts/hostname/self@cell
```

The NIM master and all secure clients must have DCE installed and configured at a level greater than or equal to 2.2.1.

If secure clients will be reinstalled with BOS, the authentication methods on the NIM master should be set for both Kerberos 5 and Standard UNIX. Because the client will not have DCE or Kerberos 5 configured and running after the BOS is installed, NIM will therefore have to rely on standard **rhhosts** to remotely execute commands on the client until it can be configured with Kerberos 5 and made into a secure client.

If only software customization and maintenance will be performed, the NIM master must have its authentication methods set to match those of the clients. To manage secure clients, the master will need authentication methods set to include Standard UNIX.

---

## Concurrency Control

NIM installations can become overburdened when they are being performed on a large number of clients at the same time. This can be caused by network bandwidth or workload on the NIM servers. Users can ease the severity of this situation by controlling the number of clients installing at the same time.

The **concurrent** and **time\_limit** attributes can be used in conjunction with the **bos\_inst**, **cust**, and **alt\_disk\_install** operations to control the number of client machines being operated on simultaneously from a client group. The **concurrent** attribute controls the number of clients in a group that are processing a particular operation at one time. After a client finishes the operation, another client will initiate the operation one at a time. The **time\_limit** attribute prohibits NIM from initiating an operation on any more clients of the group, after the specified time (in hours) has elapsed.

## From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select multiple targets.
3. From the Selected menu, choose any of the following options:
  - **Install Operating System**
  - **Install/Update Software**
  - **Alternate Disk Install**
4. From any of those dialogs, select the **NIM settings** or **Advanced** button.
5. In those dialogs, a section containing the Concurrency Controls can be specified.

**Note:** Web-based System Manager does not provide support for continuing after a failure or if the group of machines were individually selected and the time limit expired. The user must reselect the clients that failed or were not attempted and then reissue the command.

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## From SMIT

The Concurrency Control attributes can be accessed from all SMIT panels under the Install and Update Software menu and the Alternate Disk Installation menu.

## From the Command Line

The **concurrent** and **time\_limit** attributes can be used in conjunction with the **bos\_inst**, **cust** and **alt\_disk\_install** operations.

For example, to have the **bos.games** fileset installed on only five machines from the client group **tmp\_grp** at one time, enter the following command:

```
nim -o cust -a lpp_source=lpp_source1 -a filesets=bos.games \  
-a concurrent=5 tmp_grp
```

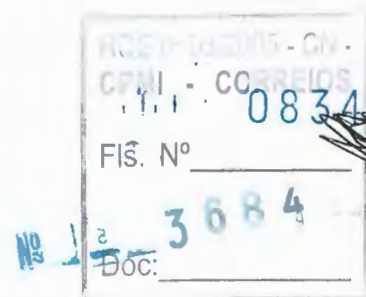
In this example, to BOS install only 10 clients from **tmp\_grp**, using **lpp\_source**, **lpp\_source1**, and **SPOT**, **spot1**, with no other installs permitted after three hours have elapsed, enter the following command:

```
nim -o bos_inst -a lpp_source=lpp_source1 -a spot=spot1 \  
-a concurrent=10 -a time_limit=3 tmp_grp
```

**Note:** The Concurrency Controlled operation can complete and leave the group in one of the following states:

- All machines install successfully.
- Some machines may fail the installation.
- If the **time\_limit** attribute was used, time may have expired before the installation operation was complete.

In the first situation, the group will revert to the state prior to the operation. In the second and third situations, the group will be left in a state that indicates some machines have completed and some have not. Problems with failing machines should be investigated. At this point, the user can continue with the machines that did not complete by rerunning the command on the group. Alternatively, the user can "reset" the group, which will set the group back to its state prior to the Concurrency Controlled operation.





## Chapter 22. Advanced NIM Configuration Tasks

This chapter describes the following procedures for performing advanced Network Installation Management (NIM) configuration tasks using the Web-based System Manager NIM application or the System Management Interface Tool (SMIT), as well as from the command line:

- "Removing Machines from the NIM Environment"
- "Creating Additional Interface Attributes" on page 216
- "Defining /usr versus non-/usr SPOTs" on page 217
- "Re-Creating SPOT Resources from Existing Directories" on page 218
- "Defining an lpp\_source on CD-ROM versus Disk" on page 219
- "Establishing a Default NIM Route Between Networks" on page 219
- "Establishing a Static NIM Route Between Networks" on page 220
- "Recovering the /etc/niminfo File" on page 221
- "Backing Up the NIM Database" on page 222
- "Restoring the NIM Database and Activating the NIM Master" on page 222
- "Unconfiguring the NIM Master" on page 223
- "Booting Diagnostics" on page 223
- "Booting in Maintenance Mode" on page 224
- "Secondary Adapter Support" on page 226

### Removing Machines from the NIM Environment

Removing a machine from the NIM environment can be done by removing the client information from the NIM database.

**Note:** When a client is removed from the NIM environment, NIM attempts to remove the `/etc/niminfo` file from the client machine. However, the client fileset and rhost permission for the NIM master must be removed manually from the client system if such additional cleanup is desired.

#### From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a machine to remove from the NIM environment.
3. From the Selected menu, choose **Delete** to remove the machine.

#### From SMIT

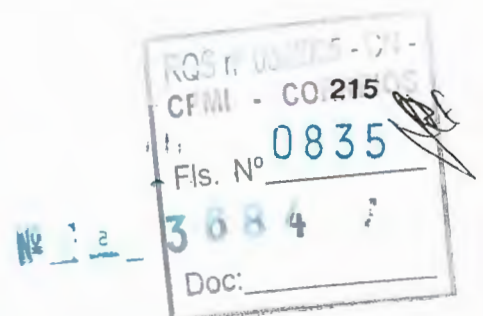
1. To remove a machine from the NIM environment, enter the `smit nim_rmmac` fast path.
2. Select the machine to remove.
3. In the displayed dialog fields, accept the defaults.

#### From the Command Line

To remove a machine from the NIM environment, enter:

```
nim -o remove MachineName
```

where *MachineName* is the name of the machine to be removed.







## Creating Additional Interface Attributes

The primary interface or the first interface (**if1**) is created when the master is activated, and a sequence number is used to identify the additional interfaces (**if2**, **if3**, ...) in the machine object definition. To create an additional **if** attribute for the master object, use either Web-based System Manager, SMIT, or the **nim -o change** command operation.

### From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select any machine (master, standalone, diskless, or dataless).
3. From the Selected menu, choose **Properties**. The General page of the Machine Properties notebook for the selected machine displays.
4. Select the NIM Interfaces tab.
5. Follow the dialog instructions.

### From SMIT

1. To create an additional **if** attribute, enter the **smit nim\_mac\_if** fast path.
2. Select the Define a Network Install Interface option.
3. Select the machine object name. In the example, this is master.
4. Enter the host name for the interface.
5. Complete the network-specific information in the entry fields on the Define a Network Install Interface screen.

**Note:** If a NIM network does not already exist corresponding to the IP address of the host name specified for the interface, additional network information will be requested so the network can be defined.

### From the Command Line

To create an additional **if** attribute for the master object, enter:

For Token-Ring:

```
nim -o change -a ifseq_no='NetworkObjectName AdapterHostName \
AdapterHardwareAddress' -a ring_speedseq_no=Speed master
```

For Ethernet:

```
nim -o change -a ifseq_no='NetworkObjectName AdapterHostName \
AdapterHardwareAddress' -a cable_typeseq_no=Type master
```

For FDDI:

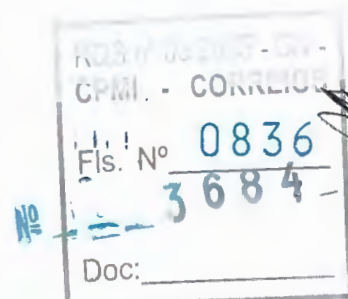
```
nim -o change -a ifseq_no='NetworkObjectName AdapterHostName \
AdapterHardwareAddress' master
```

For other networks:

```
nim -o change -a ifseq_no='NetworkObjectName AdapterHostName \
AdapterHardwareAddress' master
```

**Note:** If you do not know the name of the NIM network to which the interface is attached or if a network corresponding to the interface has not been defined, use the **find\_net** keyword and **net\_definition** attribute as described in "Defining NIM Clients" on page 240.

In the example, the following command is run:





```
nim -o change -a if2='Network2 srv1_ent 0' -a \
cable_type2=bnc master
```

With this syntax, another **if** attribute is created for the master, which tells NIM that the master has an Ethernet interface that uses a host name of **srv1\_ent**, that the Ethernet adapter's hardware address is 0 (not used), and that the master connects to the Network2 network object.

To display detailed information about the master which will now show the **if2** attribute, enter:

```
lsnim -l master
```

The command produces output similar to the following:

```
master:
  class      = machines
  type       = master
  Cstate     = ready for a NIM operation
  reserved   = yes
  platform   = rs6k
  serves     = boot
  serves     = nim_script
  comments   = machine which controls the NIM environment
  Mstate     = currently running
  prev_state = ready for a NIM operation
  if1        = Network1 server1 10005AA88399
  master_port = 1058
  registration_port = 1059
  ring_speed1 = 16
  if2        = Network2 Srv1_ent 02608c2e222c
  cable_type2 = bnc
```

---

## Defining /usr versus non-/usr SPOTs

A **SPOT** resource contains operating system files that are normally installed in the **/usr** file system of a machine. If disk space is limited on a machine or a **SPOT** must be created quickly, it may be helpful to convert the machine's **/usr** file system to a **SPOT** instead of creating an entirely separate **SPOT** at a different location.

If the **/usr** file system of a machine is converted to a **SPOT**, additional software will be installed on the machine to provide support for machines with different hardware configurations. Most of the operating system files will already be installed on the system and will not be reinstalled when the **SPOT** is created.

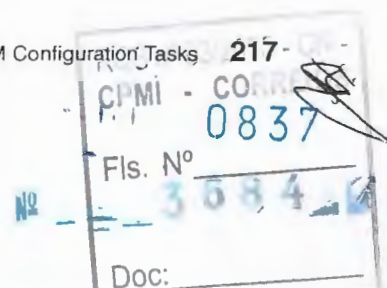
After a **/usr** file system is converted to a **SPOT**, all software installation and maintenance operations on the machine should be performed using NIM on the **/usr SPOT** resource that was created. This will ensure that all necessary **SPOT** operations are performed in addition to software installation or maintenance on the machine.

## From Web-based System Manager

1. Select the Resources container.
2. From the Resources menu, select **New Resource**.
3. Follow the wizard instructions to create the **SPOT** resource.

## From SMIT

1. To create a **/usr SPOT**, enter the **smit nim\_mkres** fast path.
2. Select the Resource Type.
3. Type **/usr** in the Location of Resource field.
4. Supply the values or accept the defaults for all other fields on this screen.





## From the Command Line

To create a **/usr-SPOT**, enter:

```
nim -o define -t spot -a server=ServerName \  
-a location=/usr -a source=SourceName ResourceName
```

### Example:

To convert the **/usr** file system on the machine, **client1**, to a **SPOT** named **usrspot** using **lppsource1** as the source for additional installation images, enter:

```
nim -o define -t spot -a server=client1 -a location=/usr \  
-a source=lpp_source1 usrspot
```

## Using the installp Command

After you convert a **/usr** file system to a **SPOT**, it is not recommended that you use the **installp** command to install or maintain software on the machine serving the **SPOT**. The diskless and dataless clients and network boot images associated with the **SPOT** will not be updated by the **installp** command unless it is invoked using NIM's **cust** or **maint** operations. If you need to use the **installp** command to install or maintain software on a **/usr SPOT** server, use the following steps:

1. Ensure that all NIM operations on the server and any clients associated with the **SPOT** are complete.
2. Deallocate the **SPOT** from all standalone clients.
3. Run the **installp** command.
4. Run the **check** operation on the **SPOT** after the **installp** command has completed:

```
nim -o check -F usrSPOTName
```

**Note:** The **-F** flag is required for rebuilding the boot images.

5. If this **SPOT** is being used to serve diskless or dataless clients, resynchronize all diskless and dataless clients with the **SPOT** after the **installp** command completes by issuing the **nim** command with the **sync\_roots** operation for the **/usr SPOT**:

```
nim -o sync_roots usrSPOTName
```

```
nim -o check -F usrSPOTName
```

The **cust** and **maint** operations must be used to manage software installed on non-**/usr SPOTs**.

## Re-Creating SPOT Resources from Existing Directories

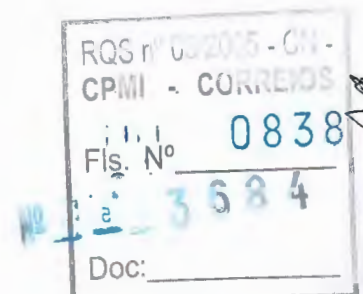
Defining NIM resources from existing files and directories can usually be done by specifying the **server** and **location** attributes to the **nim -o define** command. SPOT resources take longer to define because software must be installed from installation images into the SPOT location. The **nim -o** command line interface always builds a SPOT from installation images. However, if a directory structure for a SPOT already exists from a prior creation, it is possible to call a NIM method directly to redefine the SPOT without reinstalling all the software.

The need to define a SPOT from an existing SPOT directory typically arises only when it is necessary to rebuild the NIM database during system recovery.

To define a SPOT from a directory that previously had a SPOT installed in it, use the following command:

```
/usr/lpp/bos.sysmgmt/nim/methods/m_mkspot -o -a server=server \  
-a location=location -a source=no spotname
```

### Example:





A SPOT named **spot1** was created on the NIM master in the **/export/spot** directory. Later, the NIM database became corrupted and has to be rebuilt. The SPOT files are still on the machine, but the SPOT must be redefined to NIM using the following command:

```
/usr/lpp/bos.sysmgmt/nim/methods/m_mkspot -o -a server=master \  
-a location=/export/spot -a source=no spot1
```

---

## Defining an lpp\_source on CD-ROM versus Disk

Normally an **lpp\_source** resource is created by copying installation images from installation media to the hard disk of the **lpp\_source** server. If disk space is limited on the server or if an **lpp\_source** is needed quickly, you can use a directory mounted from CD-ROM installation media as the **lpp\_source**.

### From Web-based System Manager

1. Select the Resources container.
2. From the Resources menu, select **New Resource**.
3. Follow the wizard instructions to create the **lpp\_source** resource.

**Note:** You can also define an **lpp\_source** resource through the Configure NIM wizard, both when you are configuring your environment, and after configuration.

### From SMIT

1. Mount the CD as a **CDROM** file system. The installation images can be found in the **/usr/sys/inst.images** directory under the mount point of the **CDROM** file system.
2. To define the **lpp\_source** using the directory of install images, enter the **smit nim\_mkres** fast path.
3. Specify the name of the machine with the CD-ROM as the Server.
4. Specify **CD\_MountPoint/usr/sys/inst.images** as the location of the **lpp\_source**, and leave the Source field blank.

### From the Command Line

1. Mount the CD as a **CDROM** file system. The installation images can be found in the **/usr/sys/inst.images** directory under the mount point of the **CDROM** file system.
2. Define the **lpp\_source** using the directory of install images for the **location** attribute. Do not specify a value for the **source** attribute, since an existing set of images will be used. With the CD mounted at **/cdfs** on the NIM master, to define an **lpp\_source** named **cd\_images**, enter:

```
nim -o define -t lpp_source -a server=master \  
-a location=/cdfs/usr/sys/inst.images cd_images
```

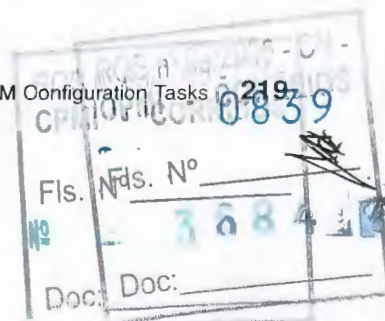
---

## Establishing a Default NIM Route Between Networks

This procedure describes how to create default NIM routes for two Networks (for example, Network1 and Network3).

### From Web-based System Manager

1. Select the Networks container.
2. In the contents area, select any network.
3. From the Selected menu, choose **Properties**. The General page of the Properties notebook for the selected network displays.
4. Select the NIM Routes tab. The NIM Routes page of the Properties notebook displays.
5. Use the NIM Routes page to add the default route.







## From SMIT

1. To create default NIM routes, enter the **smit nim\_mkdroute** fast path.
2. In the displayed dialog fields, supply the values or accept the defaults. Use the help information and the LIST option to help you.

## From the Command Line

To create a default NIM route for a network, enter:

```
nim -o change -a routingseq_no='default Gateway' NetworkObject
```

where **default** is the reserved keyword used by NIM to indicate a default route, and *Gateway* is the host name (or IP address) of the interface that clients on *NetworkObject* use to contact other networks in the NIM environment.

For example, to establish default NIM routes for Network1 and Network3, enter:

```
nim -o change -a routing1='default gw1_tok' Network1
nim -o change -a routing1='default gw1_fddi' Network3
```

where **gw1\_tok** is the host name of the default gateway for machines on Network1, and **gw1\_fddi** is the host name of the default gateway for machines on Network3.

The detailed information for the network objects now shows the added default routes. To display the detailed information for the two networks, enter:

```
lsnim -l Network1 Network3
```

which produces output similar to the following:

```
Network1:
  class      = networks
  type       = tok
  net_addr   = 9.101.1.0
  snm        = 255.255.255.0
  Nstate     = ready for use
  prev_state = ready for use
  routing1   = default gw1_tok

Network3:
  class      = networks
  type       = fddi
  net_addr   = 9.101.3.0
  snm        = 255.255.255.0
  Nstate     = ready for use
  prev_state = information is missing from this
              object's definition
  routing1   = default gw1_fddi
```

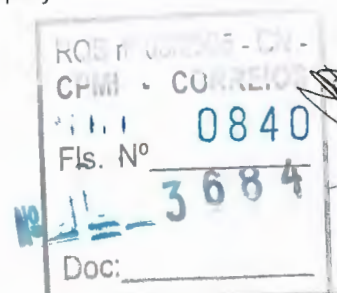
---

## Establishing a Static NIM Route Between Networks

This procedure describes how to create a static NIM route between two networks (for example, Network1 and Network3).

### From Web-based System Manager

1. Select the Networks container.
2. In the contents area, select any network.
3. From the Selected menu, choose **Properties**. The General page of the Properties notebook for the selected network displays.
4. Select the NIM Routes tab. The NIM Routes page of the Properties notebook displays.





5. Use the NIM Routes page to add the static route.

## From SMIT

1. To create a static NIM route, enter the **smit nim\_mkroute** fast path.
2. In the displayed dialog fields, supply the values or accept the defaults. Use the help information and the LIST option to help you.

## From the Command Line

To create a static NIM route between two networks, enter:

```
nim -o change -a routingseq_no='DestinationNetworkObject \
Gateway1 Gateway2' NetworkObject
```

where *Gateway1* is the host name of the interface that clients on *NetworkObject* use to get to *DestinationNetworkObject*, and *Gateway2* is the host name that clients on *DestinationNetworkObject* use to get back to *NetworkObject*.

For example, to establish a NIM route between Network1 and Network3, enter:

```
nim -o change -a routing1='Network3 gw1_tok gw1_fddi' Network1
```

where *gw1\_tok* is the host name of the gateway that machines on Network1 use to communicate with machines on Network3, and *gw1\_fddi* is the host name of the gateway that machines on Network3 use to communicate with machines on Network1.

The detailed information for the network objects now shows the added routing attributes.

To display the detailed information about the two networks, enter:

```
lsnim -l Network1 Network3
```

The command produces output similar to the following:

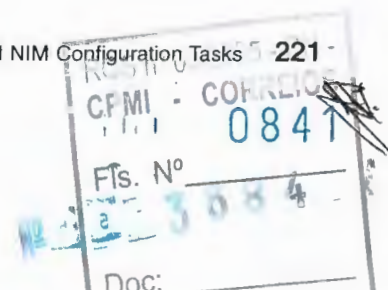
```
Network1:
class      = networks
type       = tok
net_addr   = 9.101.1.0
snm        = 255.255.255.0
Nstate     = ready for use
prev_state = ready for use
routing1   = Network3 gw1_tok

Network3:
class      = networks
type       = fddi
net_addr   = 9.101.3.0
snm        = 255.255.255.0
Nstate     = ready for use
prev_state = information is missing from this object's
              definition
routing1   = Network1 gw1_fddi
```

---

## Recovering the /etc/niminfo File

The */etc/niminfo* file, which resides on the master and running NIM clients, is required to run NIM commands and perform NIM operations. If the */etc/niminfo* file is accidentally deleted, you can rebuild the file.







## From Web-based System Manager

1. Select the NIM container.
2. From the NIM menu, select **Advanced Configuration** → **Rebuild Master Configuration File**.

**Note:** The Configure NIM wizard will detect when you do not have a **niminfo** file, yet do have NIM database entries. The wizard queries whether it should rebuild the master configuration file.

## From the Command Line

Enter the following command from the master to rebuild the file:

```
nimconfig -r
```

To rebuild the **/etc/niminfo** file from a running NIM client, enter:

```
niminit -a master_port=PortNumber -a master=MasterHostName \  
-a name=ClientMachineObjectName
```

---

## Backing Up the NIM Database

To back up the NIM database, you will be prompted for the name of a device or a file to which the NIM database and the **/etc/niminfo** file will be backed up. The level of the installed NIM master fileset will also be written to a file called **/etc/NIM.level** and saved in the backup. A backup of a NIM database should only be restored to a system with a NIM master fileset which is at the same level or a higher level than the level from which the backup was created.

## From Web-based System Manager

1. From the NIM container, from the NIM menu, select **Back Up Database**.
2. Use the dialog to specify the backup device or file.

## From SMIT

To back up the NIM database, enter the **smit nim\_backup\_db** fast path.

## From the Command Line

Save the following NIM files:

```
/etc/niminfo
```

```
/etc/objrepos/nim_attr
```

```
/etc/objrepos/nim_attr.vc
```

```
/etc/objrepos/nim_object
```

```
/etc/objrepos/nim_object.vc
```

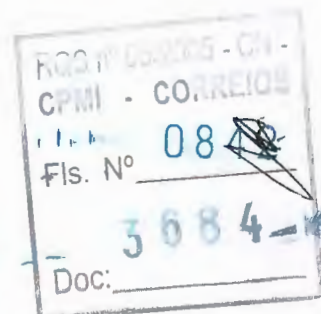
---

## Restoring the NIM Database and Activating the NIM Master

**Note:** A NIM database should only be restored to the same or later level of NIM that was used for the backup.

## From Web-based System Manager

1. From the NIM container, from the NIM menu, select **Restore Database**.
2. Use the dialog to specify the restore device or file.





## From SMIT

To configure a NIM master from a NIM database backup, enter the **smit nim\_restore\_db** fast path.

## From the Command Line

Restore the files saved in "Backing Up the NIM Database" on page 222.

---

## Unconfiguring the NIM Master

This operation removes the NIM daemons from the system and removes all configuration from the NIM database. The NIM master should only be unconfigured if the NIM environment is to be completely redefined or if the NIM master fileset is to be removed from the system.

## From Web-based System Manager

1. From the NIM Container, from the NIM menu, select **Unconfigure Environment**.
2. You have the option to back up the NIM database before starting the unconfigure action.

## From SMIT

To unconfigure a NIM master, enter the **smit nim\_unconfig** fast path.

The SMIT screen will prompt you to first back up your NIM database before unconfiguring the NIM master.

## From the Command Line

To unconfigure a NIM master, enter **nim -o unconfig master**.

---

## Booting Diagnostics

Hardware diagnostics can be performed on all NIM clients using a diagnostic boot image from a NIM server, rather than booting from a diagnostic tape or CD-ROM. This is useful for standalone clients, because the diagnostics do not have to be installed on the local disk. Diagnostic support comes from a **SPOT** resource.

## From Web-based System Manager

1. Select the NIM container.
2. In the contents area, select the standalone, diskless, or dataless machine you want to enable for diagnostics boot.
3. From the Selected menu, choose **Troubleshooting** —> **Enable Diagnostic Boot**.
4. Use the dialog to select a **SPOT** resource from which to boot.

## From SMIT

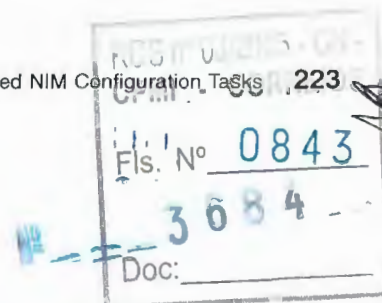
---

### Initiating the diag Operation from the Client

1. Enter the **smit nim\_client\_op** fast path.
2. Select the **diag** operation from the displayed list of operations.

### Initiating the diag Operation from the Master

1. Enter the **smit nim\_mac\_op** fast path.
2. Select the machine object.
3. Select the **diag** operation from the list of operations.







## From the Command Line

To perform the **diag** operation from the client, enter:

```
nimclient -o diag -a spot=SPOTName
```

To perform the **diag** operation from the master, enter:

```
nim -o diag -a spot=SPOTName MachineObjectName
```

## Verifying the diag Operation

After you have enabled the client to perform a diagnostic boot, you can verify the success of the operation by querying the client's *control state* (**Cstate**).

On the client, enter:

```
nimclient -l -l ClientMachineObjectName
```

On the master, enter:

```
lsnim -l ClientMachineObjectName
```

If the operation is successful, output similar to the following is displayed:

```
Cstate = Diagnostic boot has been enabled
```

For the client to boot the diagnostics, you need to reboot the client. If it is a diskless or a dataless client, you have already defined a network adapter as the default boot device (BOOTP request), so no additional action is required. For a standalone machine, the boot list for normal boot lists the hard disk as the primary boot device, so you must follow the procedure described in "Booting a Machine Over the Network" on page 323.

## Loading Diagnostics without the diag Operation

In addition to using the procedure in the previous section, diskless and dataless clients have another way of loading diagnostics from the network. You can boot a diskless or dataless client from the network the same way you do for normal use, but with the machine's key mode switch in the Service position. If the client's key mode switch is in the Service position at the end of the boot process, hardware diagnostics from the server's **SPOT** are loaded. If a standalone client boots with the key mode switch in the Service position, the diagnostics (if installed) are loaded from the hard disk.

---

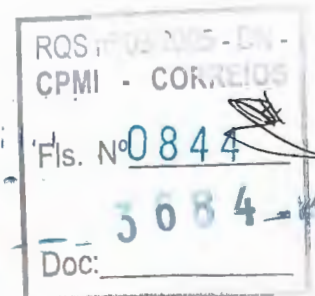
## Booting in Maintenance Mode

If you need to perform maintenance on a standalone machine that is not part of the NIM environment, the system must be booted from a bootable tape or CD-ROM. This may require connecting an external device. If the machine is part of a NIM environment, you can enter maintenance mode directly by enabling the **maint\_boot** operation for a NIM standalone machine.

---

## From Web-based System Manager

1. Select the Machines container.
2. In the contents area, select a target standalone machine you want to enable for maintenance boot.
3. From the Selected menu, choose **Troubleshooting** —> **Enable Maintenance Boot**.
4. Use the dialog to select a **SPOT** resource from which to boot.





## From SMIT

### Initiating the maint\_boot Operation from the Client

1. Enter the **smit nim\_client\_op** fast path.
2. Select the **maint\_boot** operation.
3. Select the **SPOT** to be used for the operation.
4. Press Enter to enable the client for maintenance boot.

### Initiating the maint\_boot Operation from the Master

1. Enter the **smit nim\_mac\_op** fast path.
2. Select the client's machine object.
3. Select the **maint\_boot** operation.
4. Select the **SPOT** to be used for the operation.
5. Press Enter to enable the client for maintenance boot.

## From the Command Line

To issue the **maint\_boot** operation from the client, enter:

```
nimclient -o maint_boot -a spot=SPOTNAME
```

To issue the **maint\_boot** operation from the master, enter:

```
nim -o maint_boot -a spot=SPOTNAME CLIENT
```

To verify that the maintenance boot operation worked:

1. On the client, enter:  

```
nimclient -l -l ClientMachineObjectName
```
2. On the master, enter:  

```
lsnim -l ClientMachineObjectName
```

If the operation was successful, the client's **Cstate** output will look similar to the following:

```
Cstate = maintenance boot has been enabled
```

For the machine to boot into maintenance mode, follow the procedure for issuing the BOOTP request from the client. See "Booting a Machine Over the Network" on page 323 for more information about initiating a BOOTP request.

## Using Maintenance Mode

After successfully booting and defining the console, the System Maintenance menu is displayed. The maintenance menu options and their descriptions are described below. For more information about maintenance mode, see "Accessing a System That Does Not Boot" on page 147.

#### Access a Root Volume Group

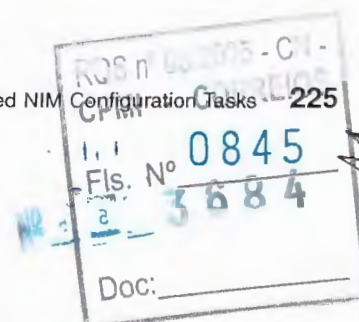
This option allows you to activate the root volume group and start the maintenance shell with a full set of commands.

#### Copy a System Dump to Removable Media

This option allows you to copy a previous system dump to external media.

#### Access Advanced Maintenance Function

This option allows you to start a maintenance shell with a limited set of commands.







## Secondary Adapter Support

Previously, during a NIM **rte** BOS installation operation, only the network adapter and interface used during BOS installation were configured. Using NIM secondary adapter definitions you can have additional network adapters and interfaces configured during a BOS installation or customized installation.

The **nimadapters** command parses a secondary adapter stanza file to build the files required to add NIM secondary adapter definitions to the NIM environment as part of an **adapter\_def** resource. The **nimadapters** command does not configure secondary adapters. The actual configuration takes place during a **nim -o bos\_inst** operation or a **nim -o cust** operation that references the **adapter\_def** resource.

The secondary adapter stanza file is processed by the **nimadapters** command and turned into a file that contains one stanza for each secondary adapter or interface on the NIM client. During a BOS installation, NIM processes this information and converts it into options and parameters that the **mktcpip2** command can process. If a secondary adapter is already configured in the requested manner, NIM does not reconfigure the secondary adapter.

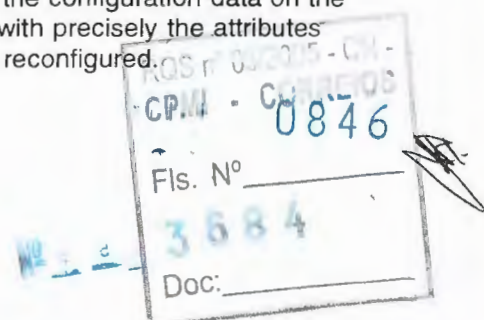
**Note:** Before using the **nimadapters** command, you must configure the NIM master. For information on configuring the NIM master, refer to "Configuring the NIM Master and Creating Basic Installation Resources" on page 174.

## Secondary Adapter File Rules

The format of the secondary adapter file must comply with the following rules:

- After the stanza header, follow attribute lines of the form: **Attribute = Value**
- If you define the value of an attribute multiple times within the same stanza, only the last definition is used.
- If you use an invalid attribute keyword, that attribute definition is ignored.
- Each line of the file can have only one header or attribute definition.
- More than one stanza can exist in a definition file for each machine host name.
- Each stanza for a machine host name represents a secondary adapter definition on that NIM client. No two secondary adapter definitions for the same machine host name can have the same location or **interface\_name**. There should be only one definition per adapter or interface on a given NIM client.
- If the stanza header entry is the **default** keyword, this specifies to use that stanza for the purpose of defining default values.
- You can specify a default value for any secondary adapter attribute. However, the **netaddr** and **secondary\_hostname** attribute must be unique. Also, the **location** and **interface\_name** must be unique on a NIM client.
- If you do not specify an attribute for a secondary adapter but define a default value, the default value is used.
- You can specify and change default values at any location in the definition file. After a default value is set, it applies to all definitions following it.
- To turn off a default value for all following machine definitions, do not set the attribute value in a default stanza.
- To turn off a default value for a single machine definition, do not set the attribute value in the machine stanza.
- You can include comments in a client definition file. Comments begin with the **#** character.
- When parsing the definition file for header and attribute keywords and values, tab characters and spaces are ignored.

**Note:** During a **nim -o bos\_inst** or **nim -o cust** operation, if NIM examines the configuration data on the client and determines that a secondary adapter is already configured with precisely the attributes requested in the **adapter\_def** resource, this secondary adapter is not reconfigured.





## Secondary Adapter File Keywords

The secondary adapter file uses the following keywords to specify machine attributes:

### Required Attributes

#### **machine\_type = secondary**

Specifying the **machine\_type** attribute as **secondary** clearly distinguishes the **nimadapters** input from **nimdef** input. If a secondary adapters file is mistakenly passed to the **nimdef** command, the error can be detected.

#### **netaddr**

Specifies the network address for the secondary adapter.

#### **network\_type = en | et | sn | ml**

Specifies the type of network interface, which can be one of **en**, **et**, **sn**, or **ml**.

#### **subnet\_mask**

Specifies the subnet mask used by the secondary adapter.

### Optional Attributes

#### **attributes**

Blank-separated list of interface attributes and values. For example, *Attribute1=Value1 Attribute2=Value2*. To see the list of attributes that can be set for the requested interface, run the command **lsattr -E -l InterfaceName**.

#### **cable\_type**

Specifies the cable type (optional if **network\_type** is **en** or **et**).

#### **comments**

Specifies a comment to include in the secondary adapter definition. Enclose the comment string in quotation marks.

#### **interface\_name**

Specifies the name of the network interface for the secondary adapter (for example, **en1**, **sn0**, **ml0**). Do not specify both **location** and **interface\_name**.

**Note:** The **interface\_name** must be consistent with the **network\_type**.

#### **location**

Specifies the physical location of the adapter corresponding to this network interface. Do not specify both the **location** and **interface\_name** attributes.

**Note:** Except for the multilink pseudo-device, use of the **location** attribute is highly recommended. If the **location** attribute is not specified and the user adds multiple adapters or adds an adapter at the same time that the operating system is reinstalled, the adapter and network interface names might be reassigned by the operating system in unexpected ways.

#### **media\_speed**

Specifies the media speed (optional if **network\_type** is **en** or **et**).

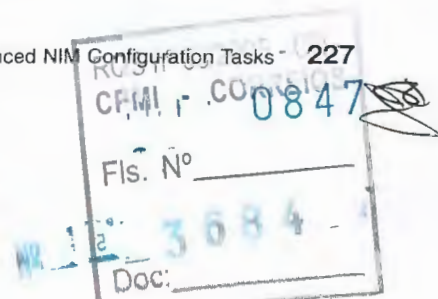
#### **secondary\_hostname**

Host name to save in the **/etc/hosts** file with the **netaddr** attribute. This host name is not set using the **hostname** command or **uname -S** command.

## Secondary Adapter File Stanza Errors

A secondary adapter stanza causes an error under any of the following conditions:

- The host name that was used in the stanza header for the definition cannot be resolved.
- A required attribute is missing.
- An invalid value was specified for an attribute.







- An attribute mismatch occurs. For example, if the **network\_type** is not **en** or **et**, you cannot specify **cable\_type=bnc** or **media\_speed=1000\_Full\_Duplex**.
- The stanza contains both a **location** attribute and an **interface\_name** attribute.
- Secondary adapter definitions occur multiple times for the same adapter location and the same host name.
- Secondary adapter definitions occur multiple times for the same **interface\_name** and the same host name.

If a secondary adapter stanza is incorrect, the errors are reported, the stanza is ignored, and the following input is processed without regard to the incorrect stanza.

## Example Secondary Adapter File

The following is an example of a secondary adapter file:

```
# Set default values.
default:
    machine_type    = secondary
    subnet_mask     = 255.255.240.0
    network_type    = en
    media_speed     = 100_Full_Duplex

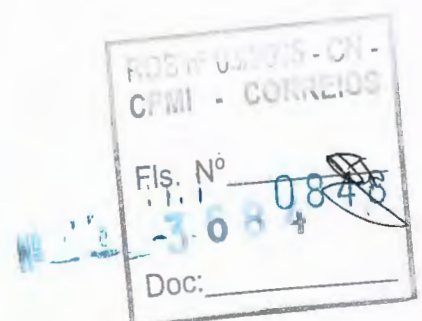
# Define the machine "lab1"
# Take all defaults and specify 2 additional attributes.
# Unlike the case of the client definitions that are input to the
# nimdef command, the secondary adapter definition includes at least
# one required field that cannot be defaulted.
lab1:
    netaddr = 9.53.153.233
    location = P2-I1/E1

# Change the default "media_speed" attribute.
default:
    media_speed = 100_Half_Duplex

# define the machine "test1"
# Take all defaults and include a comment.
test1:
    comments = "This machine is a test machine."
```

## Examples

1. To preview the client definition file **secondary\_adapters.defs**, type:  
`nimadapters -p -f secondary_adapters.defs adapter_def`
2. To add the NIM secondary adapters described in the secondary adapters definition file **secondary\_adapters.defs**, type:  
`nimadapters -d -f secondary_adapters.defs adapter_def`
3. To define the NIM secondary adapters for a client called **pilsner**, type:  
`nimadapters -d \  
-a info="en,P2-I1/E1,N/A,1000_Full_Duplex,9.53.153.233,255.255.254.0" \  
-a client=pilsner adapter_def`





## Chapter 23. Additional NIM Topics

This chapter describes Network Installation Management (NIM) topics that are not part of the usual installation procedures.

The following topics are included:

- "NIM Master Management Tasks"
- "NIM Name Resolution" on page 231
- "Bootting a FDDI Interface Over a Router" on page 231
- "Default Paging Space During BOS Installation Through NIM" on page 232
- "Migrating Diskless and Dataless Clients and NIM SPOTS" on page 232
- "Defining the NIM Environment Using the nimdef Command" on page 233
- "Name Requirements for NIM Object Definitions" on page 233
- "Interacting with the Dynamic Host Configuration Protocol" on page 233
- "Creating File Resources in the root Directory" on page 233
- "Restricting NIM Client Resource Allocation" on page 234
- "Preventing Machines from Adding Themselves as Clients" on page 234
- "Disabling Client CPU ID Validation" on page 235
- "Exporting NIM Resources Globally" on page 235
- "Creating Network Boot Images to Support Only the Defined Clients and Networks" on page 236
- "Updating a Spot with New Device Support for a New Level of AIX" on page 237
- "Tuning Client-Request Processing" on page 237

### NIM Master Management Tasks

The following tasks can be performed on the NIM master:

- "Deactivating the NIM Master and Removing the NIM Master Fileset"
- "Increasing the Number of Hosts to Which NIM Can NFS-Export a Resource" on page 230
- "Controlling the Asynchronous Behavior of NIM Operations" on page 230
- "Suppressing Output from NIM Operations" on page 230
- "Reducing Space Requirements for NIM Resources" on page 231

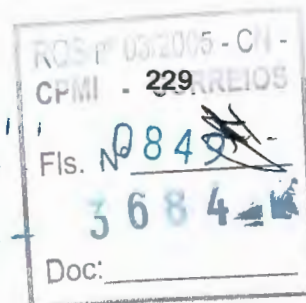
### Deactivating the NIM Master and Removing the NIM Master Fileset

After the NIM master fileset has been installed, the master activated, and the master object defined in the NIM database, this object, and hence the master fileset itself, cannot be removed. The master must be deactivated before the NIM master fileset can be removed.

To deactivate the master using Web-based System Manager, see "Unconfiguring the NIM Master" on page 223.

To use the command line to deactivate the master and remove the NIM master fileset, enter:

```
nim -o unconfig master
installp -u bos.sysmgt.nim.master
```







## Increasing the Number of Hosts to Which NIM Can NFS-Export a Resource

By default, when NIM exports a file or directory through NFS during resource allocation, it creates an entry in the `/etc/exports` file granting the target host both client mount access and root access for root users. As a result, when exporting to numerous clients, the limit on the length of a line in the exports file (32767 characters) may be exceeded, resulting in failure.

NIM provides an option to decrease the line length of an allocation entry in an NFS exports file by approximately one-half, effectively permitting files to be allocated to a greater number of hosts. This action has the side effect of increasing the number of machines permitted in a NIM machine group. NIM achieves this by only granting root access to allocation target hosts. The client mount access list is not created, which allows any machine to mount the resource, but still restricts root access to NIM clients only. NFS permits no more than 256 host names in a root exports file entry.

To enable this mode of operation, set the `restrict_nfs_exports` attribute to `no` on the master's NIM object. Use the **change** operation as follows:

```
nim -o change -a restrict_nfs_exports=no master
```

To restore client mount access restrictions, set `restrict_nfs_exports` to `yes` with the **change** operation.

For information about how to export NIM resources globally, see "Exporting NIM Resources Globally" on page 235.

## Controlling the Asynchronous Behavior of NIM Operations

Certain NIM operations are asynchronous, meaning that NIM master might initiate the operation on the client, but does not wait for the operation to finish. The reason for this asynchronous behaviour is because the NIM operation running on the client is typically time-consuming. An example of an asynchronous operation is the **bos\_inst** operation. Examples of synchronous operations are the **cust**, **maint**, and **lppchk** operations on a single machine target. However, these operations, when applied to members of a machine group, are asynchronous. The **nim** command initiates these operations on each member of the group without waiting for the operation to finish.

If desired, the asynchronous behavior of the **cust**, **maint**, and **lppchk** operations can be controlled by setting the **async** attribute on the command line. For example, to ensure that the execution of a customization script identified by the NIM resource `script1` is executed completely on a given member of the group `MacGrp1` before initiating execution of the script on the next member of the group, enter the following:

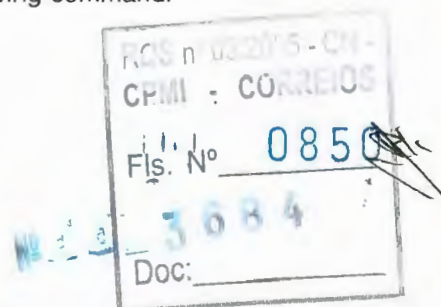
```
nim -o cust -a script=script1 -a async=no MacGrp1
```

To force the master to not wait for the customization operation to finish when running the script on machine `Standalone1` that is not part of a machine group, enter:

```
nim -o cust -a script=script1 -a async=yes Standalone1
```

## Suppressing Output from NIM Operations

By default, progress messages are displayed by the **nim** command operating on machine groups to inform the user of how much processing remains. Similarly, the output from the installation and customization programs invoked by the **cust** and **maint** operations on **SPOTs** and machines is also displayed. This output can be suppressed by setting the **show\_progress** attribute to `no` on the command line. For example, to indicate to NIM not to display output from the **installp** command when updating the machine `Standalone1` with software from the **lpp\_source** named `images1`, enter the following command:







```
nim -o cust -a show_progress=no -a lpp_source=images1 \  
-a fixes=update_all Standalone1
```

## Reducing Space Requirements for NIM Resources

It is not unusual for resources such as the **SPOT** and **lpp\_source** to take several hundred megabytes of storage space on a NIM server. By creating **/usr SPOTs** and defining CD-ROM file-system directories as **lpp\_sources**, space consumption can be reduced significantly on resource servers.

A **/usr SPOT** can be created from the **/usr** file system of the NIM master or any NIM client. The AIX system files for the BOS are already installed, so only software for additional device support will be added to the system. The resulting system ultimately has more software installed on it than it needs to run, but far less disk space is used than otherwise would have been, had a **non-/usr SPOT** been created on the same system. For more information on creating **/usr SPOT** resources, see "SPOT (Shared Product Object Tree) Resource" on page 260 and "Defining **/usr** versus non-**/usr** SPOTs" on page 217.

A directory on the AIX product CD can be mounted and defined as an **lpp\_source**, eliminating the need to copy installation images to the hard disk of a resource server. The defined **lpp\_source** contains all the images available on the CD, but the CD must remain mounted at the server for the **lpp\_source** to be usable in NIM operations. For more information about using a CD-ROM file system as an **lpp\_source**, see "Defining an **lpp\_source** on CD-ROM versus Disk" on page 219.

---

## NIM Name Resolution

NIM relies on standard AIX library routines to perform name resolution. If a network environment uses multiple sources for name resolution, NIM will resolve host names by querying the sources in whatever order is specified for the system. For example, if a system is configured to resolve host names by first querying NIS, then BIND/DNS, then a local **/etc/hosts** file, NIM will also follow that order when resolving client host names.

Problems may result if the NIM master and the NIM clients use different orders when querying sources for name resolution. Problems may also arise if a name service is available to one machine but not to another, causing different name resolution sources to be used.

**Note:** Mixing BIND/DNS, which is not case-sensitive, with NIS, which is case-sensitive, may result in problems.

It is possible to override the default system-wide order that AIX and NIM use when querying sources for host name resolution. This can be done by setting the **NSORDER** environment variable in the environment where NIM commands are being run. For example, to configure the environment to query NIS first, then BIND/DNS, then a local **/etc/hosts** file, type the following on the command line where NIM operations are being run:

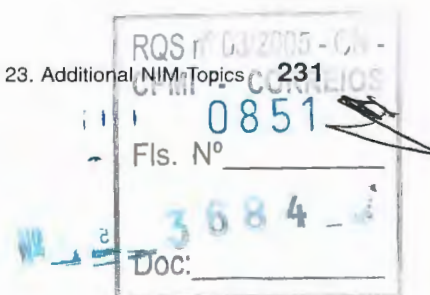
```
export NSORDER=nis,bind,local
```

For more information on TCP/IP name resolution, refer to *AIX 5L Version 5.2 System Management Guide: Communications and Networks*.

---

## Booting a FDDI Interface Over a Router

Boot over a router on a FDDI interface only if the router supports all-route broadcast. Booting over a router that does not support all-route broadcast on a FDDI interface may fail due to known limitations of these router types.







## Default Paging Space During BOS Installation Through NIM

In AIX 4.3 or later, default paging space is set by the BOS installation process when installing through NIM. Default paging space is set by the BOS installation process, if the following conditions are met:

- The method of installation is **overwrite**.
- Neither an **image\_data** resource nor an **image.data** file on the diskette is specified for the installation.
- The source of the BOS image is not a **mksysb** image.
- The source of the BOS image is a **SPOT**, and the default **image.data** file contains more than one entry for paging. This file is located at:  
(spot\_location)/lpp/bosinst/image\_template
- The source of the BOS image is a **SPOT**, and the LPs value for the single paging entry is set to the default value of 16.

The default paging size is calculated from the smaller value of **optimal\_ps** and **recommended\_ps** where:

**RAM** = amount of memory on the target system measured in megabytes (MB).

**optimal\_ps** = maximum between **RAM** and (0.2 size of rootvg)

IF CDE (Common Desktop Environment) is installed, **recommended\_ps** =

- amount of **RAM** is less than 32 MB, then **recommended\_ps** = 3 \* **RAM**
- amount of **RAM** is 32 MB or more, then **recommended\_ps** = **RAM** + 64 MB

IF CDE (Common Desktop Environment) is not installed, **recommended\_ps** =

- amount of **RAM** is less than 32 MB, then **recommended\_ps** = 2 \* **RAM**
- amount of **RAM** is 32 MB or more, then **recommended\_ps** = **RAM** + 32 MB

The default paging space set by this process is never greater than 512 MB.

## Migrating Diskless and Dataless Clients and NIM SPOTS

Migration to a new release of AIX is not supported for diskless and dataless clients. Also, migration of a **SPOT** that is not a converted **/usr** file system is not supported.

After migrating a machine that is a **SPOT** server to a new release of AIX, you must remove and redefine the **SPOT** in order to also bring it to the new AIX level.

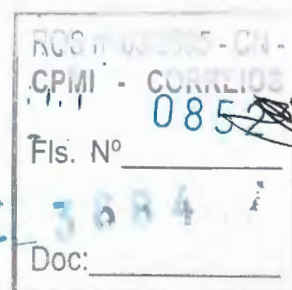
To remove and redefine the **SPOT**, enter:

```
nim -o remove SPOT_name
nim -o define -t spot -a location=SPOTDirectory \
-a server=SPOTServer -a source=SPOTSource SPOTName
```

A **/usr SPOT** served by a client in the NIM environment can be reinstalled with a new level of AIX using the migration procedure, but the **SPOT** object must be removed and then redefined after the migration completes. Any diskless or dataless clients served by that **SPOT** must be reinitialized. To reinitialize diskless and dataless clients after migrating a **/usr SPOT** server, deallocate, then reallocate the root resources, and then perform the **dtls\_init** or **dkls\_init** operation accordingly.

To reinitialize diskless and dataless clients, enter:

```
nim -o reset -F ClientName
nim -o deallocate -a root=RootResourceName ClientName
nim -o allocate -a root=RootResourceName ClientName
nim -o dkls_init ClientName
```





**Attention:** Any customization that was done previously will be erased, because deallocating the root resource will delete all the files in the root directory.

---

## Defining the NIM Environment Using the nimdef Command

The **nimdef** command assists administrators when defining complex NIM environments and adding large numbers of client machines.

The **nimdef** command solves a common usability problem when defining large NIM environments.

Regardless of how well a NIM environment is understood, it can be a very time-consuming process to execute all the commands necessary to define it. If NIM could process a simple definition file for configuration of the NIM environment, a great deal of time could be saved that would otherwise be spent defining each network and machine manually.

The **nimdef** command reads a definition file for input. The definition file is in a structured stanza format. Each stanza describes a machine that will be added to the NIM environment. Included in the stanza is information about the machine's network adapter and routing configuration. Based on the supplied information, the **nimdef** command can determine the remaining information needed to define both networks and machines in the NIM environment.

For more information, see the **nimdef** command. For a sample definition file for the **nimdef** command, see Chapter 25, "Sample Files", on page 285.

---

## Name Requirements for NIM Object Definitions

The name that you give a NIM object will be used in all future operations involving that object. This name must be unique among NIM objects, and it must adhere to certain restrictions:

- It must have between 1 and 39 characters.
- Valid NIM name characters include the uppercase and lowercase letters of the alphabet, the numbers 0-9, and the underscore character.
- Invalid NIM name characters include the dot character, all shell metacharacters, all file system metacharacters, and all regular expression metacharacters.

---

## Interacting with the Dynamic Host Configuration Protocol

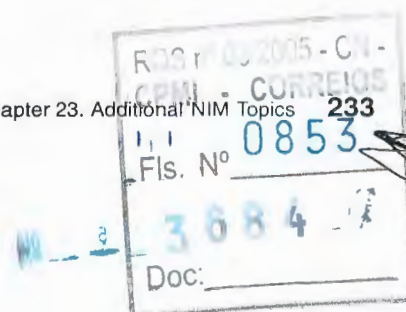
Select your NIM master to be the same system as the Dynamic Host Configuration Protocol (DHCP) server when using NIM in an environment that uses DHCP. Use host names whenever possible when defining NIM machine objects.

For more information, refer to DHCP and Network Installation Management (NIM) Interactions and Suggestions in *AIX 5L Version 5.2 System Management Guide: Communications and Networks*.

---

## Creating File Resources in the root Directory

Due to a limitation in NFS, file resources, such as **bosinst\_data** and **script** resources cannot be created in the root directory ("/") of a resource server.







## Restricting NIM Client Resource Allocation

NIM provides client machines with the capability of allocating and using any resource in the NIM environment. In some tightly controlled NIM environments, administrators may not want clients to be able to access all resources at all times. To control client-resource allocation, a NIM administrator can use the **client\_alloc** attribute. The restrictions placed by the **client\_alloc** attribute will prevent clients from allocating and using resources, but the NIM master will continue to have the full capability of performing operations on clients.

**Note:** This task is not supported by Web-based System Manager.

### From SMIT

NIM client-allocation restrictions can be changed from the SMIT interface by typing the SMIT fast path:

```
smit nim_control_alloc
```

### From the Command Line

To restrict all clients from being able to use any resources, set the attribute **client\_alloc=no** on the NIM master:

```
nim -o change -a client_alloc=no master
```

To restrict a particular client from being able to use any resources, set the attribute **client\_alloc=no** on the client:

```
nim -o change -a client_alloc=no clientname
```

To restrict all clients from being able to use a particular resource, set the attribute **client\_alloc=no** on the resource:

```
nim -o change -a client_alloc=no resourcename
```

To lift the restrictions on client-resource allocation, remove the **client\_alloc** attribute by setting it to **yes** for the applicable object:

```
nim -o change -a client_alloc=yes master
nim -o change -a client_alloc=yes clientname
nim -o change -a client_alloc=yes resourcename
```

## Preventing Machines from Adding Themselves as Clients

Machines may add themselves as clients in NIM environments by using the **niminit** command and specifying the hostname of a NIM master. In some environments, administrators may want total control over which machines are added as clients of their masters. To prevent clients from adding themselves to a NIM environment, an administrator can use the **client\_reg** attribute.

**Note:** This task is not supported by Web-based System Manager.

### From SMIT

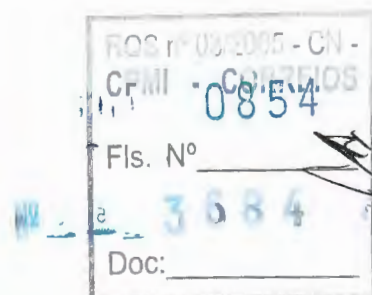
The option to allow clients to add themselves to a NIM environment can be changed from the SMIT interface by typing the SMIT fast path:

```
smit nim_client_reg
```

### From the Command Line

To prevent machines from adding themselves as clients in a NIM environment, set the attribute **client\_reg=no** on the NIM master:

```
nim -o change -a client_reg=no master
```





To allow machines to add themselves as clients of a NIM master, remove the **client\_reg** attribute by setting it to **yes** on the master:

```
nim -o change -a client_reg=yes master
```

---

## Disabling Client CPU ID Validation

The CPU ID of a NIM client is stored in the NIM database so that the master can perform verification that NIM client commands are coming from the machines that were originally registered as clients. A NIM administrator would not want this CPU ID validation to be performed in the following situations:

- When the hardware of a client machine is changed, giving the client a new CPU ID.
- When a single client definition is used to install different machines, as on a preinstall assembly line.

## From Web-based System Manager

To enable or disable NIM client CPU ID validation from the NIM application:

1. From the NIM menu, select **Advanced Configuration** —> **Control Client CPU ID Validation**.
2. Use the dialog to complete the task.

## From SMIT

Manage the client CPU ID validation from the SMIT interface by typing the SMIT fast path:

```
smit nim_cpuid_validate
```

## From the Command Line

Client CPU ID validation can be managed on the NIM master by using the **validate\_cpuid** attribute.

To disable client CPU ID validation, set the attribute **validate\_cpuid=no** on the NIM master:

```
nim -o change -a validate_cpuid=no master
```

To perform client CPU ID validation, remove the **validate\_cpuid** attribute from the master by setting it to "yes":

```
nim -o change -a validate_cpuid=yes master
```

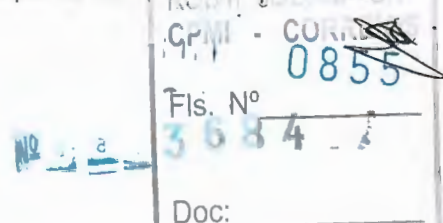
**Attention:** The value of the **validate\_cpuid** attribute should not be changed while operations are being performed on NIM clients because it could potentially disrupt client communications for active machines.

---

## Exporting NIM Resources Globally

When resources are allocated for use during NIM operations, they are NFS-exported to the client machines where the operations will be performed. If operations are performed simultaneously on many different clients, the **/etc/exports** and **/etc/xtab** files may become very large on the resource servers. This may cause size limits to be exceeded in the files, and it may also negatively affect NIM performance as the files are locked and modified for each resource allocation or deallocation.

In environments where administrators are not concerned about who has access to the NIM resources, they may set an option to globally export the resources and thereby eliminate the repeated updates to the **/etc/exports** and **/etc/xtab** files. The only resources that may not be globally exported are those that are used exclusively by diskless and dataless clients. The global export of a NIM resource will make it readable by any machine in the network, not just those in the NIM environment. The resource will be globally exported as long as it is allocated to any client. When the resource is deallocated from all clients, it is unexported.







## From Web-based System Manager

To enable or disable global export of NIM resources from the NIM application:

1. From the NIM menu, select **Advanced Configuration** —> **Export NIM Resources Globally**.
2. Use the dialog to complete the task.

## From SMIT

To manage global exporting of NIM resources from the SMIT interface, type the SMIT fast path:

```
smit nim_global_export
```

## From the Command Line

Global exporting of NIM resources for use by clients can be managed with the **global\_export** attribute.

To enable global exporting of NIM resources, set the attribute **global\_export=yes** on the NIM master:

```
nim -o change -a global_export=yes master
```

To disable global exporting of NIM resources, remove the **global\_export** attribute from the master by setting it to **no**:

```
nim -o change -a global_export=no master
```

Do not change the enablement and disablement of global exports when there are resources allocated to clients because this could lead to situations where resources are exported with incorrect permissions. All NIM operations should be completed and resources deallocated before any attempts are made to change the **global\_export** value. If resources are currently allocated to clients, the **nim** command will fail to change the **global\_export** value.

---

## Creating Network Boot Images to Support Only the Defined Clients and Networks

When a SPOT resource is created, network boot images are created in the **/tftpboot** directory to support certain NIM operations.

NIM only creates network boot images to support clients and networks that are defined. If a new client is defined and there is no network boot image already created for it in the environment, then the boot image will not be created until either the SPOT is allocated to the client or a check operation is performed on the SPOT to rebuild the boot images.

When clients are removed from the NIM environment, boot images are not automatically removed. To remove boot images that are no longer necessary for a NIM environment, the list of required machine-network combinations in the environment must be rebuilt. The boot images must then be rebuilt for each SPOT.

## From Web-based System Manager

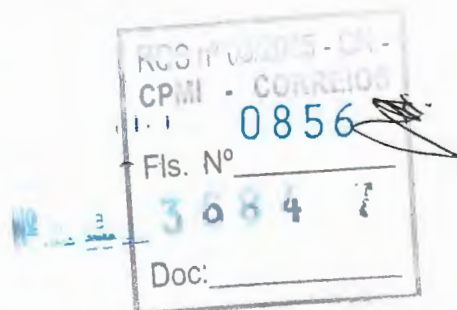
To limit or enable boot image creation according to whether the interface is defined from the Web-based System Manager application:

1. From the NIM menu, select **Advanced Configuration** —> **Control Network Boot Image Creation**.
2. Use the dialog to complete the task.

## From SMIT

To manage the creation of boot images from the SMIT interface, type the SMIT fast path:

```
smit nim_control_boot
```





## From the Command Line

To rebuild the list of machine types and networks that must be supported by network boot images in the NIM environment, perform a **change** operation on the NIM master with the **if\_discover=yes** attribute:

```
nim -o change -a if_discover=yes master
```

To rebuild network boot images from a SPOT, perform a **check** operation on the SPOT with the **force** option:

```
nim -Fo check spot_name
```

If an administrator prefers to have NIM always create all possible boot images from the SPOT resources, the **if\_prebuild=yes** attribute can be specified on the master:

```
nim -o change -a if_prebuild=yes master
```

To return NIM to the behavior of creating only the boot images that are required for the environment, remove the **if\_prebuild** attribute from the master by setting it to "no":

```
nim -o change -a if_prebuild=no master
```

---

## Updating a Spot with New Device Support for a New Level of AIX

A NIM SPOT may be updated from one level of AIX to another using the **update\_all** option of the NIM **cust** operation. This process will update all current SPOTs with the latest level of code on the installation media. However, this process will not automatically install new software packages or device drivers from the installation media.

Machines in the NIM environment that are being upgraded to a new level of AIX require that new applicable device support be updated for any existing NIM SPOTs intended to support network boot and installation. This must be done after the SPOT is updated to the new level of AIX.

The new device support can be installed in the SPOT using NIM's **cust** operation, specifying the desired device-specific filesets in an **installp\_bundle** resource or by using the **filesets** attribute. Alternatively, a fileset name of **devices** can be specified as the value of the **filesets** attribute to install all devices on the installation media. For further details about the **cust** operation, see "cust" on page 272.

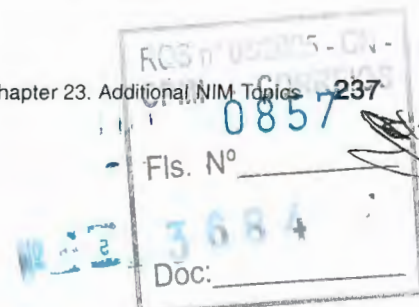
---

## Tuning Client-Request Processing

For large installation environments, NIM can be scaled to support anywhere from 20 to 150 client requests simultaneously. NIM scaling is done by enabling the multithreaded option on the **nimesis** daemon. The multithreaded option provides better handling of the volume of client information change requests and client state changes. Without the use of the multithreaded option, the NIM master can become overloaded by activity on the NIM database and the number of active processes, resulting in simultaneous failures during the installation of a large number of client machines.

The multithreaded **nimesis** daemon will serialize and buffer NIM client requests to protect the NIM master from process overload, without causing significant performance degradation. The user must understand that many of the client information changes will not be reflected in the NIM database. The most recent information changes for any client, however, are eventually processed. Debugging of failed or hung clients will not be adversely affected.

The number of threads assigned to this daemon determines how many simultaneous NIM client requests can be handled in the NIM environment. Because most of the NIM client requests are processed rapidly, it is not necessary to have one thread for every client installing. The number of threads needed to support the activities in a NIM environment is dependent upon several items. The following should be considered when determining the number of threads:







- Number of clients that will be operated on at the same time
- Processing capacity of the NIM master machine
- What type of operations are planned

In general, one thread can support two to four clients that are installing BOS at the same time. For example, when installing 150 machines, 50 to 75 threads is sufficient. The number of threads is highly dependent on the processing power of the NIM master machine, and slower master machines may require more threads.

For smaller NIM environments, enabling the multithreaded daemon can monopolize system resources on the master that will not be used. For example, when installing 50 machines simultaneously, 20 to 25 threads or even the single-threaded daemon would suffice.

**Note:** The multithreaded option alone will not allow more machines to be installed simultaneously. The multithreaded option should be used in conjunction with global export of NIM resources, distribution of NIM resources throughout the NIM environment, and a network environment capable of handling a large volume of throughput.

## From SMIT

To tune client-request processing from the SMIT interface, type the SMIT fast path:

```
smit nim_tune_nimesis
```

## From Web-based System Manager

To tune client-request processing from the NIM application:

1. From the NIM menu, select **Advanced Configuration—>Tune Client Request Processing**.
2. Use the dialog to complete the task.

## From the Command Line

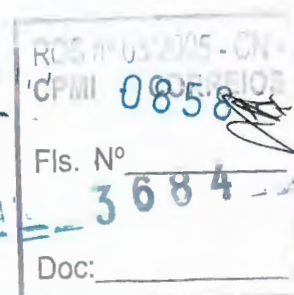
The **max\_nimesis\_threads** attribute can be used to tune client-request processing. To enable the multithreaded **nimesis** daemon, set a value to the **max\_nimesis\_threads** attribute on the NIM master using the following command:

```
nim -o change -a max_nimesis_threads=value master
```

**Note:** The range for the *value* attribute above is 20 to 150.

To disable the multithreaded **nimesis** daemon, set a null value to the **max\_nimesis\_threads** attribute on the NIM master:

```
nim -o change -a max_nimesis_threads="" master
```





## Chapter 24. Network Installation Management Concepts

This chapter discusses the concepts required to understand the operation of Network Installation Management (NIM). To use all the available features in NIM, you should understand various components of AIX installation. The details discussed in this chapter focus on command-line operations, but the information is applicable to the other NIM interfaces as well. Use this chapter as reference material to supplement the online help available in the other interfaces.

This chapter contains the following topics:

- "NIM Machines"
- "NIM Networks" on page 244
- "NIM Resources" on page 248
- "NIM Operations" on page 263
- "NIM Groups" on page 282

### NIM Machines

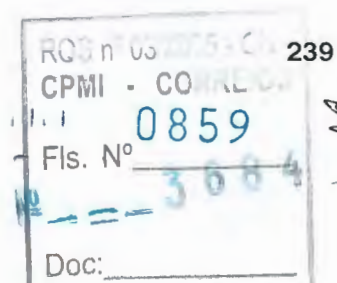
The types of machines that can be managed in the NIM environment are *standalone*, *diskless*, and *dataless* clients. This section describes the differences between the machines, the attributes required to define the machines, and the operations that can be performed on them. The NIM environment is composed of two basic machine roles: *master* and *client*. The NIM master manages the installation of the rest of the machines in the NIM environment. The master is the only machine that can remotely run NIM commands on the clients. All other machines participating in the NIM environment are clients to the master, including machines that may also serve resources.

### NIM Operations on Client Machines

There are unique operations to initialize the different client configurations. NIM checks that the operation is a valid operation for a specific client configuration. The following table shows the operations that can be performed on the different client configuration types.

NIM Operation	Machine Configuration		
	Standalone	Diskless	Dataless
bos_inst	x		
dkls_init		x	
dtls_init			x
diag	x	x	x
cust	x		
fix_query	x		
lppchk	x		
maint	x		
maint_boot	x		
reset	x	x	x
check	x	x	x
showlog	x	x	x
reboot	x	x	x

For more information about NIM operations, see "NIM Operations" on page 263.







## Defining NIM Clients

Standalone, diskless, and dataless clients are defined in the NIM environment using the NIM **define** operation. The command line syntax is as follows:

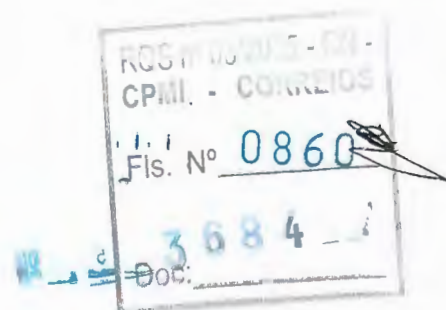
```
nim -o define -t MachineType -a Attribute=Value ... MachineName
```

where the following attributes are required:

- |                        |   |
|------------------------|---|
| <b>-t MachineType</b>  | Specifies the type of machine being defined. Valid values are <b>standalone</b> , <b>diskless</b> , and <b>dataless</b> .   |
| <b>-a if=Value ...</b> | Stores network interface information for a NIM client, and requires a sequence number when specified. The value for this attribute consists of three required values and a fourth, optional value:<br><br><b>Value 1</b><br>Specifies the name of the NIM network to which this interface connects. If the name of the NIM network is unknown, then the <b>find_net</b> keyword can be used to match the client's IP address to a defined NIM network. If the <b>find_net</b> keyword is used, but NIM does not find a matching network, the optional <b>net_definition</b> attribute should be used to define the network, as well.<br><br><b>Value 2</b><br>Specifies the host name associated with this interface.<br><br><b>Value 3</b><br>Specifies the network adapter hardware address of this interface. A value of <b>0</b> can be specified unless broadcasting is used for network boot of the client.<br><br><b>Value 4</b><br>Specifies the logical device name of the network adapter used for this interface. If this value is not specified, NIM uses a default based on the type of network interface defined. This field is required when the client is defined on a heterogeneous network.<br><br>This attribute requires a sequence number for NIM to distinguish between multiple network interfaces. Because machines can be multihomed, NIM allows more than one if attribute per machine. |

The following attributes are optional:

- |                                |   |
|--------------------------------|---|
| <b>-a ring_speed=Value</b>     | Specifies the ring speed of the client's token-ring adapter. This value is required if the client's NIM network is token-ring. This attribute requires a sequence number for NIM to distinguish between ring speeds for multiple interfaces on the machine. |
| <b>-a cable_type=Value</b>     | Specifies the cable type of the client's ethernet adapter. This value is required if the client's NIM network is Ethernet. This attribute requires a sequence number for NIM to distinguish between cable types for multiple interfaces on the machine.     |
| <b>-a platform=Value</b>       | Specifies the platform of the machine being defined. The default value is <b>platform=chrp</b> . Run the <b>bootinfo -p</b> command on a running machine to determine its platform.   |
| <b>-a netboot_kernel=Value</b> | Specifies the kernel type of the client. Valid values are <b>up</b> for uniprocessor machines and <b>mp</b> for multiprocessor machines. The default value is <b>netboot_kernel=up</b> .  |
| <b>-a iplrom_emu=Value</b>     | Specifies the device that contains the IPL ROM emulation software. IPL ROM emulation is required for machines that do not have bootp-enabled IPL ROM.   |





**-a net\_definition=Value ...**

Defines a NIM network to be associated with the client being defined. The value for this attribute consists of two required values and three optional values:

**Value 1 = NetworkType (required)**

Specified values are **tok**, **ent**, **fddi**, and **generic**.

**Value 2 = SubnetMask (required)**

Specifies the dotted decimal mask for the network.

**Value 3 = ClientGateway (optional)**

Specifies the IP address or host name of the default gateway used by the machine being defined to communicate with the NIM master.

**Value 4 = MasterGateway (optional)**

Specifies the IP address or host name of the default gateway used by the NIM master to communicate with clients on other subnets.

**Value 5 = NetworkName (optional)**

Specifies a name to be given to the NIM definition created for the network. (Otherwise, a unique default value is assigned.)

When specifying the **net\_definition** attribute to create or change a machine definition, the **find\_net** keyword must be specified as the first component of the **if** attribute for the machine. The **net\_definition** attribute may also be specified when defining additional NIM interfaces (**if** attributes) for machine definitions.

**-a cpuid=Value**

Specifies the CPU ID of the machine being defined. This attribute can be used for client verification during NIM operations. To display the CPU ID on a running machine, use the **uname -m** command. This field is optional and will be automatically set the first time a client communicates with the NIM master.

**-a master\_port=Value**

Specifies the port number used by the NIM master for socket communication with the clients. The default master port number is **1058**.

**-a registration\_port=Value**

Specifies the port number used by clients to register themselves with the NIM master. The default registration port number is **1059**.

**-a group=Value**

Specifies a machine group to which the client should be added. The group will be defined if it does not exist.

**-a comments=Value**

Provides comments about the client being defined.

**-a verbose=Value**

Displays information for debugging. Use **verbose=5** to show maximum detail.

## Standalone Clients

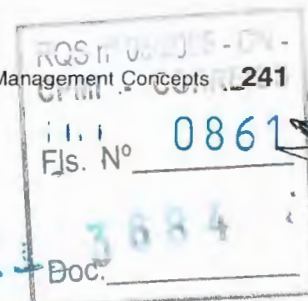
Standalone NIM clients are clients with the capability of booting and running from local resources. Standalone clients mount all file systems from local disks and have a local boot image. Standalone clients are not dependent upon network servers for operation.

### Network Booting a Standalone Client

Although an installed standalone client is capable of booting from the local disk, it may be necessary to perform a network boot of the client for certain NIM operations. Clients must boot over the network in order for NIM to perform a BOS installation (**bos\_inst**) of the client or to boot into maintenance mode (**maint\_boot**) and diagnostics (**diag**). For instructions on booting a client over the network, see "Bootng a Machine Over the Network" on page 323.

### Managing Software on Standalone Clients

The AIX Base Operating System can be installed directly on standalone clients using the NIM **bos\_inst** operation. Additional software and updates can be installed and managed on standalone clients using the NIM **cust** and **maint** operations. For more information about these and other operations, see "NIM Operations" on page 263.







## Diskless and Dataless Clients

Diskless and dataless clients are machines that are not capable of booting and running without the assistance of servers on a network. As their names imply, diskless clients have no hard disk, and dataless clients have disks that are unable to hold all the data that may be required for operation. Diskless machines must mount paging space and all file systems from remote servers. Dataless machines can only use a local disk for paging space and the **/tmp** and **/home** file systems. Neither diskless nor dataless clients have a local boot image, and they must boot from servers on the network.

Defining a machine as diskless or dataless has the following advantages:

- **Cost savings**

No hard disk is required for diskless clients. Only a small hard disk is needed for dataless clients.

- **Manage software configurations on machines**

On diskless and dataless clients, the file system containing the BOS is mounted from a server. All client systems that mount the same file system for BOS run from identical software.

- **Manage storage of user data**

User data for diskless and dataless clients are stored on remote servers. A system administrator can manage storage allocation and data backups for the client machines by managing the data on the server, rather than on each machine separately.

## Required and Optional Resources for Diskless and Dataless Clients

The file systems that are mounted by the diskless and dataless client machines are treated as resources in the NIM environment. Like other resources, they exist on a server in the NIM environment, and they are NFS-exported to the clients that use them.

The following resources are managed by NIM to support diskless and dataless clients:

<b>boot</b>	Defined as a network boot image for NIM clients. The <b>boot</b> resource is managed automatically by NIM and is never explicitly allocated or deallocated by users.
<b>SPOT</b>	Defined as a directory structure that contains the AIX run-time files common to all machines. These files are referred to as the <b>usr</b> parts of the fileset. The <b>SPOT</b> resource is mounted as the <b>/usr</b> file system on diskless and dataless clients.

Contains the **root** parts of filesets. The **root** part of a fileset is the set of files that may be used to configure the software for a particular machine. These **root** files are stored in special directories in the **SPOT**, and they are used to populate the root directories of diskless and dataless clients during initialization.

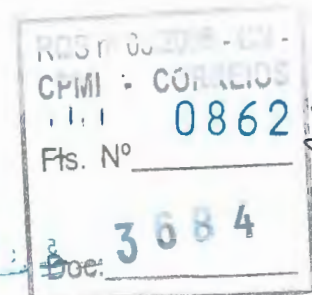
The network boot images used to boot clients are constructed from software installed in the **SPOT**.

<b>root</b>	A <b>SPOT</b> resource is required for both diskless and dataless clients. Defined as a parent directory for client <b>/</b> ( <b>root</b> ) directories. The client root directory in the <b>root</b> resource is mounted as the <b>/</b> ( <b>root</b> ) file system on the client.
-------------	--

When the resources for a client are initialized, the client **root** directory is populated with configuration files. These configuration files are copied from the **SPOT** resource that has been allocated to the same machine.

<b>dump</b>	A <b>root</b> resource is required for both diskless and dataless clients. Defined as a parent directory for client dump files. The client dump file in the <b>dump</b> resource is mounted as the dump device for the client.
-------------	---

A **dump** resource is required for both diskless and dataless clients.





<b>paging</b>	Defined as a parent directory for client paging files. The client paging file in the <b>paging</b> resource is mounted as the paging device for the client.
<b>home</b>	A <b>paging</b> resource is required for diskless clients and optional for dataless clients. Defined as a parent directory for client <b>/home</b> directories. The client directory in the <b>home</b> resource is mounted as the <b>/home</b> file system on the client.
<b>shared_home</b>	A <b>home</b> resource is optional for both diskless and dataless clients. Defined as a <b>/home</b> directory shared by clients. All clients that use a <b>shared_home</b> resource will mount the same directory as the <b>/home</b> file system.
<b>tmp</b>	A <b>shared_home</b> resource is optional for both diskless and dataless clients. Defined as a parent directory for client <b>/tmp</b> directories. The client directory in the <b>tmp</b> resource is mounted as the <b>/tmp</b> file system on the client.
<b>resolv_conf</b>	A <b>tmp</b> resource is optional for both diskless and dataless clients. Contains nameserver IP addresses and a network domain name.  Unlike the other resources used by diskless/dataless clients, the <b>resolv_conf</b> resource does not remain mounted by the client. Instead, it is copied to the <b>/etc/resolv.conf</b> file in the client's root directory.  A <b>resolv_conf</b> resource is optional for both diskless and dataless clients.

## Initialization of Diskless and Dataless Clients

Diskless and dataless clients are not installed in the same way as standalone machines. Instead, they are initialized. Initialization of diskless and dataless clients involves several phases of operation:

<b>Resource Allocation</b>	The resources required to support a diskless/dataless client must be allocated to the client before or during the initialization operation.  If the resource is a parent directory of client directories, the allocation will create an empty subdirectory for the client. The client subdirectory is then NFS-exported to the client. The client subdirectories are not populated until the initialization is actually performed.
<b>Client Initialization</b>	The <b>dkls_init</b> and <b>dtls_init</b> operations are used in NIM to initialize the resources for client use.  Among the operations performed during client initialization are the following: <ul style="list-style-type: none"><li>• The boot image is made available to the client for performing a network.boot.</li><li>• The root files, which are used for machine-specific customization, are copied into the client's subdirectory in the <b>root</b> resource. The files that are copied into the client root directories come from the <b>SPOT</b> resource that has been allocated to the client.</li><li>• The <b>/tftpboot/Client.info</b> file is created on the boot server (which is the <b>SPOT</b> server). This file contains information that will be needed by the client during the start-up configuration processing to successfully configure as a diskless or dataless client.</li></ul> The following are some of the variables defined in the <b>Client.info</b> file: <pre>export NIM_CONFIGURATION=diskless export RC_CONFIG=rc.dd_boot export ROOT=Host:Client_Root_Directory export DUMP=Host:Client_Dump_Directory export SPOT=Host:SPOT_Location</pre>

The paging location is set in the client's root directory in the **/etc/swapspaces** file.

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Doc: 3084





**Network Boot of the Client** The client machine is booted over the network using standard **bootp** procedures for the machine type. The client obtains the boot image and begins running a mini-kernel in a file system in RAM.

The client tftp's the *Client.info* file from the */tftpboot* directory on the **SPOT** server. The information in the *Client.info* file is used to properly configure the client as a diskless or dataless machine.

The remote file systems are mounted from the resource servers.

If the client is a dataless client, and no **paging**, **ttmp**, **home**, or **shared\_home** resource is allocated, then the client will create the missing file system on the local hard disk.

## Managing Software on Diskless and Dataless Clients

The **/usr** and **root** file systems of diskless and dataless clients are resources that have been mounted from a server. Therefore, in order to install or uninstall software on a diskless or dataless client, the processing must actually occur on the resources that the clients use.

The **SPOT** contains the directory structure for an installed **/usr** file system. It also contains subdirectories for the "root" parts of installed filesets. Because the **SPOT** contains both **usr** and **root** files, software maintenance must be performed on the **SPOT** in order to update the software that is running on the clients. Such actions must be performed using the NIM **cust** and **maint** operations. For more information about the **cust** and **maint** operations, see "NIM Operations" on page 263.

If the **SPOT** is currently allocated for client use, NIM will prevent software customization operations from being performed on it. This is to safeguard the **SPOT** from changes that may adversely affect running client machines. However, this restriction can be overridden by specifying the **force** option when performing the operation.

When NIM is used to install software in a **SPOT**, the following operations are performed to manage the software for diskless and dataless clients:

1. The **/usr** files are installed in the **SPOT**. These files are automatically seen by all the clients that mount the **SPOT** as their **/usr** file systems.
2. The root files are installed in special subdirectories in the **SPOT**.
3. After all the filesets have been installed in the **SPOT**, the **root** files are copied to the **root** directories of any diskless or dataless clients that have been initialized with the **SPOT**.

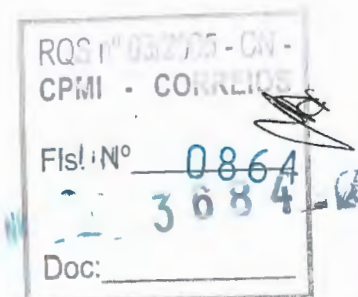
When NIM is used to uninstall software in a **SPOT**, the following operations are performed to manage the software for diskless and dataless clients:

1. The **/usr** files are removed from the **SPOT**. This also automatically "removes" the files from the client systems.
2. The **root** files of the software are removed from the client **root** directories.

NIM also provides a **sync\_roots** operation to perform consistency verification and correction to ensure the client **root** directories match the **root** parts stored in the **SPOT**.

## NIM Networks

In order to perform certain NIM operations, the NIM master must be able to supply information necessary to configure client network interfaces. The NIM master must also be able to verify that client machines can access all the resources required to support operations. To avoid the overhead of repeatedly specifying network information for each individual client, NIM networks are used to represent the networks in a NIM





environment. When NIM clients are defined, the associated network for the client must be specified. During NIM operations, the NIM master is able to use information from the client's network definition when necessary.

When the NIM master is configured, the network associated with the master is automatically defined in the NIM environment. It is necessary only to define additional NIM networks if clients reside on other local area networks or subnets. The procedures described in this guide and reference are designed to automatically define NIM networks, if necessary, when clients are added. However, this section is included to describe NIM networks in detail in case manual definition of networks and routes is required.

## Supported NIM Network Types

The supported network types are as follows:

- Ethernet
- Standard Ethernet
- IEEE 802.3 Ethernet
- Token-Ring
- FDDI
- ATM
- Generic

Network boot support is provided for Ethernet, Token-Ring, and FDDI. Unlike other network adapters, ATM adapters cannot be used to boot a machine. Therefore, installing a machine over an ATM network requires special processing. See "Installing to Clients on ATM Networks" on page 186. The Generic network type is used to represent all other network types where network boot support is not available. For clients on Generic networks, NIM operations that require a network boot, such as **bos\_inst** and **diag**, are not supported. However, nonbooting operations, such as **cust** and **maint**, are allowed. Diskless and dataless clients cannot be associated with Generic networks, because they inherently rely on network boot capability.

## Defining NIM Networks

Networks are defined in the NIM environment using the NIM **define** operation. The command line syntax is as follows:

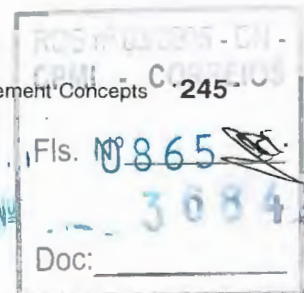
```
nim -o define -t NetworkType -a Attribute=Value ... MachineName
```

where the following attributes are required:

-a net_addr=Value	Specifies the IP address of the network being defined. If the network address is not known, see "Determining a Network's IP Address" on page 246.
-a snm=Value	Specifies the subnet mask for the network.
-t NetworkType	Specifies the type of network being defined. Valid values are <b>atm</b> , <b>tok</b> , <b>ent</b> , <b>fddi</b> , and <b>generic</b> .

The following attributes are optional:

-a comments=Value	Provides comments about this network.
-a ieee_ent=Value	Specifies IEEE 802.3 Ethernet configuration. This is only valid for networks that are defined with the <b>ent</b> type or those that have an <b>other_net_type</b> attribute set to <b>ent</b> .







- a other\_net\_type=Value** Specifies another network type that applies to this logical network. Each NIM network is used to represent one logical network that exists in the NIM environment. When the network is defined, the type of network interface used in the network must be supplied. Usually, a network is composed of only one type. However, a bridge can be used to connect different network types together to form one logical network. In that situation, NIM needs to know what the other network interface types are, and this attribute is used to specify that information. For more information on how to use the **other\_net\_type** attribute, see "Defining a Heterogeneous Network" on page 247.
- a routing=Value ...** Stores NIM routing information for a network. This attribute requires a sequence number when specified. When a new NIM route is specified, the **routing** attribute consists of three values:
- Value 1*  
Specifies the NIM name of the destination network for this route.
- Value 2*  
Specifies the host name of the gateway to use in order to communicate with the destination network.
- Value 3*  
Specifies the host name of the gateway used by the destination network to get back to this network.
- This attribute can be used to add a default route or static route. To add a default route, specify **default** for *Value 1*. Then, specify the default gateway for the network in *Value 2*. Leave *Value 3* blank.
- For more information on adding and changing routes, see "NIM Routes", "Establishing a Default NIM Route Between Networks" on page 219, and "Establishing a Static NIM Route Between Networks" on page 220.
- a verbose=Value** Displays information for debugging. Use **verbose=5** to show maximum detail.

It is also possible to define NIM networks automatically when client machines are defined. To do this, use the **find\_net** and **net\_definition** attributes when defining the client. For more information, see "NIM Machines" on page 239.

## Determining a Network's IP Address

NIM determines a network's IP address by performing a bitwise "AND" on the binary representations of the network's subnet mask and the address of any machine's IP address on the same network. For example:

```
subnet mask = 255.255.254.0
client address = 129.35.58.207
```

In binary:

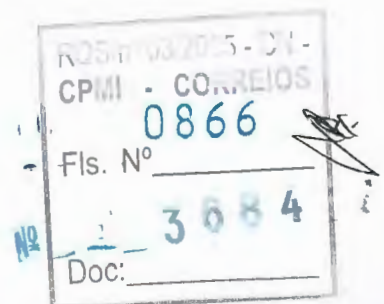
```
subnet mask = 11111111.11111111.11111110.00000000
client address = 10000001.00100011.00111010.11001111
network address = 10000001.00100011.00111010.00000000
```

In decimal:

```
network address = 129.35.58.0
```

## NIM Routes

Routing information is used internally by NIM to ensure that a client on one network can communicate with a server on another network. It defines the gateway to use to go from one network to the other network.





NIM provides the ability to define default or static routes. Default NIM routes provide the following advantages over static routes:

- They more closely model the network configuration of common network environments.
- They permit resources that are distributed throughout a NIM environment to be more easily accessed by any client in the NIM environment.

To determine the gateway used by machines on a given network, run **netstat -rn** on a running machine on the network to see if a default gateway is listed. You can also issue **traceroute Host\_Name** from a running machine on the network in question, where *Host\_Name* is the name of the master's primary network interface if determining the gateway for a client, or the name of a target client if determining the gateway used by the master. The first gateway listed is the gateway used by machines on the specified network.

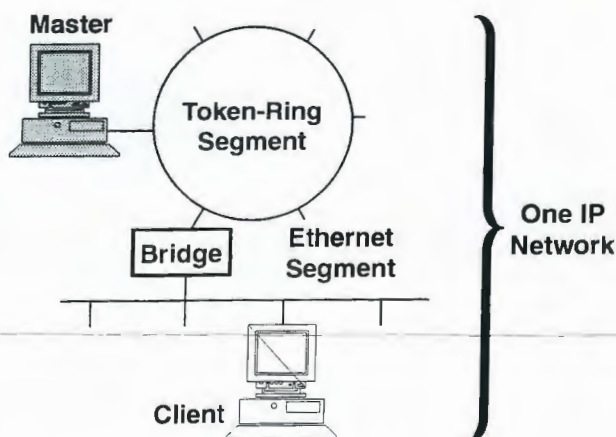
Note that NIM routes are not required if the only networks defined in a NIM environment are associated with interfaces (if attributes) defined on the NIM master and if all resources will be defined on the master. If resources are served by machines other than the master to clients that do not reside on the same network as the server, NIM routes are required between those networks even if all networks are attached to interfaces belonging to the master. In this case, the master must act as a gateway (with IP-forwarding switched on), and the host name of the interface on the master should be used as a gateway.

Networks with default routes may be created automatically when NIM machines are being defined.

Communications between networks go through several gateways. However, it is important to remember that when defining NIM routes for networks, the only gateways of interest are the first ones used by the networks to reach their destinations. Intermediate gateways between the originating and destination networks are irrelevant for NIM routing purposes.

## Defining a Heterogeneous Network

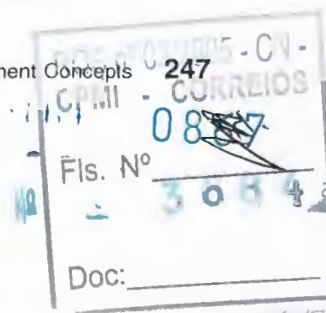
This section describes the NIM feature that enables NIM to model networks consisting of different data-link protocol segments. These kinds of networks use bridges to connect two segments that have different data link protocols. A network consisting of a Token-Ring and an Ethernet segment can be connected to form a single logical network, as shown in the following figure.



### Heterogeneous Network

Figure 1. Heterogeneous Network. This illustration shows a single IP network in which the master server uses its token-ring connection and a bridge to communicate with its client on an Ethernet segment.

Because a single NIM network object is used to represent one network, the **other\_net\_type** attribute is reserved for a different type of interface that can exist in a network. The **other\_net\_type** attribute can be







added to the definition of a network object. When present in a network definition, the **other\_net\_type** attribute tells NIM that this logical network uses a bridge to connect the other network type to the network type that was specified when the object was defined.

When you define a machine object to be connected to a network object, NIM checks to see if the network has any **other\_net\_type** attributes. If so, NIM requires that the fourth field, which is usually optional, in the **if** attribute, be specified. This field specifies the logical name of the client's network adapter. The following example defines a network object that has a bridge joining a Token-Ring and an Ethernet segment:

```
nim -o define -t tok -a net_addr=129.35.129.0 \  
-a snm=255.255.240.0 -a other_net_type1=ent b905net  
  
lsnim -l b905net  
  
class      = network  
type       = tok  
net_addr   = 129.35.128.0  
snm        = 255.255.240.0  
other_net_type1 = ent  
Nstate     = ready for use  
prev_state = information is missing from this object's def>
```

The **other\_net\_type** attribute requires a sequence number because a network could be composed of all three types of interfaces linked by bridges.

When you define a client's interface that is physically connected to an Ethernet segment joined with a Token-Ring network using a bridge (with master being on the Token-Ring side), you must supply the fourth field:

```
nim -o define -t standalone -a if1='find_net mymac 08005ac9430c \  
ent' -a cable_type1=bnc mymac
```

## Adding Another Network Type to a NIM Network

### From Web-based System Manager

1. In the NIM Network container, double-click on a network. The General page of the properties notebook displays.
2. Use the General page to add a network type to the network.

### From SMIT

1. To add another network type, enter the **smit nim\_chnet** fast path.
2. Select the network to change.
3. Specify the additional network type to be supported.

### From the Command Line

To define a NIM network, enter:

```
nim -o change -a other_net_typeSequenceNumber=NetworkType NetworkName
```

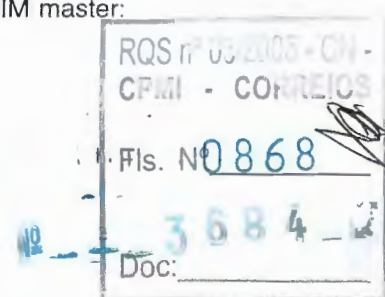
For example, to change a Token-Ring network called **network1** to also support Ethernet and FDDI, enter:

```
nim -o change -a other_net_type1=ent -a other_net_type2=fddi network1
```

## NIM Resources

A large number of resources (files and directories) are needed to support NIM software installation and maintenance operations. Resources can be added through the Web-based System Manager **New Resources** wizard.

To obtain detailed information about any resource, enter the following from the NIM master:





lsnim -Pa ResourceType

The Web-based System Manager and SMIT interfaces are designed to hide much of the detail required for the command line interface. Therefore, these sections only document the resource task procedures for the command line. The following information applies to the other interfaces as well, but discussion of those interfaces is deferred to the online contextual help available for those applications. The following sections describe detailed information about each NIM resource:

- "adapter\_def Resource"
- "boot Resource" on page 250
- "bosinst\_data Resource" on page 250
- "dump Resource" on page 250
- "exclude\_files Resource" on page 251
- "fb\_script Resource" on page 251
- "fix\_bundle Resource" on page 252
- "home Resource" on page 253
- "image\_data Resource" on page 253
- "installp\_bundle Resource" on page 254
- "lpp\_source Resource" on page 254
- "mksysb Resource" on page 256
- "nim\_script Resource" on page 256
- "paging Resource" on page 257
- "resolv\_conf Resource" on page 257
- "root Resource" on page 258
- "script Resource" on page 258
- "shared\_home Resource" on page 259
- "SPOT (Shared Product Object Tree) Resource" on page 260
- "tmp Resource" on page 262

## adapter\_def Resource

The **adapter\_def** resource represents a directory that contains secondary adapter configuration files that are used during **bos\_inst** and **cust** operations. The **adapter\_def** resource directory is populated with secondary-adapter configuration files by the **nimadapters** command.

### Defining an adapter\_def Resource

The command line syntax for defining a **adapter\_def** resource is:

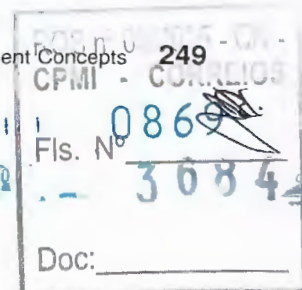
```
nim -o define -t adapter_def -a Attribute=Value ... adapter_defName
```

The following attributes are required for the **adapter\_def** resource:

<b>-a location=Value</b>	Specifies the full path name of the <b>adapter_def</b> resource directory.
<b>-a server=Value</b>	Specifies the name of the machine where the <b>adapter_def</b> resource directory resides. Only the master can serve an <b>adapter_def</b> resource.

The following attributes are optional for the **adapter\_def** resource:

<b>-a comments=Value</b>	Describes the resource.
<b>-a group=Value</b>	Specifies the name of a resource group to which this resource should be added.
<b>-a verbose=Value</b>	Displays information for debugging. To show maximum detail, specify a value of 5.







## boot Resource

The **boot** resource is an internally managed NIM resource used to indicate that a boot image has been allocated to a client. The **boot** resource is automatically allocated to clients to support NIM operations requiring a network boot. The **boot** resource will be automatically deallocated when the operation completes.

## bosinst\_data Resource

A **bosinst\_data** resource represents a file that contains information for the BOS installation program. Normally, the BOS installation program looks for this information in the **/bosinst.data** file in the BOS installation image. If this file does not exist or if it does not contain all the information that the BOS installation program requires, the program prompts for information by using a console that is local to the target. Information must then be specified manually for the BOS installation to proceed. With a **bosinst\_data** resource, the data can be specified in a NIM resource prior to the installation to prevent the need for prompting at the console.

A sample **bosinst.data** file (*SPOT\_Offset /usr/lpp/bosinst/bosinst.template*) is located on the **SPOT** resource server. Also, see "Performing a Nonprompted BOS Installation" on page 184 for a sample **bosinst\_data** file.

For instructions on how to create and use a **bosinst\_data** file, see "Performing a Nonprompted BOS Installation" on page 184.

## Defining a bosinst\_data Resource

The command line syntax for defining a **bosinst\_data** resource is:

```
nim -o define -t bosinst_data -a Attribute=Value ... bosinst_dataName
```

The following attributes are required for the **bosinst\_data** resource:

- |                   |  |
|-------------------|--|
| -a location=Value | Specifies the full path name of the <b>bosinst_data</b> resource file.                 |
| -a server=Value   | Specifies the name of the machine where the <b>bosinst_data</b> resource file resides. |

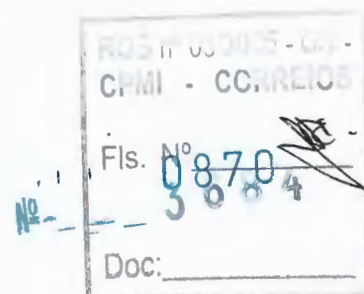
The following attributes are optional for the **bosinst\_data** resource:

- |                   |  |
|-------------------|--|
| -a comments=Value | Describes the resource.  |
| -a group=Value    | Specifies the name of a resource group to which this resource should be added.   |
| -a verbose=Value  | Displays information for debugging. To show maximum detail, specify a value of 5.  |
| -a source=Value   | Specifies an existing <b>bosinst_data</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location. |

## dump Resource

A **dump** resource represents a directory in which client dump directories are maintained. When this type of resource is allocated to a client, NIM creates a subdirectory for the client's exclusive use. This allocated subdirectory is initialized by the **dkls\_init** or **dtls\_init** operation, which creates an empty file in this subdirectory. After initialization, the client uses this file to store any **dump** images it creates.

**Note:** If you subsequently deallocate this resource, NIM removes the **dump** file and the subdirectory that NIM created for the client's use.





## Defining a dump Resource

The command line syntax for defining a **dump** resource is:

```
nim -o define -t dump -a Attribute=Value ... DumpName
```

The following attributes are required for the **dump** resource:

- |                          |   |
|--------------------------|---|
| <b>-a location=Value</b> | Specifies the full path name of the parent directory for the client <b>dump</b> files.              |
| <b>-a server=Value</b>   | Specifies the name of the machine where the directory for the <b>dump</b> resource will be created. |

The following attributes are optional for the **dump** resource:

- |                          |   |
|--------------------------|---|
| <b>-a comments=Value</b> | Describes the resource.   |
| <b>-a group=Value</b>    | Specifies the name of a resource group to which this resource should be added.    |
| <b>-a verbose=Value</b>  | Displays information for debugging. To show maximum detail, specify a value of 5. |

## exclude\_files Resource

An **exclude\_files** resource represents a file that contains a list of files and directories that should be excluded when creating a system backup image. This resource may be used when a **mksysb** resource is being created from a running NIM client.

### Defining an exclude\_files Resource

The command line syntax for defining an **exclude\_files** resource is:

```
nim -o define -t exclude_files -a Attribute=Value ... exclude_filesName
```

The following attributes are required for the **exclude\_files** resource:

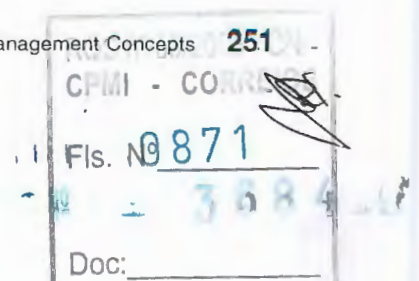
- |                          |   |
|--------------------------|---|
| <b>-a location=Value</b> | Specifies the full path name of the file containing the list of files and directories to exclude from the <b>mksysb</b> . |
| <b>-a server=Value</b>   | Specifies the name of the machine where the file for the <b>exclude_files</b> resource resides.                           |

The following attributes are optional for the **exclude\_files** resource:

- |                          |   |
|--------------------------|---|
| <b>-a comments=Value</b> | Describes the resource.   |
| <b>-a group=Value</b>    | Specifies the name of a resource group to which this resource should be added.  |
| <b>-a verbose=Value</b>  | Displays information for debugging. To show maximum detail, specify a value of 5.   |
| <b>-a source=Value</b>   | Specifies an existing <b>exclude_files</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location. |

## fb\_script Resource

An **fb\_script** resource represents a file that is used to configure devices when a NIM client is booting for the first time after the BOS installation process is completed. During BOS installation, certain customization operations (such as device configuration) cannot be performed because they require certain daemons to be running. However, at this point in the BOS installation process, daemons are not available. As a result, certain devices may not be configured during system reboot, and have to be manually configured after the system has booted.







You can use an **fb\_script** resource to provide device-configuration information. The BOS installation process adds the content of the **fb\_script** resource to the **/etc/firstboot** file, which is run the first time that a client is booted. The **/etc/firstboot** file then performs the device configuration.

## Defining an fb\_script Resource

The command line syntax for defining an **fb\_script** resource is as follows:

```
nim -o define -t fb_script -a server=server_name \  
-a location=fbscript_file_location fbscript_object_name
```

After the **fb\_script** resource is defined, you can allocate the resource and initiate a BOS installation operation using the **fb\_script** resource, as follows:

```
nim -o bos_inst -a fb_script=fbscript_object_name client_name
```

The following attributes are required for the **fb\_script** resource:

- |                                  |   |
|----------------------------------|---|
| <b>-a location=</b> <i>Value</i> | Specifies the full path name of the file being defined as the <b>fb_script</b> resource.    |
| <b>-a server=</b> <i>Value</i>   | Specifies the name of the machine where the file for the <b>fb_script</b> resource resides. |

The following attributes are optional for the **fb\_script** resource:

- |                                  |   |
|----------------------------------|---|
| <b>-a comments=</b> <i>Value</i> | Describes the resource.   |
| <b>-a source=</b> <i>Value</i>   | Specifies an existing <b>fb_script</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location. |

## fix\_bundle Resource

A **fix\_bundle** resource represents a file containing **fix** keywords to be used by the **instfix** command, which is called by the NIM **cust** and **fix\_query** operations. NIM mounts the **fix\_bundle** resource on the client so it can be used by the local **instfix** command. NIM automatically unmounts the resource when the operation has completed.

A fix can include either a single fileset update or multiple fileset updates that are related in some way; fixes are identified by unique keywords. When a fix is identified with an Authorized Program Analysis Report (APAR) number, it includes all the fileset updates that are necessary to fix the reported software problem identified by that number.

## Defining a fix\_bundle Resource

The command line syntax for defining a **fix\_bundle** resource is:

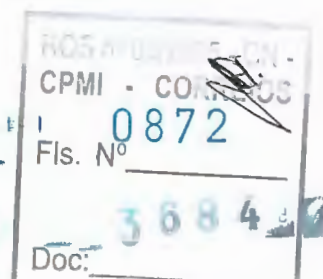
```
nim -o define -t fix_bundle -a Attribute=Value ... fix_bundleName
```

The following attributes are required for the **fix\_bundle** resource:

- |                                  |  |
|----------------------------------|--|
| <b>-a location=</b> <i>Value</i> | Specifies the full path name of the file containing the list of fixes to manage.     |
| <b>-a server=</b> <i>Value</i>   | Specifies the name of the machine where the <b>fix_bundle</b> resource file resides. |

The following attributes are optional for the **fix\_bundle** resource:

- |                                  |  |
|----------------------------------|--|
| <b>-a comments=</b> <i>Value</i> | Describes the resource.  |
| <b>-a group=</b> <i>Value</i>    | Specifies the name of a resource group to which this resource should be added.   |
| <b>-a verbose=</b> <i>Value</i>  | Displays information for debugging. To show maximum detail, specify a value of 5.  |
| <b>-a source=</b> <i>Value</i>   | Specifies an existing <b>fix_bundle</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location. |





## home Resource

A **home** resource represents a directory in which client **/home** directories are maintained. When this type of resource is allocated to a client, NIM creates a subdirectory for the client's exclusive use. This allocated subdirectory is subsequently initialized when you perform the **dkls\_init** or **dtls\_init** operation. After initialization, any time the client performs a network boot, the client NFS mounts this subdirectory over **/home** to gain access to the **home** directory that has been set up for its use. This subdirectory remains mounted over **/home** on the client as long as the client is running.

**Note:** Whenever this resource is deallocated, NIM removes the subdirectory that was created for the client's use. Therefore, back up any files you want to save in the client's subdirectory before you deallocate a resource of this type.

### Defining a home Resource

The command line syntax for defining a **home** resource is:

```
nim -o define -t home -a Attribute=Value ... HomeName
```

The following attributes are required for the **home** resource:

- |                          |   |
|--------------------------|---|
| <b>-a location=Value</b> | Specifies the full path name of the parent directory for the client <b>/home</b> directories.       |
| <b>-a server=Value</b>   | Specifies the name of the machine where the directory for the <b>home</b> resource will be created. |

The following attributes are optional for the **home** resource:

- |                          |   |
|--------------------------|---|
| <b>-a comments=Value</b> | Describes the resource.   |
| <b>-a group=Value</b>    | Specifies the name of a resource group to which this resource should be added.    |
| <b>-a verbose=Value</b>  | Displays information for debugging. To show maximum detail, specify a value of 5. |

## image\_data Resource

An **image\_data** resource represents a file that contains information for the BOS installation program. This information describes how physical disks and file systems should be configured in the root volume group during installation. Normally, the BOS installation program determines default values that should be used, or uses an **image.data** file from a **mksysb** being restored. Use a customized **image\_data** resource only in special cases.

A sample **image.data** file (*SPOT\_Offset/usr/lpp/bosinst/image.template*) is located on the **SPOT** resource server. For more information about the **image.data** file, see the *AIX 5L Version 5.2 Files Reference*.

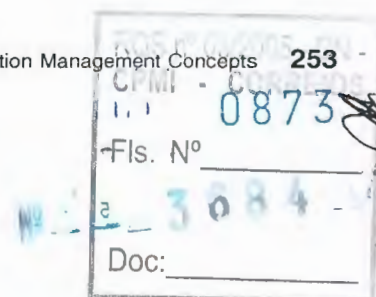
### Defining an image\_data Resource

The command line syntax for defining an **image\_data** resource is:

```
nim -o define -t image_data -a Attribute=Value ... image_dataName
```

The following attributes are required for the **image.data** resource:

- |                          |  |
|--------------------------|--|
| <b>-a location=Value</b> | Specifies the full path name of the <b>image_data</b> resource file.                 |
| <b>-a server=Value</b>   | Specifies the name of the machine where the <b>image_data</b> resource file resides. |







The following attributes are optional for the **image.data** resource:

<b>-a comments=</b> <i>Value</i>	Describes the resource.
<b>-a group=</b> <i>Value</i>	Specifies the name of a resource group to which this resource should be added.
<b>-a verbose=</b> <i>Value</i>	Displays information for debugging. To show maximum detail, specify a value of 5.
<b>-a source=</b> <i>Value</i>	Specifies an existing <b>image.data</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location.

## installp\_bundle Resource

An **installp\_bundle** resource represents a file that contains the names of filesets that should be managed by NIM. During an installation or maintenance operation, NIM mounts the **installp\_bundle** file on the client machine so it can be used by the local **installp** command. NIM automatically unmounts the resource from the client when the operation has completed.

### Defining an installp\_bundle Resource

The command line syntax for defining an **installp\_bundle** resource is:

```
nim -o define -t installp_bundle -a Attribute=Value ... installp_bundleName
```

The following attributes are required for the **installp\_bundle** resource:

<b>-a location=</b> <i>Value</i>	Specifies the full path name of the file containing the list of software to manage.
<b>-a server=</b> <i>Value</i>	Specifies the name of the machine where the <b>installp_bundle</b> resource file resides.

The following attributes are optional for the **installp\_bundle** resource:

<b>-a comments=</b> <i>Value</i>	Describes the resource.
<b>-a group=</b> <i>Value</i>	Specifies the name of a resource group to which this resource should be added.
<b>-a verbose=</b> <i>Value</i>	Displays information for debugging. To show maximum detail, specify a value of 5.
<b>-a source=</b> <i>Value</i>	Specifies an existing <b>installp_bundle</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location.

## lpp\_source Resource

An **lpp\_source** resource represents a directory in which software installation images are stored. If the **lpp\_source** contains the minimum set of support images required to install a machine, it is given the **simages** attribute and can be used for BOS installation (**bos\_inst**) operations. If an **lpp\_source** does not contain enough software to be an **simages lpp\_source**, then it can only be used in NIM **cust** operations to install software on running machines and **SPOTs**.

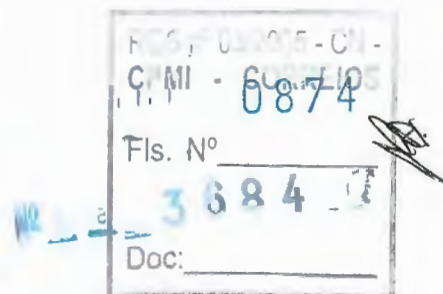
NIM uses an **lpp\_source** for an installation operation by first mounting the **lpp\_source** on the client machine. The **installp** commands are then started on the client using the mounted **lpp\_source** as the source for installation images. When the installation operation has completed, NIM automatically unmounts the resource.

In addition to providing images to install machines, **lpp\_source** resources can also be used to create and update **SPOT** resources.

**Note:** When copying device images to a directory that you plan to define as an **lpp\_source**, be sure to copy all the device images for a given type of device. For example:

```
cp /cds/usr/sys/inst.images/devices.pci.* lpp_source_directory
```

You can define an **lpp\_source** in several ways:







- If a directory containing installation images already exists, it can be directly defined as an **lpp\_source** resource.
- If a directory should be created and populated by NIM with the default set of support images for a BOS install, use the **source** attribute when defining the resource. This attribute specifies the name of the device that contains the installation images. NIM copies the software images from this device into the location specified for the **lpp\_source**. The images copied will include those from the **simages** list, all available device support, and some additional software that is typically installed as well (for example, X11).
- If an **lpp\_source** should be created from a source device using a list of software other than the default set of images, specify the **packages** attribute when defining the **lpp\_source**. Use the **packages** attribute to list the alternative set of software images to copy.

The size of an **lpp\_source** may vary greatly with the amount of software it includes. A minimum **lpp\_source** with just enough software to qualify for the **simages** attribute may be under 100 MB, but a default **lpp\_source** created from a CD-ROM may be over 350 MB. It is recommended that a separate file system be created to contain an **lpp\_source** so the space can be more easily managed. By default, NIM automatically expands a file system as needed when creating an **lpp\_source** and copying images from a source device.

Beginning in AIX 5.2, the **simages** message displays only if the user is creating an **lpp\_source** resource with the default installation packages. The **simages** message will display if the **simages** attribute could not be set for the **lpp\_source**. If a user creates an **lpp\_source** and specifies a list of packages, the **simages** message is not printed. The **simages** attribute is set correctly, whether or not a **simages** message is printed or not.

If a user attempts to do an **rte** BOS installation with an **lpp\_source** that does not have the **simages** attribute, the user receives an error. The error message instructs the user to run **nim -o check** on the **lpp\_source** to determine the missing packages needed for an **rte** BOS installation. Whenever a user runs **nim -o check** on an **lpp\_source** after it has been created, the **simages** message is printed if the **lpp\_source** does not contain all the images needed for a **rte** BOS installation.

## Defining an lpp\_source Resource

The command line syntax for defining an **lpp\_source** resource is:

```
nim -o define -t lpp_source -a Attribute=Value ... lpp_sourceName
```

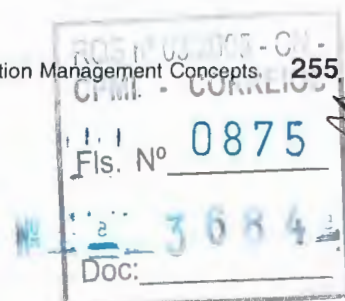
The following attributes are required for the **lpp\_source** resource:

- |                   |   |
|-------------------|---|
| -a location=Value | Specifies the directory that will contain the installation images.              |
| -a server=Value   | Specifies the name of the machine where the <b>lpp_source</b> is to be created. |

The following attributes are optional for the **lpp\_source** resource:

- |                   |  |
|-------------------|--|
| -a comments=Value | Describes the <b>lpp_source</b> .  |
| -a group=Value    | Specifies the name of a resource group to which this resource should be added.   |
| -a packages=Value | Specifies a list of filesets to copy into the <b>lpp_source</b> if the default list of images is not desired.  |
| -a source=Value   | Identifies the source device for copying installation images when defining the <b>lpp_source</b> . This attribute is not required if the location of the <b>lpp_source</b> already contains installation images. |
| -a verbose=Value  | Displays information for debugging. To show maximum detail, specify a value of 5.  |

If a migration installation will be performed on NIM client machines, the **lpp\_source** used in the operation must contain all the required software to migrate the machine.







If the directory specified in the **location** attribute does not exist, NIM will create the directory. NIM will also remove the directory and its contents if the **lpp\_source** is later removed.

## mksysb Resource

A **mksysb** resource represents a file that is a system backup image created using the **mksysb** command. This type of resource can be used as the source for the installation of a client. The **mksysb** image must reside on the hard disk of a machine in the NIM environment in order to be defined as a resource. It cannot be located on a tape or other external media.

A **mksysb** resource can be defined from an image that already exists on the hard disk of the NIM master or any NIM client. If such an image does not exist, it can be created when the resource is defined. To create the image when the resource is defined, specify the name of the NIM client that will be the **source** for the backup, and set the **mk\_image** attribute to **yes** in the command to define the **mksysb** resource. Use an **exclude\_files** resource to list any files and directories that should not be included in the backup image.

### Defining a mksysb Resource

The command line syntax for defining a **mksysb** resource is:

```
nim -o define -t mksysb -a Attribute=Value ... mksysbName
```

The following attributes are required for the **mksysb** resource:

- |                          |  |
|--------------------------|--|
| <b>-a location=Value</b> | Specifies the full path name of the <b>mksysb</b> image.                                     |
| <b>-a server=Value</b>   | Specifies the name of the machine where the <b>mksysb</b> image resides or is to be created. |

The following attributes are optional for the **mksysb** resource:

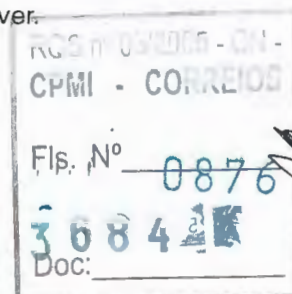
- |                               |  |
|-------------------------------|--|
| <b>-a comments=Value</b>      | Describes the <b>mksysb</b> .  |
| <b>-a exclude_files=Value</b> | Specifies an <b>exclude_files</b> resource to use to exclude files and directories from the system backup.   |
| <b>-a group=Value</b>         | Specifies the name of a resource group to which this resource should be added.   |
| <b>-a mk_image=Value</b>      | Specifies the flag to use to create a <b>mksysb</b> image from a machine in the NIM environment.   |
| <b>-a mksysb_flags=Value</b>  | Specifies the flags to use to tell the command how to create the backup.   |
| <b>-a size_preview=Value</b>  | Specifies the flag to verify that space is available before creating a <b>mksysb</b> image.  |
| <b>-a source=Value</b>        | Specifies the name of the machine to be backed up in the <b>mksysb</b> image.  |
| <b>-a verbose=Value</b>       | Displays information for debugging. To show maximum detail, specify a value of 5.  |
| <b>-a source=Value</b>        | Specifies the name of the machine to be backed up in the <b>mksysb</b> image if the <b>mk_image</b> attribute is specified. If the <b>mk_image</b> attribute is not specified, this value specifies an existing <b>mksysb</b> resource to be replicated when defining a new <b>mksysb</b> resource. The file pointed to by the source resource will be copied to the new location. |

## nim\_script Resource

The **nim\_script** resource is an internally managed NIM resource used to indicate that a script should be run by NIM as part of a NIM operation. The **nim\_script** resource is automatically allocated to support some NIM operations, and it is automatically deallocated when the operations complete.

Depending on the operation, NIM will use the following rules to determine which NIM server to place the **nim\_script** resource on:

- For a **bos\_inst** operation, the **nim\_script** resource will be placed on the **SPOT** server.





- For **cust** operation with an **lpp\_source**, the **nim\_script** resource will be placed on the **lpp\_source** server.
- For a **cust** operation without an **lpp\_source**, the **nim\_script** resource will be placed on the script server.
- Otherwise, the **nim\_script** resource will be placed on the NIM master.

## paging Resource

A **paging** resource represents a directory where client paging files are maintained. When this type of resource is allocated to a client, NIM creates a subdirectory for the client's exclusive use. This allocated subdirectory is initialized by the **dkls\_init** or **dtls\_init** operation, which creates a file in this subdirectory that the client configures as a paging device when it performs a network boot. By default, 32 MB are reserved for this file. A different value can be specified using the **size** flag when the **dkls\_init** or **dtls\_init** operation is performed.

After this resource has been initialized for a client, it is configured as a paging device by the client each time the client performs a network boot.

**Note:** If you subsequently deallocate this resource, NIM removes the **paging** file and the subdirectory it created for the client's use.

### Defining a paging Resource

The command line syntax for defining a **paging** resource is:

```
nim -o define -t paging -a Attribute=Value ... PagingName
```

The following attributes are required for the **paging** resource:

<b>-a location=Value</b>	Specifies the full path name of the parent directory for the client <b>paging</b> files.
<b>-a server=Value</b>	Specifies the name of the machine where the directory for the <b>paging</b> resource will be created.

The following attributes are optional for the **paging** resource:

<b>-a comments=Value</b>	Describes the resource.
<b>-a group=Value</b>	Specifies the name of a resource group to which this resource should be added.
<b>-a verbose=Value</b>	Displays information for debugging. To show maximum detail, specify a value of 5.

## resolv\_conf Resource

A **resolv\_conf** resource represents a file containing valid **/etc/resolv.conf** entries that define Domain Name Protocol name-server information for local resolver routines. A **resolv\_conf** resource can be allocated to a standalone machine as part of a **bos\_inst** operation or to a diskless or dataless machine as part of a **dkls\_init** or **dtls\_init** operation. Upon successful installation and reboot, the machine will be configured to use the domain name services defined by the resource.

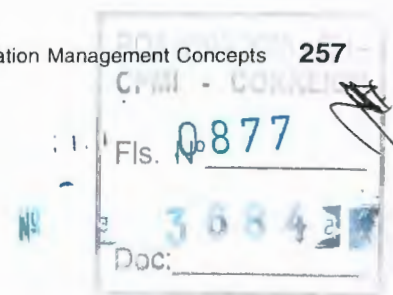
The following are sample entries in a **resolv\_conf** resource file:

```
nameserver 129.35.143.253
domain test.ibm.com
```

### Defining a resolv\_conf Resource

The command line syntax for defining a **resolv\_conf** resource is:

```
nim -o define -t resolv_conf -a Attribute=Value ... resolv_confName
```







The following attributes are required for the **resolv\_conf** resource:

- |                                  |   |
|----------------------------------|---|
| <b>-a location=</b> <i>Value</i> | Specifies the full path name of the file containing the information for domain name server (DNS) name resolution. |
| <b>-a server=</b> <i>Value</i>   | Specifies the name of the machine where the <b>resolv_conf</b> resource file resides.                             |

The following attributes are optional for the **resolv\_conf** resource:

- |                                  |   |
|----------------------------------|---|
| <b>-a comments=</b> <i>Value</i> | Describes the resource.   |
| <b>-a group=</b> <i>Value</i>    | Specifies the name of a resource group to which this resource should be added.  |
| <b>-a verbose=</b> <i>Value</i>  | Displays information for debugging. To show maximum detail, specify a value of 5.   |
| <b>-a source=</b> <i>Value</i>   | Specifies an existing <b>resolv_conf</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location. |

## root Resource

A **root** resource represents a directory in which client **root** directories are maintained. When this type of resource is allocated to a diskless or a dataless client, NIM creates a subdirectory for the client's exclusive use. This allocated subdirectory is subsequently initialized when you perform the **dkls\_init** or **dtls\_init** operation.

After initialization, anytime the client performs a network boot, the client NFS mounts this subdirectory over **/** to gain access to the **root** directory that has been set up for its use. This subdirectory remains mounted over **/** on the client as long as the client is running.

**Note:** Whenever this resource is deallocated, NIM removes the subdirectory that was created for the client's use. Therefore, any files you want to save in the client's subdirectory should be backed up before you deallocate a resource of this type.

## Defining a root Resource

The command line syntax for defining a **root** resource is:

```
nim -o define -t root -a Attribute=Value ... RootName
```

The following attributes are required for the **root** resource:

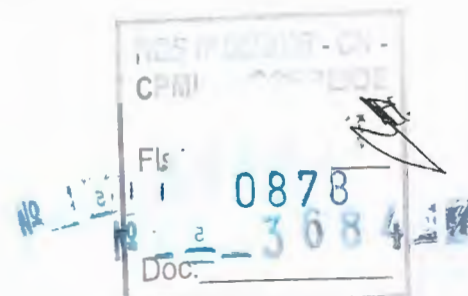
- |                                  |   |
|----------------------------------|---|
| <b>-a location=</b> <i>Value</i> | Specifies the full path name of the directory under which client <b>root</b> directories will be created. |
| <b>-a server=</b> <i>Value</i>   | Specifies the name of the machine where the directory for the <b>root</b> resource will be created.       |

The following attributes are optional for the **root** resource:

- |                                  |   |
|----------------------------------|---|
| <b>-a comments=</b> <i>Value</i> | Describes the resource.   |
| <b>-a group=</b> <i>Value</i>    | Specifies the name of a resource group to which this resource should be added.    |
| <b>-a verbose=</b> <i>Value</i>  | Displays information for debugging. To show maximum detail, specify a value of 5. |

## script Resource

A **script** resource represents a file that is a user-defined shell script. After it is defined, this type of resource can be used to perform processing on a client as part of a NIM **cust** or **bos\_inst** operation.





The **script** resources are always run by NIM after software installation is performed in **cust** or **host\_inst** operations. This allows the scripts to perform configuration processing on the client after all the software is installed. Multiple **script** resources can be allocated for client use, but the order in which the scripts will be run is not predictable.

**Note:** The **script** resources must not point to files that reside in the **/export/nim/scripts** directory. This directory is used for the **nim\_script** resource that is managed by NIM. NFS restrictions prevent defining multiple resources in the same location.

## Defining a script Resource

The command line syntax for defining a **script** resource is:

```
nim -o define -t script -a Attribute=Value ... ScriptName
```

The following attributes are required for the **script** resource:

- |                          |  |
|--------------------------|--|
| <b>-a location=Value</b> | Specifies the full path name of the <b>script</b> resource file.                 |
| <b>-a server=Value</b>   | Specifies the name of the machine where the <b>script</b> resource file resides. |

The following attributes are optional for the **script** resource:

- |                          |  |
|--------------------------|--|
| <b>-a comments=Value</b> | Describes the resource.  |
| <b>-a group=Value</b>    | Specifies the name of a resource group to which this resource should be added.   |
| <b>-a verbose=Value</b>  | Displays information for debugging. To show maximum detail, specify a value of 5.  |
| <b>-a source=Value</b>   | Specifies an existing <b>script</b> resource to be replicated when defining a new resource. The file pointed to by the source resource will be copied to the new location. |

## shared\_home Resource

A **shared\_home** resource represents a directory that can be used as a common **/home** directory by one or more clients. When this type of resource is allocated to a client, and when the **dkls\_init** or **dtls\_init** operation is performed, NIM configures the client's configuration to use this common directory. After initialization, anytime the client performs a network boot, the client NFS mounts this common directory over its **/home** directory. This common directory remains mounted as long as the client is running.

**Note:** Whenever this resource is deallocated, NIM only changes the client's configuration so that this directory is no longer used by the client. NIM does not remove the common directory.

## Defining a shared\_home Resource

The command line syntax for defining a **shared\_home** resource is:

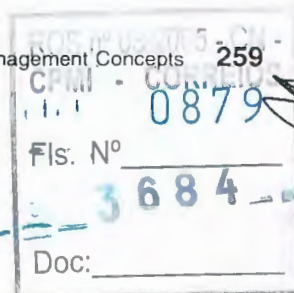
```
nim -o define -t shared_home -a Attribute=Value ... shared_homeName
```

The following attributes are required for the **shared\_home** resource:

- |                          |  |
|--------------------------|--|
| <b>-a location=Value</b> | Specifies the full path name of the directory to be used as a common <b>/home</b> directory among clients. |
| <b>-a server=Value</b>   | Specifies the name of the machine where the directory for the <b>shared_home</b> resource will be created. |

The following attributes are optional for the **shared\_home** resource:

- |                          |  |
|--------------------------|--|
| <b>-a comments=Value</b> | Describes the resource.  |
| <b>-a group=Value</b>    | Specifies the name of a resource group to which this resource should be added. |





-a verbose=Value

Displays information for debugging. To show maximum detail, specify a value of 5.



## SPOT (Shared Product Object Tree) Resource

The **SPOT (Shared Product Object Tree)** is a fundamental resource in the NIM environment. It is required to install or initialize all machine configuration types. A **SPOT** provides a **/usr** file system for diskless and dataless clients, as well as the network boot support for all clients.

Everything that a machine requires in a **/usr** file system, such as the AIX kernel, executable commands, libraries, and applications are included in the **SPOT**. Machine-unique information or user data is usually stored in the other file systems. A **SPOT** can be located on any standalone machine within the NIM environment, including the master. The **SPOT** is created, controlled, and maintained from the master, even though the **SPOT** can be located on another system.

You can create a **SPOT** by converting the **/usr** file system (**/usr SPOT**), or you can locate the **SPOT** elsewhere within the file system (**non-/usr SPOT**) on the server.

The **/usr SPOT** inherits all the optional software that is already installed on the server. All the clients using the **/usr SPOT** have access to the optional software installed on the server. The **non-/usr SPOT** can be used to manage a different group of optional software than those that are installed and licensed for the server.

Creating a **SPOT** by converting the **/usr** file system has the advantage of being fast and using much less disk space. However, this method does not give you the flexibility to choose which software packages will be included in the **SPOT**, because all the packages and filesets installed in the **/usr** file system of the machine serving the **SPOT** will be included in the **SPOT**. The second method, creating a **non-/usr SPOT**, uses more disk space, but it is more flexible. Initially, only the minimum set of software packages required to support NIM clients is installed in the **SPOT**, but additional packages and filesets can be installed. Also, it is possible to have multiple **SPOTs**, all with different additional packages and filesets installed, serving different clients.

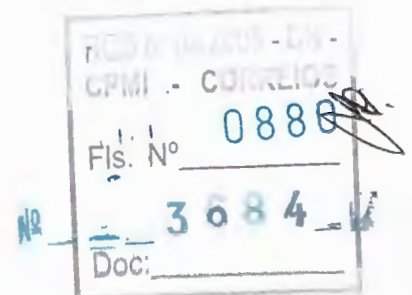
**Note:** Do not create a **non-/usr SPOT** in a subdirectory of the **/usr** file system.

A **SPOT** varies in size from 100 MB up to, and sometimes in excess of, 300 MB depending on the software that is installed. Because all device support is installed in the **SPOT** and the number of device filesets typically increases, the size is not easily predictable from one release of AIX to another.

**SPOTs** are used to support all NIM operations that require a machine to boot over the network. These operations are as follows:

- **bos\_inst**
- **maint\_boot**
- **diag**
- **dkts\_init**
- **dtls\_init**

When a **SPOT** is created, network boot images are constructed in the **/tftpboot** directory of the **SPOT** server, using code from the newly created **SPOT**. When a client performs a network boot, it uses **tftp** to obtain a boot image from the server. After the boot image is loaded into memory at the client, the **SPOT** is mounted in the client's RAM file system to provide all additional software support required to complete the operation.





Each boot image created is up to 4 MB in size. Before creating a **SPOT**, ensure there is sufficient space in the root (/) file system, or create a separate file system for **/tftpboot** to manage the space required for the network boot images.

A single network boot image can be accessed by multiple clients; therefore, the network boot image cannot contain any client-specific configuration information. The platform type is specified when the machine object is defined, while the network type is determined from the primary interface definition. Two files are created in the **/tftpboot** directory on the **SPOT** server for each client to be network-booted: *ClientHostName* and *ClientHostName.info*. The *ClientHostName* file is a link to the correct network boot image, while the *ClientHostName.info* file contains the client configuration information.

When the **SPOT** is defined (and created), the following occurs:

- The BOS image is retrieved from archive or, for **/usr** conversion, just the **root** directory is retrieved from archive (**/usr/lpp/bos/inst\_root**).
- The device support required to support NIM operations is installed.
- Network boot images are created in the **/tftpboot** directory.

To list the software installed in a **SPOT**, enter the following command:

```
nim -o lslpp SPOTName
```

If you want to change your **/usr SPOT** back to a normal **/usr** file system, you must remove the **SPOT** from the NIM database.

For information about software installation and maintenance tasks you can perform on a **SPOT**, see "Customizing NIM Clients and SPOT Resources" on page 187.

## Network Boot Images for AIX 4.2 SPOTs

Each network boot image supports a single network, platform, and kernel type. The network boot image files are named *SPOTName.Platform.Kernel.Network*. The network types are Token-Ring, Ethernet, and FDDI. The platform types are:

<b>rs6k</b> (AIX 5.1 and earlier)	Used for POWER family/POWER family2/P2SC/POWER-based MCA bus-based machines.
<b>rspc</b> (AIX 5.1 and earlier)	Used for POWER-based Reference Platform (PREP) Architecture-based machines.
<b>chrp</b>	Used for POWER-based Common Hardware Reference Platform (CHRP) Architecture-based machines.

The **rs6ksmp** platform for AIX 4.2 (and later) **SPOTs** is represented by the boot image with a platform type of **rs6k** and a kernel type of **mp**.

The kernel types are:

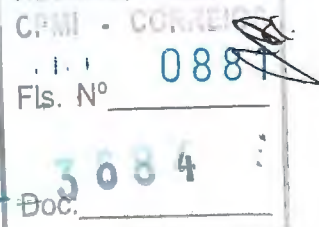
<b>up</b>	Used for single processor machines.
<b>mp</b>	Used for multiple processor machines.

Both **up** and **mp** boot images are created for each platform and network type. The network boot images located in **/tftpboot** for a **SPOT** named 42spot look similar to the following:

42spot.rs6k.mp.ent

42spot.rs6k.mp.fddi

42spot.rs6k.mp.tok







42spot.rs6k.up.ent  
42spot.rs6k.up.fddi  
42spot.rs6k.up.tok  
42spot.rspc.mp.ent  
42spot.rspc.mp.tok  
42spot.rspc.up.ent  
42spot.rspc.up.tok

The amount of space used in the **/tftpboot** directory for boot images may become very large. An AIX 4.2.1 (or later) **SPOT** that supports network boot for all possible combinations of platforms, kernel types, and network adapters may require as much as 60 MB in **/tftpboot**. If the same server serves multiple **SPOTs**, the space required in **/tftpboot** will be even more because each **SPOT** creates its own set of boot images.

## Network Boot Images for AIX 4.3 or later SPOTs

In AIX 4.3 or later, NIM creates by default only the boot images required to support the machines and network types that are defined in the environment. This situation should significantly reduce the amount of disk space used and the time required to create boot images from **SPOT** resources.

## Defining a SPOT Resource

The command line syntax for defining a **SPOT** resource is:

```
nim -o define -t spot -a Attribute=Value ... SPOTName
```

The following attributes are required for the **SPOT** resource:

- |                          |  |
|--------------------------|--|
| <b>-a location=Value</b> | Specifies the parent directory under which the <b>SPOT</b> is to be created.                 |
| <b>-a server=Value</b>   | Specifies the name of the machine where the <b>SPOT</b> is to be created.                    |
| <b>-a source=Value</b>   | Identifies the source device for installation images to create and install the <b>SPOT</b> . |

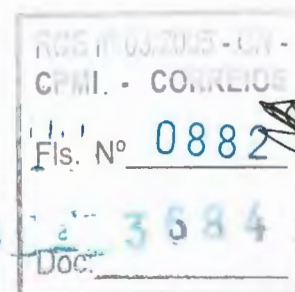
The following attributes are optional for the **SPOT** resource:

- |                                |   |
|--------------------------------|---|
| <b>-a auto_expand=Value</b>    | Expands the file system as needed when installing the <b>SPOT</b> . The default value is <b>yes</b> .                                   |
| <b>-a comments=Value</b>       | Describes the <b>SPOT</b> .   |
| <b>-a debug=Value</b>          | Builds debug-enabled network boot images. The default value is <b>no</b> .  |
| <b>-a installp_flags=Value</b> | Specifies the flags that describe how <b>installp</b> should install software into the <b>SPOT</b> . The default value is <b>agQX</b> . |
| <b>-a show_progress=Value</b>  | Shows <b>installp</b> output as <b>SPOT</b> is installed. The default value is <b>yes</b> .   |
| <b>-a verbose=Value</b>        | Displays information for debugging. To show maximum detail, specify a value of 5.   |

**Note:** The creation of a **SPOT**, by default, produces a large amount of output. Be sure to scan the output to look for nonfatal errors and warnings that may not be evident from a successful return code.

## tmp Resource

A **tmp** resource represents a directory where client **/tmp** files are maintained. When this type of resource is allocated to a client, NIM creates a subdirectory for the client's exclusive use. This allocated subdirectory is subsequently initialized when you perform the **dkls\_init** or **dtls\_init** operation. After initialization, anytime the client performs a network boot, the client NFS mounts this subdirectory over **/tmp** to gain access to the **/tmp** directory that has been set up for its use. This subdirectory remains mounted over **/tmp** on the client as long as the client is running.





**Note:** Whenever this resource is deallocated, NIM removes the subdirectory that was created for the client's use. Therefore, back up any files you want to save in the client's subdirectory before you deallocate a resource of this type.

## Defining a tmp Resource

The command line syntax for defining a **tmp** resource is:

```
nim -o define -t tmp -a Attribute=Value ... TmpName
```

The following attributes are required for the **tmp** resource:

- |                          |   |
|--------------------------|---|
| <b>-a location=Value</b> | Specifies the full path name of the directory where client/ <b>tmp</b> directories will be created. |
| <b>-a server=Value</b>   | Specifies the name of the machine where the directory for the <b>tmp</b> resource will be created.  |

The following attributes are optional for the **tmp** resource:

- |                          |   |
|--------------------------|---|
| <b>-a comments=Value</b> | Describes the resource.   |
| <b>-a group=Value</b>    | Specifies the name of a resource group to which this resource should be added.    |
| <b>-a verbose=Value</b>  | Displays information for debugging. To show maximum detail, specify a value of 5. |

## Distributed NIM Resources

Usually, a NIM administrator will use the NIM master as the server for all resources. This strategy keeps all resources together on one machine. However, there are several reasons to distribute resources onto client machines:

- If the NIM environment requires several large resources to be defined, it may not be possible to put them all on the same server because of disk space limitations. Creating resources on different machines allows the burden of disk consumption to be distributed over several machines.
- Serving resources from different machines helps avoid bottlenecks when performing NIM operations on large numbers of clients. Bottlenecks can occur on server machines or on network gateways, so it may be beneficial to distribute resources across servers running in different subnets.
- Multiple resources of the same type can be created on different machines to increase the availability of resources when servers are taken offline for scheduled maintenance.
- Some **SPOT** resources at certain levels cannot be served by some machines at certain levels. Specifically, **SPOT** creation is not supported when the level of AIX installed in the **SPOT** is higher than the level of AIX running on the server. When you are creating **SPOTs** at multiple levels, it may be necessary to distribute the **SPOTs** on different servers.

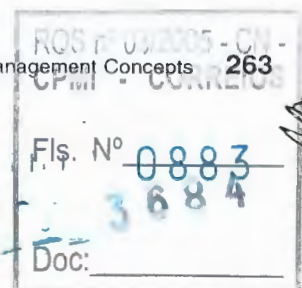
Distributing resources on different machines in the NIM environment is simply a matter of specifying the correct server information when the resource is defined. After the resources are created, they are used no differently than resources defined on the master.

---

## NIM Operations

A large number of operations can be performed to manage a NIM environment and perform software installation and maintenance. The Web-based System Manager and SMIT interfaces are designed to hide much of the detail required for the command line interface. Therefore, this section only documents the operations for the command line. All of this information applies to the other interfaces as well, but discussion of those interfaces is deferred to the online contextual help available for those applications.

Most NIM operations are performed by running the **nim** command with various attributes for each possible operation. The command line syntax is as follows:







```
nim -o OperationName -a Attribute=Value ... TargetName|TargetNames
```

The NIM operations you can perform are:

- “allocate”
- “alt\_disk\_install” on page 265
- “bos\_inst” on page 266
- “change” on page 271
- “check” on page 271
- “cust” on page 272
- “deallocate” on page 273
- “define” on page 273
- “diag” on page 274
- “dkls\_init” on page 274
- “dtls\_init” on page 275
- “fix\_query” on page 275
- “lppchk” on page 276
- “lppmgr” on page 276
- “maint” on page 277
- “maint\_boot” on page 277
- “reboot” on page 278
- “remove” on page 278
- “reset” on page 278
- “select” on page 279
- “showlog” on page 279
- “showres” on page 280
- “sync\_roots” on page 281
- “unconfig” on page 281
- “update” on page 282

## allocate

The **allocate** operation is used to make resources available to NIM clients for subsequent operations.

The command line syntax for the **allocate** operation is as follows:

```
nim -o allocate -a ResourceType=ResourceName ... TargetName|TargetNames
```

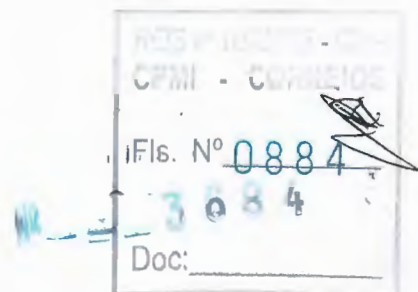
The target of an **allocate** operation may be a NIM client or group of NIM clients.

The following attribute can be specified for the **allocate** operation:

**-a ResourceType=ResourceName** (required)

Specifies the resource to allocate to the client, for example, `lpp_source=42_images`.

When a resource is allocated to a client, an entry is added to the **/etc/exports** file on the resource server to NFS export the resource to the client. The allocation count for the resource is also incremented. When the allocation count is greater than 0, the resource cannot be modified. During NIM operations, a client mounts and uses the resources that have been allocated to it.





## alt\_disk\_install

The **alt\_disk\_install** operation (available in AIX 4.3 or later) can be used to install a **mksysb** image on a client system's alternate disk or disks, or it can be used to clone a client running **rootvg** to an alternate disk.

The command line syntax for the **alt\_disk\_install mksysb** operation is as follows:

```
nim -o alt_disk_install -a source=mksysb -a mksysb=mksysb_resource \  
-a disk=target_disk(s) -a attribute=Value.... TargetName|TargetNames
```

The command line syntax for the **alt\_disk\_install rootvg** clone operation is as follows:

```
nim -o alt_disk_install -a source=rootvg -a disk=target_disk(s) \  
-a attribute=Value.... TargetName|TargetNames
```

The target of an **alt\_disk\_install** operation can be a standalone NIM client or a group of standalone NIM clients. The clients must also have the **bos.alt\_disk\_install.rte** fileset installed.

To display the alternate disk installation status while the installation is progressing, enter the following command on the master:

```
lsnim -a info -a Cstate ClientName
```

OR

```
lsnim -l ClientName
```

The following are required attributes for **alt\_disk\_install mksysb** operation:

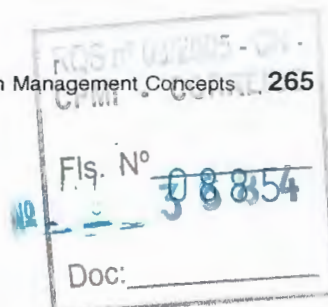
- |                                  |  |
|----------------------------------|--|
| <b>-a source=mksysb</b>          | Specifies the type of <b>alt_disk_install</b> to perform.  |
| <b>-a disk=target_disk(s)</b>    | Specifies the disks on the client system that the <b>mksysb</b> image will be restored. This disk or these disks must not currently contain any volume group definition. The <b>lspv</b> command should show these disks as belonging to volume group <b>None</b> . If you are specifying more than one disk, the disk names must be enclosed in a set of single quotes; for example, 'hdisk2 hdisk3'. |
| <b>-a mksysb=mksysb_resource</b> | Specifies the <b>mksysb</b> resource to use.   |

The following are required attributes for the **alt\_disk\_install rootvg** clone operation:


- |                               |  |
|-------------------------------|--|
| <b>-a source=rootvg</b>       | Specifies the type of <b>alt_disk_install</b> to perform.  |
| <b>-a disk=target_disk(s)</b> | Specifies the disks on the client system that the <b>mksysb</b> image will be restored. This disk or these disks must not currently contain any volume group definition. The <b>lspv</b> command shows these disks as belonging to volume group <b>None</b> . If you are specifying more than one disk, the disk names must be enclosed in a set of single quotes; for example, 'hdisk2 hdisk3'. |

The following are optional attributes that can be specified for both **alt\_disk\_install mksysb** and the **alt\_disk\_install rootvg** clone operation:

- |                              |  |
|------------------------------|--|
| <b>-a concurrent=Value</b>   | Specifies the maximum number of machines from the selected group that should be installing at any given time. This attribute is only valid when the target of the operation is a machine group. If specified, NIM will monitor the progress of all machines in the group and attempt to keep no more or less than the number specified installing until all machines in the group are installed. |
| <b>-a set_bootlist=Value</b> | Specifies whether to set the bootlist to point to the new <b>rootvg</b> when the install is complete. <i>Value</i> can be yes or no, where yes is the default value. The next time the system is rebooted, it will boot from the newly installed alternate disk if <i>Value</i> is set to yes.   |







<b>-a boot_client=</b> <i>Value</i>	Specifies whether to reboot the client when the <b>alt_disk_install</b> operation is completed. <i>Value</i> can be yes or no, where no is the default value. This attribute would normally be set only if the <b>set_bootlist</b> attribute was also set to yes.
<b>-a debug=</b> <i>Value</i>	Specifies whether to print debug ( <b>set -x</b> ) output from the <b>alt_disk_install</b> script. <i>Value</i> can be yes or no, where no is the default value. This output does not go to the screen, but is saved to the NIM log, <b>/var/adm/ras/nim.alt_disk_install</b> , on the client system. This file can be checked after the <b>alt_disk_install</b> has completed.
<b>-a image_data=</b> <i>Value</i>	Specifies the <b>image_data</b> resource to use when creating the new alternate <b>rootvg</b> and its logical volumes and file systems. The new volume group created must be large enough to restore the <b>mksysb</b> image or a copy of the running <b>rootvg</b> . An <b>exclude_files</b> attribute can also be used with an <b>alt_disk_install rootvg</b> clone to specify files or directories that should not be backed up.
<b>-a resolv_conf=</b> <i>Value</i>	Specifies the <b>resolv_conf</b> resource to use for configuring the domain and name resolution on the client system when the system is rebooted. This is the <b>/etc/resolv_conf</b> file that will be copied into the alternate disk's file system. This may be useful if the <b>mksysb</b> image you are using has a different <b>/etc/resolv_conf</b> file than the one you want the client to retain.
<b>-a script=</b> <i>Value</i>	Specifies the script resource to call at the end of the <b>alt_disk_install</b> operation. This script is called on the running system before the <b>/alt_inst</b> file systems are unmounted, so files can be copied from the running system to the <b>/alt_inst</b> file systems before the reboot. This is the only opportunity to copy or modify files in the alternate file system because the logical volume names will be changed to match those of <b>rootvg</b> , and they will not be accessible until the system is rebooted with the new alternate <b>rootvg</b> .
<b>-a time_limit=</b> <i>Value</i> ,	Specifies the maximum number of hours that should elapse before ceasing to initiate installation of additional members of the selected group of machines. This value can only be specified when limiting the number of concurrent operations on a group.
<b>-a verbose=</b> <i>Value</i>	Specifies whether to show files as they are being backed up for a <b>rootvg</b> clone, or to show files as they are being restored for a <b>mksysb</b> install. <i>Value</i> can be yes or no, where no is the default value. The output goes to the <b>alt_disk_install</b> log on the client, <b>/var/adm/ras/alt_disk_inst.log</b> .

The following are optional attributes that can be specified only for the **alt\_disk\_install rootvg** clone operation:

<b>-a exclude_files=</b> <i>Value</i>	Specifies an <b>exclude_files</b> resource to use to exclude files and directories from the <b>rootvg</b> . Files and directories specified in this file will not be copied to the new cloned <b>rootvg</b> .
<b>-a filesets=</b> <i>Value</i>	Specifies the list of filesets to install into the alternate <b>rootvg</b> after the clone of the <b>rootvg</b> is complete.
<b>-a fixes=</b> <i>Value</i>	Specifies the APARs to install into the alternate <b>rootvg</b> after the clone of the running <b>rootvg</b> . The fixes are in the format "IX123456" or "update_all".
<b>-a fix_bundle=</b> <i>Value</i>	Specifies the <b>fix_bundle</b> resource that lists the APARs to install into the alternate <b>rootvg</b> after the clone of the running <b>rootvg</b> .
<b>-a installp_bundle=</b> <i>Value</i>	Specifies an <b>installp_bundle</b> resource that lists filesets to install into the alternate <b>rootvg</b> after the clone of the running <b>rootvg</b> .
<b>-a installp_flags=</b> <i>Value</i>	Tells <b>installp</b> how to apply the filesets, <b>installp_bundle</b> , fixes, or <b>fix_bundles</b> attributes. The default value is <b>installp_flags=-acgX</b> .

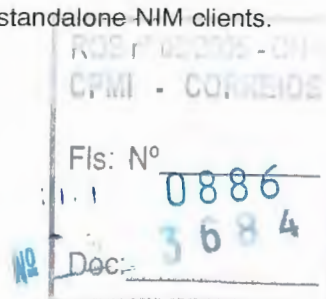
## bos\_inst

The **bos\_inst** operation is used to install the AIX BOS on standalone clients.

The command line syntax for the **bos\_inst** operation is as follows:

```
nim -o bos_inst -a source=Value -a Attribute=Value ... TargetName|TargetNames
```

The target of a **bos\_inst** operation can be a standalone NIM client or a group of standalone NIM clients.





The following NIM resources are required attributes that can be specified for the **bos\_inst** operation to install and customize a machine:

**-a lpp\_source=Value**

Identifies the **lpp\_source** resource to be used. The **lpp\_source** resource is only required for an **rte** installation. The **lpp\_source** resource specified must have the **simages** attribute set. However, if you are performing a **bos\_inst** operation using a **mksysb** resource and an **lpp\_source** resource, then the **simages** attribute is optional. The **lpp\_source** provides software for machine customization. It also provides the BOS image for installation if the **source** attribute is **rte**.

**-a source=Value**

Identifies the source for BOS run-time files. Valid values are:

**rte**                      Installs from a BOS image in the **lpp\_source**.

**mksysb**                Installs the machine from a **mksysb** image.

**-a spot=Value**

Identifies the **SPOT** resource to be used. The **SPOT** provides support for network boot and operations in the boot environment.

The following NIM resources are optional attributes that can be specified for the **bos\_inst** operation:

**-a accept\_licenses=Value**

Specifies whether license agreements should be accepted during BOS installation. Before the installation process can complete, this attribute must be set to **yes**. The default value is **accept\_licenses=no**. If the **bosinst\_data** resource resides on the NIM master, the **ACCEPT\_LICENSES** field in the **bosinst\_data** resource can also be set to **yes**. You can also set the **NIM\_LICENSE\_ACCEPT** global environment variable to **yes** on the NIM master.

**-a adapter\_def=Value**

Specifies the directory containing secondary adapter definition files. The **nimadapters** command parses a secondary-adapters stanza file to build the files required to add NIM secondary adapter definitions to the NIM environment as part of the **adapter\_def** resource. The **nimadapters** command does not configure secondary adapters. The actual configuration takes place during a **nim -o bos\_inst** or **nim -o cust** operation that references the **adapter\_def** resource.

**-a async=Value**

Specifies whether NIM should perform operations on group members asynchronously and not wait for the operation to complete on one member before beginning the operation on the next. The default value is **async=yes**.

**-a auto\_expand=Value**

Indicates whether to expand file systems when setting up a client for a **force\_push** installation. The default value is **auto\_expand=yes**.

**-a boot\_client=Value**

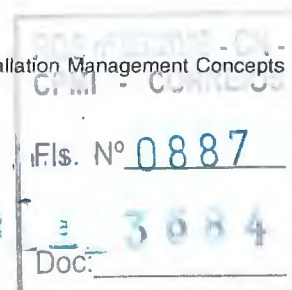
Indicates whether NIM should attempt to reboot the client immediately for BOS installation. The **boot\_client** attribute is the converse of the **no\_client\_boot** attribute. The default value is **boot\_client=yes**, indicating that NIM should attempt to reboot the client.

**-a bosinst\_data=Value**

Specifies the **bosinst\_data** resource to use for nonprompted installation.

**-a concurrent=Value**

Specifies the maximum number of machines from the selected group that should be installing at any given time. This attribute is only valid when the target of the operation is a machine group. If specified, NIM will monitor the progress of all machines in the group and attempt to keep no more or less than the number specified installing until all machines in the group are installed.







**-a filesets=Value**

Specifies a list of filesets to install on the target after BOS installation.

**-a force\_push=Value**

Indicates whether or not a **force\_push** installation should occur. A **force\_push** should be used for installing machines that are running, but are not configured with the NIM client fileset. See the "force\_push Attribute" on page 270 for more information.

**-a group=Value**

Specifies the name of a resource group to use for installation. A resource group can be specified as an alternative to specifying multiple resources as separate attributes. If a resource group is specified, and it contains a **SPOT** and **lpp\_source**, the **spot** and **lpp\_source** attributes are no longer required.

**-a image\_data=Value**

Specifies an **image\_data** resource to describe how physical and logical data is organized on the client.

**-a install\_bundle=Value**

Specifies an **install\_bundle** resource that lists filesets to install on the target after BOS installation.

**-a installp\_flags=Value**

Tells **installp** how to apply the filesets specified by the **filesets** or **install\_bundle** attributes. The default value is **installp\_flags=-agQX**.

**-a mkysyb=Value**

Provides the run-time files for BOS and other filesets if the **source** attribute is **mkysyb**. The level of BOS run-time files in the **mkysyb** must be equal to the level of the **SPOT** resource used for the installation.

If the level of the **SPOT** resource is greater than the level of the **mkysyb** resource, then an **lpp\_source** resource must be used and match the level of the **SPOT** resource. When this situation occurs, an update operation is performed by default.

**-a no\_client\_boot=Value**

Indicates whether the target should remain in the NIM environment after installation completes. The default value is **no**, indicating that the target system should remain in the NIM environment.

**-a physical\_loc=Value**

Specifies the physical location code or AIX location code of the installation disk to the BOS installation process. This attribute allows you to specify the location code for the installation disk or disks on the command line, and allows you to have a *generic bosinst.data* file that does not contain location code information.

To determine a disk's physical location code, type the following:

```
lsdev -Cc disk -l hdisk0 -F "name physloc"
```

**-a preserve\_res=Value**

Indicates whether resources in non-rootvg file systems should be preserved on the client system being installed. The default value is **preserve\_res=no**.

**-a resolv\_conf=Value**

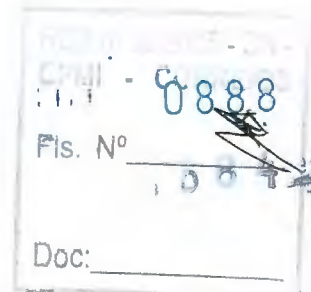
Specifies the **resolv\_conf** resource to use for configuring domain and name resolution on a client.

**-a script=Value**

Specifies the **script** resource to be run on the target system after all software has been installed.

**-a set\_bootlist=Value**

Indicates whether NIM should set the bootlist of the client so that the client boots over the network on the next reboot. Usually, **set\_bootlist** would be **yes** if the client is not going to be rebooted immediately for installation (**no\_client\_boot=yes** or **boot\_client=no**). The default value is **set\_bootlist=no**.





**-a show\_progress=Value**

Indicates whether status should be displayed for each group member when the installation target is a group of machines. The default value is **show\_progress=yes**.

**-a time\_limit=Value**

Specifies the maximum number of hours that should elapse before ceasing to initiate installation of additional members of the selected group of machines. This value can only be specified when limiting the number of concurrent operations on a group.

**-a verbose=Value**

Displays information for debugging. Valid values are 1-5. Use **verbose=5** to show maximum detail. The default is to show no debugging output.

When a **bos\_inst** operation is performed on a client, the following occurs:

On the **SPOT** server:

1. A link is created in **/tftpboot** to a boot image matching the platform type, kernel type, and network adapter of the client.
2. The **/etc/bootptab** file is updated with client information to allow the boot image to be used.
3. A **ClientName.info** file is created in **/tftpboot** to provide client-specific installation and configuration information in the boot environment.
4. The **/etc/tftpaccess.ctl** file is modified, if necessary, to allow access to the **/tftpboot** directory.

On the target system:

1. The bootlist is modified so the network adapter is the default boot device for normal mode boot, unless **no\_client\_boot=yes**, **set\_bootlist=no**, and **force\_push=no** are specified.
2. The client is rebooted to begin the installation, unless **no\_client\_boot=yes**, **boot\_client=no**, and **force\_push=no** are specified.

When the client boots over the network adapter, it obtains the boot image from the **SPOT** server. The boot image configures devices and sets up the machine for the BOS installation. The **Client.info** file is transferred to the client machine; and based on its contents, the network adapter is configured, routes are added, and NIM resources are mounted in the boot environment. Processing control is then passed to the BOS installation program.

## NIM BOS Installation Details

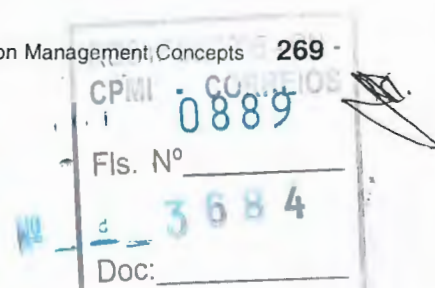
The BOS installation program requires access to an image that contains the BOS run-time files. This image is used by the BOS installation program to populate the target's **/usr** file system. In the NIM environment, this image can come from one of the following resources:

- A BOS run-time image that is part of the **lpp\_source** resource that has been allocated to the target
- A **SPOT** resource that has been allocated to the target
- A **mksysb** image that has been allocated to the target

A **spot** and **lpp\_source** are always required to support the **bos\_inst rte** operation. A **bos\_inst mksysb** operation only requires a **spot** resource be used.

To indicate which BOS image to use, specify the **source** attribute when performing the **bos\_inst** operation. The **source** attribute may have one of the following values:

- rte** When an **rte** value (the default) is used for the **source** attribute, NIM directs the BOS installation program to use the BOS run-time image that is in the **lpp\_source** directory. This image contains only the BOS run-time files; it does not contain any optional software packages. Selecting an **rte** source may increase the BOS installation time, because the BOS installation program installs the





appropriate device support after populating the target's **/usr** file system to make the target viable. The installation time may also be increased due to additional **installp** activity during the NIM customization phase.



**Note:** The **rte** source must be used when performing BOS migration installation.

### **mksysb**

Using **mksysb** as the source results in a target machine that has the same configuration as the machine from which the **mksysb** image was created. This may save installation and configuration time. The **mksysb** images could be very large, and the installation will fail if the target does not have enough disk space to accommodate the image.

After the installation is initiated from the master, the NIM master attempts to contact the target and execute a script that will force the system to reboot. The target system issues a BOOTP request to the server after it has shut down. The **bos\_inst** operation is considered complete even if the target does not immediately issue a BOOTP request. The target must issue a BOOTP request to load a network boot image from the server to start the installation.

If the master is unable to contact the target system for any reason (for example, the system is turned off, it is not a running NIM client, or there is a network problem), a message is displayed and user intervention is then required at the target to issue the BOOTP request using the IPL ROM. See "Bootting a Machine Over the Network" on page 323.

By default (**no\_nim\_client=no**), NIM also includes the customization required for the target to remain a NIM client after the install. This customization includes the installation and configuration of the **bos.sysmgt.nim.client** fileset and its requisite filesets, **bos.net.tcp.client** and **bos.net.nfs.client**, so that the NIM master can communicate with and control the client after installation. The **installp\_flags** are passed to the **installp** command for installing the software on the standalone client. The **filesets** attribute can be used to install a list of additional filesets or software packages from the allocated **lpp\_source**.

To display BOS installation status information while the installation is progressing, enter the following command on the master:

```
lsnim -a info -a Cstate ClientName
```

OR

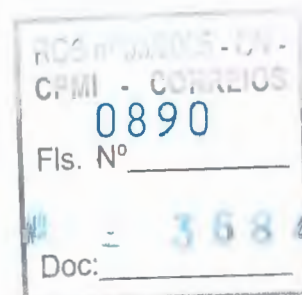
```
lsnim -l ClientName
```

Errors in the allocation of a **nim\_script** or **boot** resource type are fatal errors because the network BOS installation process cannot proceed without these resources. On the other hand, any error encountered during the attempt to cause the target to issue a BOOTP request is a nonfatal error to NIM because, at that point, NIM has successfully initialized the environment to perform a network installation. As soon as the target has successfully loaded its allocated network boot image, the BOS installation process begins.

### **force\_push** Attribute

When assigned a value of **yes**, the **force\_push** attribute tells NIM that the target of the **bos\_inst** operation does not necessarily have the **bos.sysmgt.nim.client** fileset installed and configured. NIM will attempt to NFS mount or copy the minimal client support to the target system to perform an unattended installation or migration of the base operating system. If client support is copied to the target machine, NIM will automatically expand the necessary file systems on the target unless the **auto\_expand** attribute to **bos\_inst** is set to **no**.

The **force\_push** attribute requires that the client grant root **rsh** permissions to the master and that the key on the client be in the normal position. The **force\_push** attribute also requires that a **bosinst\_data** file be







allocated to the target machine to indicate that a no-prompt installation should occur. The **force\_push** attribute is set to **yes** by setting the Force Unattended Installation Enablement? option to **yes** when using SMIT to perform the **bos\_inst** operation.

### boot\_client Attribute

When assigned a value of **no**, the **boot\_client** attribute is used to instruct NIM not to attempt to initiate the BOS installation on the target machine after setting up the installation with the **bos\_inst** operation. This allows a BOS installation to be set up while deferring the actual installation until the client is rebooted at a later time. Also, if the client is not a running machine, this attribute will avoid waiting for the reboot attempt to time-out or fail. If the installation of the client system is going to be initiated later from the server, the normal mode boot device list on the client must be set so that a network boot is attempted when the client is rebooted. No attempt is made to modify the boot list when **boot\_client** is set to **no** unless the **force\_push** or **set\_bootlist** attributes are specified and set to a value of **yes**. The **boot\_client** attribute is set to **no** by setting Initiate Boot Operation on Client to **no** when using SMIT to perform the **bos\_inst** operation.

### set\_bootlist Attribute

The **set\_bootlist** attribute can be used with the **boot\_client** attribute to modify the boot device list on the client for normal mode so a network boot is attempted when the client is rebooted. It is not necessary to specify the **set\_bootlist** attribute if the **force\_push** attribute is set to **yes** or if **boot\_client** is unspecified or set to **yes**. In both instances, the boot list will be modified as the default. The only valid values for **set\_bootlist** are **yes** and **no**. The **set\_bootlist** attribute is set to **yes** by setting Set Boot List if Boot not Initiated on Client? when using SMIT to perform the **bos\_inst** operation.

### preserve\_res Attribute

The **preserve\_res** attribute can be used to preserve the NIM database definitions for resources residing on a NIM client that is being reinstalled. When set to **yes**, any resources that reside in file systems which are being preserved by the BOS installation process will also be preserved.

## change

The **change** operation is used to modify attributes of NIM objects. The command line syntax is as follows:

```
nim -F -o change -a Attribute=Value ... TargetName|TargetNames
```

**-F** (optional) Tells NIM to **force** the operation if the target is currently in use.

The target of a **change** operation can be any network, machine, resource, or group in the NIM environment. Not all attributes can be modified on targets. Usually, the attributes are changed automatically as parts of other operations, so there is little need for you to use the **change** operation explicitly.

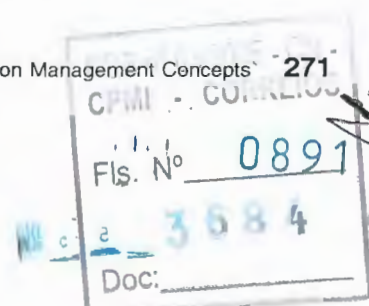
## check

The **check** operation is used to verify the usability of a machine or resource in the NIM environment.

The command line syntax for the **check** operation is as follows:

```
nim -F -o check -a debug=Value TargetName|TargetNames
```

The target of a **check** operation can be any NIM client, a group of NIM clients, a **SPOT** resource, or an **lpp\_source** resource.







The flags and attributes that can be specified for the **check** operation are as follows:

- F** (optional) Tells NIM to "force" the operation if the target is currently in use. If the **-F** flag is specified when the target is a **SPOT** resource, it will force the **SPOT**'s network boot images to be rebuilt. The **-F** flag is typically not required when performing the **check** operation on client machines.
- a debug=Value** (optional) Builds a **SPOT**'s network boot images in debug mode if **debug=yes** is specified. This attribute is only valid if the target is a **SPOT** resource. The default value is **debug=no**. For more information on the **debug** attribute, refer to "Producing Debug Output from a Network Boot Image" on page 318.

When applied to NIM clients, the **check** operation updates the machine state (**Mstate**) of the client. A ping test is performed to check whether the client is reachable. After the **check** operation is performed, the client's **Mstate** is set to either **running** or **not running**.

When applied to **SPOT** resources, the **check** operation performs root synchronization for diskless and dataless clients and rebuilds the **SPOT**'s network boot images, if necessary.

When applied to **lpp\_source** resources, the **check** operation rebuilds the table of contents (**.toc**) file in the **lpp\_source** directory. It also determines whether all filesets are included in the resources to qualify the **lpp\_source** for the **simages** attribute.

## cust

The **cust** operation is used to install software filesets and updates on standalone clients and **SPOT** resources.

See "Customizing NIM Clients and SPOT Resources" on page 187 for information on performing a software customization of standalone NIM clients.

The command line syntax for the **cust** operation is as follows:

```
nim -o cust -a Attribute=Value ... TargetName|TargetNames
```

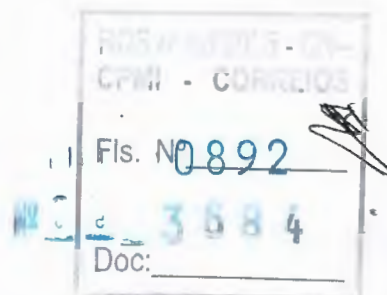
The target of a **cust** operation can be a standalone NIM client, a group of standalone NIM clients, or a **SPOT** resource.

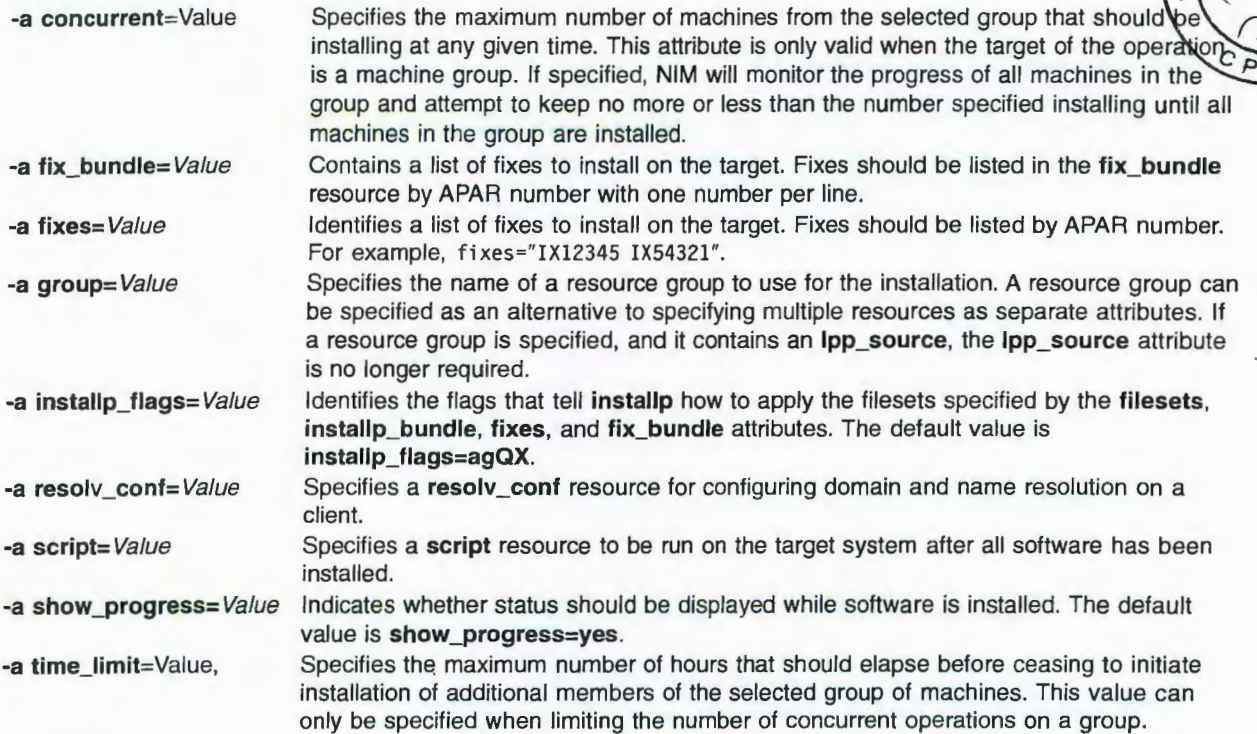
The following are required attributes that can be specified for the **cust** operation:

- a filesets=Value** Specifies a list of filesets to install on the target. This attribute is required unless an **installp\_bundle** is used for the operation.
- a installp\_bundle=Value** Specifies an **installp\_bundle** resource that lists filesets to install on the target. This attribute is required unless the **filesets** attribute is specified.
- a lpp\_source=Value** Identifies the **lpp\_source** resource that will provide the installation images for the **cust** operation.

The following are optional attributes that can be specified for the **cust** operation:

- a accept\_licenses=Value** Specifies whether software licenses should be automatically accepted during installation. If **accept\_licenses=yes**, the **-Y** flag is passed on the **installp** command and licenses are automatically accepted. If **accept\_licenses=no**, license processing is controlled by the **installp\_flags** attribute. The default value is **accept\_licenses=no**.
- a async=Value** Specifies whether NIM should perform operations on group members asynchronously and not wait for the operation to complete on one member before beginning the operation on the next. The default value is **async=yes**.





The **dealloc** operation is used to unlock and unexport resources when they are no longer needed by NIM clients. It is generally unnecessary to perform explicit deallocations after NIM operations, because upon successful completion, operations will automatically deallocate resources from the clients.

```
nim -o deallocate -a ResourceType=ResourceName ... -a subclass=all TargetName|TargetNames
```

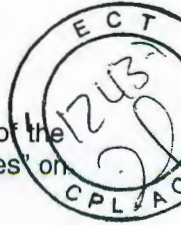
The following list includes all the attributes that can be specified for the **deallocate** operation:

- |  |  |
|--|--|
| <b>-a <i>ResourceType=ResourceName</i></b> | Specifies the resource to deallocate from the client, for example, <code>1pp_source=42_images</code> . This attribute is required. |
| <b>-a <b>subclass=all</b></b>              | Specifies that all resources should be deallocated from the target. This attribute is optional.                                    |

## define

```
nim -o define -t ObjectType -a Attribute=Value ... ObjectName
```





The attributes for the **define** operation vary for the different object types. For a complete description of the attributes required to define the various NIM objects, see "NIM Networks" on page 244, "NIM Machines" on page 239, "NIM Resources" on page 248, and "NIM Groups" on page 282.

## diag

The **diag** operation is used to prepare resources for a client to be network-booted into diagnostics mode.

The command line syntax for the **diag** operation is as follows:

```
nim -o diag -a Attribute=Value ... TargetName|TargetNames
```

The target of a **diag** operation can be any standalone NIM client or group of standalone NIM clients.

The following are required attributes that can be specified for the **diag** operation:

**-a spot=Value** Specifies the **SPOT** resource to be used to provide network boot and diagnostics support.

The following are optional attributes that can be specified for the **diag** operation:

**-a group=Value** Specifies the name of a resource group to use for the operation. A resource group can be specified as an alternative to specifying multiple resources as separate attributes.

**-a verbose=Value** Displays information for debugging. Valid values are 1-5. Use **verbose=5** to show maximum detail. The default is to show no debugging output.

## dkls\_init

The **dkls\_init** operation is used to prepare resources for use by a diskless client.

The command line syntax for the **dkls\_init** operation is as follows:

```
nim -o dkls_init -a Attribute=Value ... TargetName|TargetNames
```

The target of a **dkls\_init** operation can be any diskless NIM client or group of diskless NIM clients.

The following are required attributes that can be specified for the **dkls\_init** operation:

**-a dump=Value** Specifies the **dump** resource that contains client dump files.

**-a paging=Value** Specifies the **paging** resource that contains client paging files.

**-a root=Value** Specifies the **root** resource that contains the client root (/) directories. The **root** resource must be served by the same machine that serves the **SPOT**.

**-a spot=Value** Specifies the **SPOT** resource to be used to provide network boot support and the **/usr** file system for clients.

~~The following are optional attributes that can be specified for the **dkls\_init** operation:~~

**-a group=Value** Specifies the name of a resource group to use for the installation. A resource group can be specified as an alternative to specifying multiple resources as separate attributes.

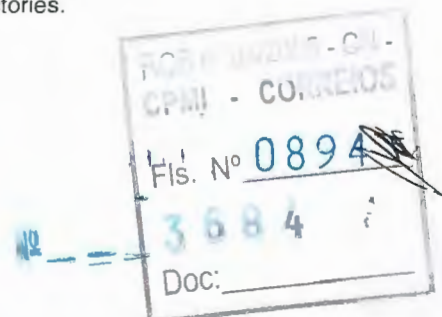
**-a home=Value** Specifies the **home** resource that contains client **/home** directories.

**-a resolv\_conf=Value** Specifies the **resolv\_conf** resource to configure Domain Name Protocol name server information on the client.

**-a shared\_home=Value** Specifies the **shared\_home** resource that contains a common **/home** directory for multiple clients.

**-a size=Value** Specifies the size in megabytes for client paging files.

**-a tmp=Value** Specifies the **tmp** resource that contains client **/tmp** directories.



**-a verbose=Value**

Displays information for debugging. Valid values are 1-5. Use **verbose=5** to show maximum detail. The default is to show no debugging output.



The **dkls\_init** operation populates client directories and creates client paging and dump files. A network boot image is also allocated to the client. When the client boots over the network, it obtains the boot image and is configured to mount the remaining resources.

## dtls\_init

The **dtls\_init** operation is used to prepare resources for use by a dataless client.

The command line syntax for the **dtls\_init** operation is as follows:

```
nim -o dtls_init -a Attribute=Value ... TargetName|TargetNames
```

The target of a **dtls\_init** operation can be any dataless NIM client or group of dataless NIM clients.

The following are required attributes that can be specified for the **dtls\_init** operation:

- |                      |  |
|----------------------|--|
| <b>-a dump=Value</b> | Specifies the <b>dump</b> resource that contains client dump files.  |
| <b>-a spot=Value</b> | Specifies the <b>SPOT</b> resource to be used to provide network boot support and the <b>/usr</b> file system for clients.   |
| <b>-a root=Value</b> | Specifies the <b>root</b> resource that contains the client root ( <b>/</b> ) directories. The <b>root</b> resource must be served by the same machine that serves the <b>SPOT</b> . |

The following are optional attributes that can be specified for the **dtls\_init** operation:

- |                             |  |
|-----------------------------|--|
| <b>-a paging=Value</b>      | Specifies the paging resource containing client paging files.  |
| <b>-a group=Value</b>       | Specifies the name of a resource group to use for the installation. A resource group can be specified as an alternative to specifying multiple resources as separate attributes. |
| <b>-a home=Value</b>        | Specifies the <b>home</b> resource that contains client <b>/home</b> directories.  |
| <b>-a resolv_conf=Value</b> | Specifies the <b>resolv_conf</b> resource to configure Domain Name Protocol name server information on the client.   |
| <b>-a shared_home=Value</b> | Specifies the <b>shared_home</b> resource that contains a common <b>/home</b> directory for multiple clients.  |
| <b>-a size=Value</b>        | Specifies the size in megabytes for client paging files.   |
| <b>-a tmp=Value</b>         | Specifies the <b>tmp</b> resource that contains client <b>/tmp</b> directories.  |
| <b>-a verbose=Value</b>     | Displays information for debugging. Valid values are 1-5. Use <b>verbose=5</b> to show maximum detail. The default is to show no debugging output.                               |

The **dtls\_init** operation populates client directories and creates client paging and dump files. A network boot image is also allocated to the client. When the client boots over the network, it obtains the boot image and is configured to mount the remaining resources.

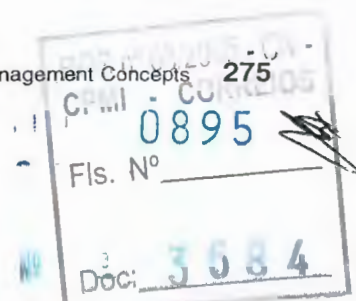
## fix\_query

The **fix\_query** operation is used to display whether specified fixes are installed on a client machine or a SPOT resource.

The command line syntax for the **fix\_query** operation is as follows:

```
nim -o fix_query -a Attribute=Value ... TargetName|TargetNames
```

The target of a **fix\_query** operation can be any standalone NIM client, group of standalone NIM clients, or SPOT resource.







The following are optional attributes that can be specified for the **fix\_query** operation:

- a fix\_bundle=Value** Specifies a **fix\_bundle** resource containing a list of fix keywords. This attribute is required unless the **fixes** attribute is specified for the operation.
- a fixes=Value** Specifies a list of keywords for the **fix\_query** operation. Fix keywords are APAR numbers used to identify software updates that can span multiple filesets. This attribute is required unless a **fix\_bundle** is used for the operation.
- a group=Value** Specifies the name of a resource group to use for the operation. A resource group can be specified as an alternative to specifying multiple resources as separate attributes.
- a fix\_query\_flags=Value** Tells the **fix\_query** operation how to display information. Valid flags are those used by the **instfix** command.
- a show\_progress=Value** Indicates whether status should be displayed as the operation is performed. The default value is **show\_progress=yes**.

**Note:** There are no required attributes for the **fix\_query** operation.

## lppchk

The **lppchk** operation is used to verify that software was installed successfully by running the **lppchk** command on a NIM client or **SPOT** resource.

The command line syntax for the **lppchk** operation is as follows:

```
nim -o lppchk -a Attribute=Value ... TargetName|TargetNames
```

The target of a **lppchk** operation can be any standalone NIM client, a group of standalone NIM clients, or a **SPOT** resource.

The following are optional attributes that can be specified for the **lppchk** operation:

- a async=Value** Specifies whether NIM should perform operations on group members asynchronously and not wait for the operation to complete on one member before beginning the operation on the next. The default value is **async=yes**.
- a filesets=Value** Specifies a list of filesets on the target on which the **lppchk** operation will be performed.
- a lppchk\_flags=Value** Tells the **lppchk** command how to perform software verification.
- a show\_progress=Value** Indicates whether status should be displayed as the operation is performed. The default value is **show\_progress=yes**.
- a verbose=Value** Displays information for debugging. Valid values are 1-5. Use **verbose=5** to show maximum detail. The default is to show no debugging output.

**Note:** There are no required attributes for the **lppchk** operation.

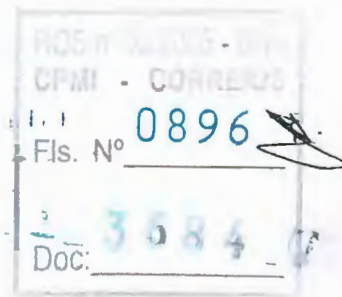
## lppmgr

The NIM **lppmgr** operation helps to manage base installation images and update images in an **lpp\_source**. Although the **lppmgr** command is a separate command, it does use NIM objects as parameters. By having the **lppmgr** operation in NIM, the **lppmgr** command is called by NIM to be executed on **lpp\_source** resources on other servers, and allows NIM to do sufficient checking of the **lpp\_source** before and after **lppmgr** is executed. The format of the operation will be as follows:

The format of the command is as follows:

```
nim -o lppmgr -a lppmgr_flags=<flags> <lpp_source_object>
```

The NIM **lppmgr** operation is also available in SMIT using the **nim\_lppmgr** fast path.





The **lppmgr** operation does not check the **lppmgr\_flags** attribute for conflicts.

**Note:** Do not use the **-p** flag for prompting to move or remove installation images.

To list the names of duplicate filesets which should be removed with space usage information, type the following:

```
nim -o lppmgr -a lppmgr_flags="-lsb" lpp_source1
```

For more information on the **lppmgr** command, see the *AIX 5L Version 5.2 Commands Reference*.

## **maint**

The **maint** operation is used to uninstall software filesets and commit and reject updates on standalone clients and **SPOT** resources.

The command line syntax for the **maint** operation is as follows:

```
nim -o maint -a Attribute=Value ... TargetName|TargetNames
```

The target of a **maint** operation can be a standalone NIM client, a group of standalone NIM clients, or a **SPOT** resource.

The following are required attributes that can be specified for the **maint** operation:

**-a installp\_flags=Value** Identifies the flags that tell **installp** what to do with the installed software.

The following are optional attributes that can be specified for the **maint** operation:

**-a async=Value** Specifies whether NIM should perform operations on group members asynchronously and not wait for the operation to complete on one member before beginning the operation on the next. The default value is **async=yes**.

**-a filesets=Value** Specifies a list of filesets to be maintained on the target.

**-a group=Value** Specifies the name of a resource group to use for the operation. A resource group can be specified as an alternative to specifying multiple resources as separate attributes.

**-a installp\_bundle=Value** Specifies an **installp\_bundle** resource that contains a list of filesets to be maintained on the target.

**-a show\_progress=Value** Indicates whether status should be displayed as maintenance is performed. The default value is **show\_progress=yes**.

## **maint\_boot**

The **maint\_boot** operation is used to prepare resources for a client to be network-booted into maintenance mode.

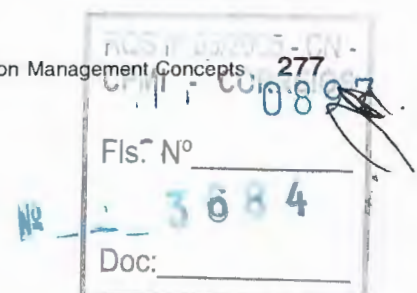
The command line syntax for the **maint\_boot** operation is as follows:

```
nim -o maint_boot -a Attribute=Value ... TargetName|TargetNames
```

The target of a **maint\_boot** operation can be any standalone NIM client or group of standalone NIM clients.

The following are required attributes that can be specified for the **maint\_boot** operation:

**-a spot=Value** Specifies the **SPOT** resource to be used to provide network boot and maintenance mode support.







The following are optional attributes that can be specified for the **maint\_boot** operation:

- |                                 |  |
|---------------------------------|--|
| <b>-a group=</b> <i>Value</i>   | Specifies the name of a resource group to use for the operation.   |
| <b>-a verbose=</b> <i>Value</i> | Displays information for debugging. Valid values are 1-5. Use <b>verbose=5</b> to show maximum detail. The default is to show no debugging output. |

After the **maint\_boot** operation is performed, the client must be rebooted over the network to load the network boot image and enter maintenance mode.

## reboot

The **reboot** operation is used to reboot a NIM client machine.

The command line syntax for the **reboot** operation is as follows:

```
nim -o reboot -a Attribute=Value ... TargetName|TargetNames
```

The target of a **reboot** operation can be any standalone NIM client or group of standalone NIM clients.

The following are optional attributes that can be specified for the **reboot** operation:

- |                                      |   |
|--------------------------------------|---|
| <b>-a inst_warning=</b> <i>Value</i> | Indicates whether a warning should be displayed to warn users that the machine will be rebooted. The default value is <b>inst_warning=yes</b> . |
|--------------------------------------|---|

**Note:** There are no required attributes for the **reboot** operation.

## remove

The **remove** operation is used to remove objects from the NIM environment. The command line syntax is as follows:

```
nim -o remove TargetName|TargetNames
```

The **remove** operation does not take any attributes. The target of this operation can be any network, machine, resource, or group in the NIM environment.

## reset

The **reset** operation is used to change the state of a NIM client or resource, so NIM operations can be performed with it. A **reset** may be required on a machine or resource if an operation was stopped before it completed successfully.

The command line syntax for the **reset** operation is as follows:

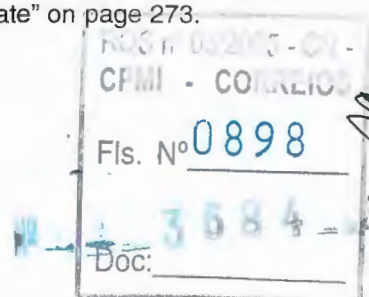
```
nim -F -o reset TargetName|TargetNames
```

The target of a **reset** operation can be any NIM client, a group of NIM clients, or a **SPOT** resource.

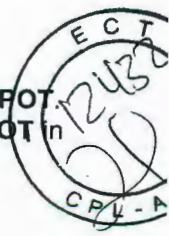
The following list includes all the flags and attributes that can be specified for the **reset** operation:

- |                      |   |
|----------------------|---|
| <b>-F</b> (optional) | Tells NIM to "force" the operation if the target is currently in use. |
|----------------------|---|

When applied to NIM clients, the **reset** operation updates the control state (**Cstate**) of the client. After the **reset** operation is performed, the client's **Cstate** is set to **ready**, and it is possible to perform NIM operations on the client. Although the **Cstate** of the client is reset by the operation, resources are not deallocated automatically. For information on deallocating resources, see "deallocate" on page 273.



When applied to **SPOT** resources, the **reset** operation updates the resource state (**Rstate**) of the **SPOT**. After the **reset** operation is performed, the **SPOT**'s **Rstate** is set to **ready**, and you can use the **SPOT** in NIM operations.



## select

The **select** operation is used to include and exclude group members from operations performed on the group.

The command line syntax for the **select** operation is as follows:

```
nim -o select -a Attribute=Value ... TargetName|TargetNames
```

The target of a **select** operation must be a group of NIM clients.

The following are optional attributes that can be specified for the **select** operation:

<b>-a exclude=Value</b>	Specifies the name of the group member to exclude from operations on the group.
<b>-a exclude_all=Value</b>	Indicates that all members of the group should be excluded from operations on the group. Valid values are <b>yes</b> and <b>no</b> .
<b>-a include=Value</b>	Specifies the name of the group member to include in operations on the group.
<b>-a include_all=Value</b>	Indicates that all members of the group should be included in operations on the group. Valid values are <b>yes</b> and <b>no</b> .
<b>-a verbose=Value</b>	Displays information for debugging. Valid values are 1-5. Use <b>verbose=5</b> to show maximum detail. The default is to show no debugging output.

To display the group members that are included and excluded from operations, use the **lsnim -g GroupName** command syntax.

## showlog

The **showlog** operation is used to list software installed on a NIM client or **SPOT** resource.

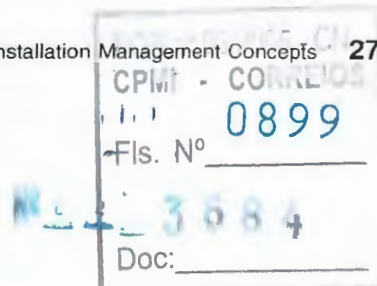
The command line syntax for the **showlog** operation is as follows:

```
nim -o showlog -a Attribute=Value ... TargetName|TargetNames
```

The target of a **showlog** operation can be any standalone NIM client, a group of standalone NIM clients, or a **SPOT** resource.

The following are optional attributes that can be specified for the **lppchk** operation:

<b>-a full_log=Value</b>	Indicates whether the entire log is displayed or only the last entry. The default value is <b>full_log=no</b> .
--------------------------	---





**-a log\_type=Value**

Specifies the type of log to display. The log types supported for both standalone clients and SPOT resources are:

<b>boot</b>	Machine's boot log
<b>bosinst</b>	Output from the BOS installation program
<b>devinst</b>	Output from the installation of key system and device-driver software
<b>lppchk</b>	Log of the output from the <b>lppchk</b> operation executed on a standalone NIM client
<b>nimerr</b>	Errors encountered during execution of the <b>nim</b> command
<b>niminst</b>	Output from the installation of user-specified software (including installation of NIM client software during a <b>bos_inst</b> operation)
<b>script</b>	Output from any configuration script resources allocated for a <b>bos_inst</b> operation.

**-a show\_progress=Value** Indicates whether status should be displayed as the operation is performed. The default value is **show\_progress=yes**.

**-a verbose=Value** Displays information for debugging. Valid values are 1-5. Use **verbose=5** to show maximum detail. The default is to show no debugging output.

**Note:** There are no required attributes for the **showlog** operation.

## showres

The **showres** operation is used to display the contents of a resource. The contents displayed will be appropriate for the type of resource on which the operation is run.

The command line syntax for the **showres** operation is as follows:

```
nim -o showres -a Attribute=Value ... TargetName
```

The target of a **showres** operation may be a **SPOT**, **lpp\_source**, **script**, **bosinst\_data**, **image\_data**, **installp\_bundle**, **fix\_bundle**, **resolv\_conf**, **exclude\_files**, or an **adapter\_def** resource.

The following are optional attributes that can be specified for the **showres** operation:

**-a client=Value**

Specifies which client's secondary adapter configuration file is displayed from an **adapter\_def** resource. This attribute is only applicable when the target of the operation is an **adapter\_def** resource.

**-a filesets=Value**

Specifies a list of filesets for which information should be displayed. This attribute is only applicable to **lpp\_source** and **SPOT** targets.

**-a installp\_flags=Value**

Specifies flags that tell the **installp** command how to format the display of filesets. This attribute is only applicable to **lpp\_source** and **SPOT** targets.

**-a instfix\_flags=Value**

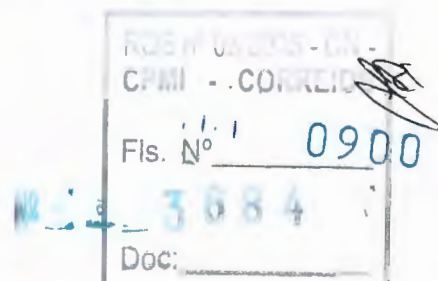
Specifies flags that tell the **instfix** command how to format the display of fixes. This attribute is only applicable to **lpp\_source** targets.

**-a lsipp\_flags=Value**

Specifies flags that tell the **lsipp** command how to format the display of installed software. This attribute is only applicable to **SPOT** targets.

**-a reference=Value**

Specifies a reference machine or **SPOT** resource for fileset comparison. This attribute is only





applicable when the target of the operation is an **lpp\_source**. Available filesets in the **lpp\_source** are compared against installed filesets in the reference machine or **SPOT**. If the **showres** operation is performed from a NIM client, the **reference** attribute is automatically set to the name of the client.

**-a resource=Value**

Specifies the name of the resource whose contents should be displayed. This attribute is only necessary when the **showres** operation is performed from a NIM client.

**-a sm\_inst\_flags=Value**

Specifies flags that tell the **sm\_inst** command how to format the display of filesets. This attribute is only applicable to **lpp\_source** and **SPOT** targets. This attribute must be used in conjunction with the **reference** attribute and is normally used only within the SMIT application.

**Note:** There are no required attributes for the **showres** operation.

- When the target of the **showres** operation is a **SPOT**, the list of filesets installed in the **SPOT** is displayed.
- When the target of the **showres** operation is an **lpp\_source**, the list of filesets contained in the **lpp\_source** is displayed.
- For all other resources that are valid targets for the **showres** operation, the character contents of the files are displayed.

## sync\_roots

The **sync\_roots** operation is used to verify that diskless and dataless clients have the correct root files for the **SPOT** resource they use.

The command line syntax for the **sync\_roots** operation is as follows:

```
nim -F -o sync_roots -a num_parallel_syncs=Value TargetName
```

The target of a **sync\_roots** operation must be a **SPOT** resource.

The following are optional flags and attributes that can be specified for the **sync\_roots** operation:

- a **num\_parallel\_syncs=Value** Specifies the number of client root directories to simultaneously synchronize with the **SPOT**'s root files. Valid values are numeric. The default value is **num\_parallel\_syncs=5**.
- F Specifies that NIM should **force** the operation.

A **sync\_roots** operation can be performed automatically when the **check** operation is performed on a **SPOT**.

## unconfig

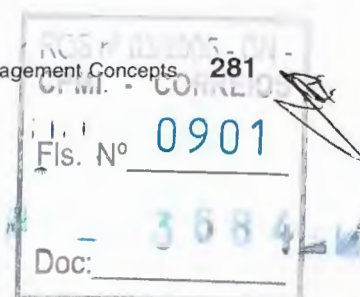
The **unconfig** operation is used to unconfigure the NIM master. The **unconfig** operation must be performed before the NIM master can be reconfigured or the NIM master fileset can be uninstalled.

**Attention:** Performing the **unconfig** operation removes all information from the NIM database and should be used with caution.

The command line syntax for the **unconfig** operation is as follows:

```
nim -o unconfig master
```

The target of the **unconfig** operation must be the NIM master.





where the following attributes are optional:

<b>default=</b> <i>Value</i>	Specifies whether a resource group should be made the default. The default value is <b>default=no</b> .
<b>ResourceType</b>	Specifies the type (for example, <b>spot</b> , <b>lpp_source</b> , <b>script</b> , etc.) and name of the resource to add to the group. One resource of each type may be specified, except for <b>script</b> and <b>installp_bundle</b> resources, which may have multiple resources participate in an operation.

The allocation of individual resource group members can be overridden by specifying additional resource attributes for the members to be changed.

For example, the resource group, **res\_grp1**, contains the **spot1**, **lpp\_source1**, **bosinst\_data1**, **script1**, and **resolv\_conf1** resources. To use the resource group to perform an **rte bos\_inst** operation on **client1**, but using no **bosinst\_data** resource, and using **resolv\_conf2** instead of **resolv\_conf1**, use the following command:

```
nim -o bos_inst -a source=rte -a group=res_group1 \  
-a bosinst_data= -a resolve_conf=resolv_conf2 client1
```

A resource group can be specified as the default set of resources to use for all NIM operations. This is done by setting the master's **default\_res** attribute to the name of the resource group that will be the default. When a default resource group is defined, the applicable member resources will always be automatically allocated during NIM operations, unless they are specifically overridden.

To set the default resource group to **res\_group1**, enter:

```
nim -o change -a default_res=res_group1 master
```

or enter:

```
nim -o change -a default=yes res_group1
```

To stop using a default resource group, enter:

```
nim -o change -a default_res=master
```

or enter:

```
nim -o change -a default=no res_group1
```

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## Chapter 25. Sample Files

This chapter contains information about the following sample files:

- "script Resource File"
- "Definition File for the nimdef Command"

---

### script Resource File

The following is an example of a customizing script that configures the target's TCP/IP domain name resolution and routing.

The **resolv\_conf** resource should be used when installing clients running the latest version of AIX.

```
#!/bin/ksh CUSTOMIZING SCRIPT to set the hostname,
#          establish the nameserver and DNS domain name,
#          and configure the routing table for the
#          target standalone client

# Truncate the host name
# if the host name is set to the fully qualified host name
#
#NOTE: This procedure will NOT result in a truncated host name if
#the bos installation operation is installing a mksysb image
#(ie. -a source=mksysb) unless the bos_inst operation is
#instructed not to configure the target as a NIM client upon
#completion (ie. unless -a no_nim_client=yes is specified)
#
chdev -l inet0 -a hostname =$(/usr/bin/hostname | cut -d. -f1)
# Set Name server and Domain Name

if [[ -f /etc/resolv.conf ]]
then
    /usr/sbin/namerslv -E '/etc/resolv.conf.sv'
fi
/usr/sbin/namerslv -a -i '9.101.1.70'
/usr/sbin/namerslv -c 'enterprise.ca'

# Flush routing table and add default route

/etc/route -n -f
odmdelete -o CuAt -q "name=inet0 and attribute=route"
chdev -l inet0 -a route=net,, '0', '9.101.1.70'
```

---

### Definition File for the nimdef Command

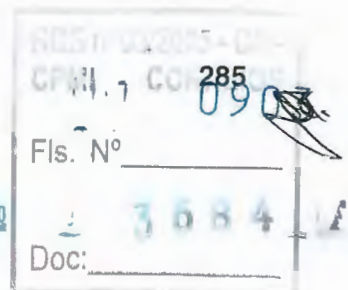
The following is an example of a definition file for the **nimdef** command:

```
# Set default values.

default:
    machine_type = standalone
    subnet_mask  = 255.255.240.0
    gateway      = gateway1
    network_type = tok
    ring_speed   = 16
    platform     = rs6k
    machine_group = all_machines

# Define the machine "lab1"
# Take all defaults.

lab1:
```







```
# Define the machine "lab2"
# Take all defaults and specify 2 additional attributes.
# The machine "lab2" uses IPL ROM emulation, and will be added to
# the machine groups "all_machines" (by default) and "lab_machines".
```

```
lab2:
    ipl_rom_emulation = /dev/fd0
    machine_group      = lab_machines
```

```
# Define the machine "lab3"
# Take all defaults, but do not add the machine to the
# default group.
```

```
lab3:
    machine_group=
```

```
# Define the machine "lab4"
# Take all defaults, but do not add "lab4" to the default group
# "all_machines".
# Instead add it to the groups "lab_machines" and "new_machines".
```

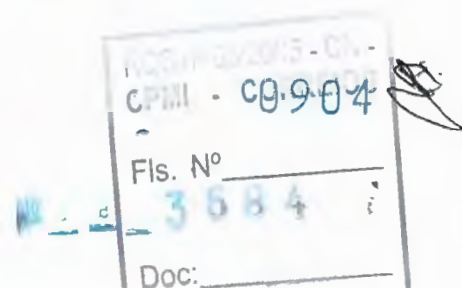
```
lab4:
    machine_group =
    machine_group = lab_machines
    machine_group = new_machines
```

```
# Change the default "platform" attribute.
```

```
default:
    platform = rspc
```

```
# define the machine "test1"
# Take all defaults and include a comment.
```

```
test1:
    comments = "This machine is a test machine."
```





## Chapter 26. NIM Error and Warning Messages

**Note:** You can access NIM error messages information (message number and message text only) through the Message Center located on the IBM eServer pSeries Information Center on the Internet at the following Web address:

[http://publib16.boulder.ibm.com/pseries/en\\_US/infocenter/base](http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base)

This chapter contains information about Network Installation Management (NIM) error and warning messages, with suggestions for resolving specific problems.

If an error condition is detected when a NIM command is executed, the command returns an error message. If a NIM command returns a warning message, this indicates that either a less severe problem was encountered by NIM, or a problem was encountered in a command called by NIM, and the severity of the problem cannot be readily determined by NIM. In the latter case, additional messages or output from the command often reveal the nature of the problem.

All NIM error messages begin with 0042 and are followed by a three-digit error code.

### Notes:

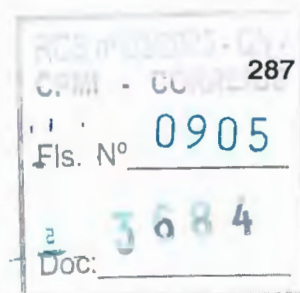
1. If you require usage information for a NIM command, type the command without any parameters or with a question mark as a parameter (for example, `nim -?`). Additional information can be obtained from the `lsnim` command, which provides several options to display NIM help and usage information. For more information, refer to the `-q`, `-O`, and `-P` options of the `lsnim` command. You can also use the `lsnim -p -a` command to display information for all NIM classes, subclasses, types, and attributes. For example, to determine the list of valid values for an attribute, enter:  
`lsnim -p -a AttributeName`
2. In some cases, a `nim` or `nimclient` operation that is being blocked because an object is in a particular state may be permitted with the use of the **force** option (the `-F` flag). However, by using the **force** option, you may adversely affect part of the NIM environment by forcing an operation that should only proceed after other actions are complete. Use error messages that are displayed without using the **force** option to determine if the **force** operation is a reasonable action.
3. If you believe that your problem is the result of a software defect, or if the User Actions provided here do not provide adequate resolution to a problem, contact your point of sale.

Information about each message listed in this chapter is organized in the following manner:

<b>Message</b>	Indicates the warning or error message ID number returned by the command
<b>Explanation</b>	Describes what is likely to have caused the message to be displayed
<b>User Action</b>	Suggests a possible resolution to the problem

**Note:** If a User Action for a given error or warning specifies using the `lsnim` command for recovery hints, and if you are operating from a NIM client, use `nimclient -l lsniOperations`, substituting the suggested `lsnim` options as appropriate.

<b>Message</b>	0042-001
<b>Explanation</b>	An error was detected by an underlying NIM method (a subcommand). This message describes where the error occurred with respect to the NIM client or master and may be useful in troubleshooting the problem. The messages that are displayed subsequent to this error are normally the true source of the problem.
<b>User Action</b>	Read the additional information and error messages, and refer to their explanation and recovery hints as appropriate.
<b>Message</b>	0042-002







**Explanation** An interrupt signal has been received, perhaps because the user entered Ctrl-C or used the **kill** command on a NIM process.

**User Action** The NIM operation that was active has been interrupted. Perform the operation again.  
**Note:** This error is expected if it occurs after the **nimclient -o bos\_inst** operation is performed on a client.

**Message** 0042-003 and 0042-004

**Explanation** An error has been returned from a system call.

**User Action** Fix the condition that caused the system call to fail and perform the operation again.

**Message** 0042-005

**Explanation** The Object Data Manager (ODM) has returned an error.

**User Action** Refer to the Message Database located on the Information Center Web page for specific details of the error. Fix the ODM problem and perform the NIM operation again.

**Message** 0042-006

**Explanation** Generic error message used for rarely occurring NIM errors.

**User Action** Phrases contained in this error message are constructed from debug information and from messages returned by commands called by NIM. If the content of the message does not give insight into the true cause of failure, contact your point of sale.

**Message** 0042-007

**Explanation** An internal NIM error has occurred.

**User Action** Try the operation again.

**Message** 0042-008

**Explanation** NIM has attempted to establish socket communications with a remote machine, and it has refused the connection.

**User Action** If the failing operation occurred on the master, verify that the master has **rsh** permissions on the client and that **inetd** is active on the client; otherwise, verify that the **nimesis** daemon is active on the master. If the failing operation was the **niminit** command on the client, a possible cause of failure is that the master does not have a network object that corresponds to the client's network. A network object that represents the client's network needs to be added to the database on the master; then a route needs to be added from the master's network to the client's network.

If the failure occurs during operations initiated from a client, using the **nimclient** command, or during a NIM installation of the base operating system, the **cpuid** attribute on the client's machine definition may be obsolete (for example, if the machine's system planar was recently replaced). To guarantee that this is not the case, erase the **cpuid** from the machine definition by issuing the following from the master:

```
nim -Fo change -a cpuid= ClientName
```

**Message** 0042-011

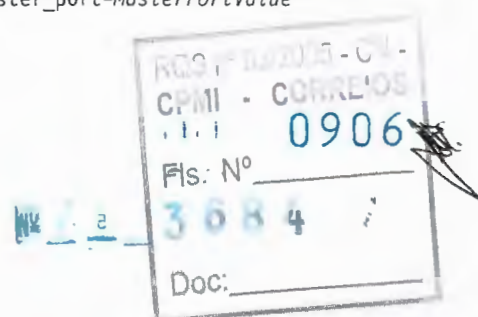
**Explanation** The **/etc/niminfo** file is not accessible.

**User Action** The **niminfo** file is required by all NIM commands and methods. This file is created when the **bos.sysmgmt.nim.master** and **bos.sysmgmt.nim.client** packages are configured. If this file is not available, this indicates that the NIM package has not been initialized or that this file has been deleted. To create the **niminfo** file, execute the **nimconfig** command on the master or the **niminit** command on the client. To recreate a deleted or corrupted **niminfo** file, enter from the master:

```
nimconfig -r
```

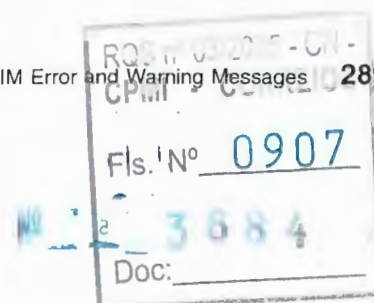
OR enter from the client:

```
niminit -aname=ClientName -amaster=MasterHostName -amaster_port=MasterPortValue
```





Message	0042-012
Explanation	The specified command may only be executed on the master.
User Action	Execute the desired operation on the NIM master.
Message	0042-013
Explanation	The global lock used for synchronized access to the NIM database could not be obtained.
User Action	Try the operation again. If the same error is returned, verify that there are no active NIM commands. If this is true, remove the <code>/var/adm/nim/glock</code> file and try the operation again. If the file does not exist and the error persists, contact your point of sale.
Message	0042-014
Explanation	An internal NIM error has occurred.
User Action	Perform the <b>remove</b> operation on the NIM object followed by the appropriate <b>define</b> operation.
Message	0042-015
Explanation	A syntax error has been detected.
User Action	Refer to the appropriate man page for the NIM command and try again using valid syntax.
Message	0042-016
Explanation	An invalid option has been specified.
User Action	Refer to the appropriate man page for the NIM command and try again using valid syntax.
Message	0042-017
Explanation	An invalid value was specified for an option argument.
User Action	Refer to the appropriate man page for the NIM command and try again using valid syntax.
Message	0042-018
Explanation	A required option was not supplied.
User Action	Refer to the appropriate man page for the NIM command and try again using valid syntax.
Message	0042-019
Explanation	An option that requires an argument was specified without its argument.
User Action	Refer to the appropriate man page for the NIM command and try again, specifying the missing argument.
Message	0042-20
Explanation	An operand was required but not supplied. Usually, the operand is the NIM object to which a given operation is being applied (that is, a NIM name for a network, machine or resource object that is the target of the NIM operation).
User Action	Refer to the appropriate man page for the NIM command and try again using valid syntax. If you do not know the name of an operand, and if the failing operation was targeted toward an existing NIM object, enter:  <code>lsnim -l -t <i>ObjectType</i></code>  OR  <code>lsnim -l</code>  to determine the operand name.
Message	0042-021
Explanation	A NIM attribute was required for the operation.





**User Action**

Specify the missing attribute. If the failing command is the **nim** or **nimclient** command, to obtain a list of attributes, enter from the master:

```
lsnim -q ObjectName
```

OR

```
lsnim -q -t ObjectType
```

OR enter from the clients:

```
nimclient -l lsnimOptions
```

For the other NIM commands, see the appropriate NIM man page.

**Message  
Explanation  
User Action**

0042-022

A value was specified that exceeds the bounds of acceptable values.

Supply a value within the acceptable bounds.

**Message  
Explanation  
User Action**

0042-023

The specified value is not valid.

Try the command again with a valid value. To determine the valid values for classes of objects and operations as they pertain to those objects, enter:

```
lsnim -Pc ObjectClass
```

AND

```
lsnim -P0c ObjectClass
```

where *ObjectClass* is one of machines, networks, or resources.

**Message  
Explanation  
User Action**

0042-024

An invalid NIM object type was specified.

Specify a valid NIM object type. See user actions for error 023 for **lsnim** options to determine a valid object type.

**Message  
Explanation  
User Action**

0042-025

The specified operation cannot be supplied to the specified NIM object.

Specify an operation that can be applied to the object. Enter **lsnim -O *ObjectName*** for a list of valid operations that can be applied to the object.

**Message  
Explanation  
User Action**

0042-027

The specified object is missing an attribute that is required to complete the specified operation. Redefine the object that is missing an attribute by performing the **remove** operation followed by the **define** operation.

**Message  
Explanation  
User Action**

0042-028 and 0042-029

The specified information cannot be supplied in the current context.

Try the operation again without supplying the offending attribute.

**Message  
Explanation  
User Action**

0042-030

A sequence number was opened to an attribute that doesn't allow sequence numbers.

Try the operation again without a sequence number on the offending attribute.

**Message  
Explanation  
User Action**

0042-031

An internal NIM error has occurred. NIM is unable to generate a unique object ID.

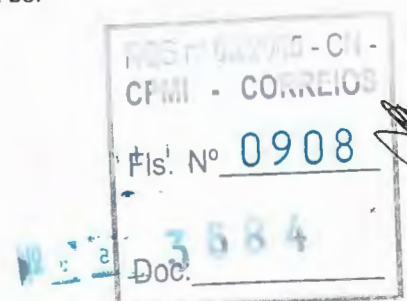
Try the operation again.

**Message  
Explanation  
User Action**

0042-032

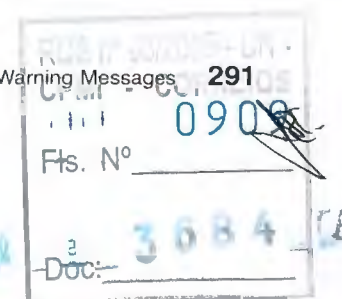
The specified value for the attribute is not unique and it must be.

Supply a unique value for the attribute.





Message	0042-033
Explanation	The specified value is not unique and it must be. An attribute with a sequence number requires a unique value.
User Action	Supply a unique value.
Message	0042-034
Explanation	The specified value is not unique and it must be.
User Action	Supply a unique value.
Message	0042-035
Explanation	NIM was attempting to access an attribute that had the specified characteristics, but the attribute doesn't exist.
User Action	Make sure the attribute exists and retry the operation.
Message	0042-036
Explanation	The <b>define</b> operation failed for a resource because the specified server does not have a standalone configuration.
User Action	Try the operation again using a NIM client that is a standalone machine.
Message	0042-037
Explanation	The NIM state of the specified object prevents the operation from succeeding.
User Action	NIM states are used to synchronize activity among NIM objects. To perform the desired operation, the state of the specified object must be changed. If the specified object is in an unexpected state, check the system to make sure another user or process is not manipulating the object. Use the <b>reset</b> operation to set the object to a known state and try the operation again.
Message	0042-038
Explanation	An object that NIM would operate on is already locked and thus cannot be operated on.
User Action	NIM object locks are used to synchronize activity among NIM objects. These locks are temporary, so try the operation again after some delay. The value of the lock is the process ID of a NIM process that is using the lock. If the lock persists and no NIM commands are active, reset all NIM locks by stopping the <b>nimesis</b> daemon, then restarting it.
Message	0042-039
Explanation	The operating system version or release level of the specified object is unacceptable.
User Action	Perform the desired operation on objects that have the appropriate operating system version and release levels.
Message	0042-040
Explanation	A NIM object could not be removed because it is being used by some other NIM object.
User Action	Remove all references to the object to be removed before the <b>remove</b> operation is specified. If NIM states are such that you cannot remove references to the object and you want to remove the object anyway, provide the <b>-F</b> flag to the <b>remove</b> operation.
Message	0042-041
Explanation	A specified value has already been defined to NIM.
User Action	Specify a value that isn't already known to NIM. <b>Note:</b> If <b>/etc/niminfo</b> is the value and the NIM command producing this error is <b>niminit</b> , this means that <b>niminit</b> has already been performed. If you want to reinitialize your NIM master or client, deinstall the appropriate fileset, and then reinstall and reconfigure the NIM master or client fileset.
Message	0042-042
Explanation	The specified machine could not be reached with the <b>ping</b> command from the master.







**User Action** If the operation you were attempting to perform requires that the target machine be running and that it can be reached, then verify that the machine is currently running. If not, turn it on; otherwise, perform network diagnostic procedures to determine why the master could not reach the target machine.

**Message** 0042-043  
**Explanation** The remove operation cannot be performed, because the target machine currently serves a NIM resource that has been allocated for use. Performing the operation at this time could lead to processing failures on clients that are attempting to use the served resources.

**User Action** You need to deallocate all resources that the target serves before you can remove the machine.

**Message** 0042-044  
**Explanation** You have specified a NIM attribute without an accompanying value. Most NIM attributes can only be specified with a value assigned to them in the form of `attr=value`.

**User Action** Retry the operation with a value assigned to the specified attribute.

**Message** 0042-045  
**Explanation** Some NIM attributes can be added to an object's definition more than once. In these cases, a sequence number is used to uniquely identify each attribute of that type. In this case, you have specified an attribute of this type without its required sequence number and, therefore, NIM is unable to determine which attribute you are attempting to specify.

**User Action** Verify the sequence number and try the operation again.

**Message** 0042-046  
**Explanation** NIM was unable to perform an operation on the specified file. This may be due to the permissions on the file. The file usually needs read, write, and, in some cases, execute permissions for root.

**User Action** Change the permissions of the specified file and try the operation again.

**Message** 0042-047  
**Explanation** Some types of NIM resources may only be used by specific machine types. In this case, you attempted to allocate a NIM resource to a type of machine that is not allowed to use that type of resource.

**User Action** Specify a resource type that the machine is allowed to use when performing allocation for the target machine.

To determine the valid resource types, enter:

```
lsnim -p -s ResourceSubclassForMachineType
```

To view the subclasses that are available, enter: `lsnim -p -S`

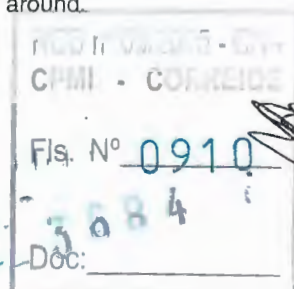
**Message** 0042-048  
**Explanation** When resource allocation is requested, NIM verifies that the designated client has the potential to communicate with the server of the resource. NIM does this by checking the NIM routing between the network that the client's primary interface connects to and all the networks that the server connects to. In this case, a NIM route is missing between the client and the server.

**User Action** Either establish a NIM route between the client and the server or choose a different resource to allocate.

**Message** 0042-049  
**Explanation** Only one resource of this type may be allocated to the client and one has already been allocated.

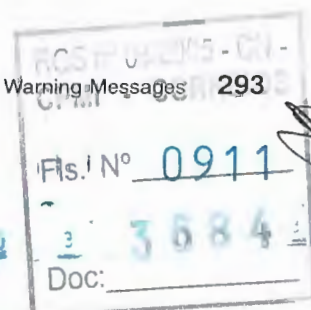
**User Action** Choose the resource that you want to use and deallocate the currently allocated resource of this type if you want to use the new one.

**Message** 0042-051  
**Explanation** NIM was unable to resolve a host name to an IP address or the other way around.





User Action	All host names that are used in the NIM environment must be resolvable. Perform the appropriate network administration tasks to ensure that the specified host name is resolvable and try the operation again.
Message Explanation	0042-052 One or more NIM resources are still allocated to the machine that you have requested to be removed from the NIM environment. To remove a machine, it cannot have any resources allocated to it.
User Action	Deallocate all resources that have been allocated to the target machine and try the operation again.
Message Explanation	0042-053 You have specified the name of a NIM object that does not currently exist in the NIM environment. NIM can only operate on objects that have been defined to NIM.
User Action	Verify that you have spelled the name of the object correctly and that it has already been defined. The name of a target machine for a NIM operation must be the NIM name, not the host name. Enter:  <code>lsnim -l -t ObjectType</code>  OR  <code>lsnim -l</code>  to obtain listings of currently defined objects in the NIM environment. If you need to define the object, use the <b>define</b> operation.
Message Explanation	0042-055 Many NIM operations require a source for installable images. You have specified a source that cannot be used for this operation. Examples of valid sources for NIM operations are: <ul style="list-style-type: none"><li>• <code>/dev/rmt0</code>, <code>/dev/cd1</code> for <b>lpp_source</b> definition</li><li>• <b>rte</b>, <b>spot</b>, <b>mksysb</b> for <b>bos_inst</b> operation</li></ul>
User Action	Try the operation again using a source that the operation can use.
Message Explanation	0042-056 You have specified the same attribute assignment more than once.
User Action	Try the operation again using only one instance of the attribute assignment.
Message Explanation	0042-058 You have attempted to allocate a <b>SPOT</b> to a client whose primary network interface type or platform is not supported by the <b>SPOT</b> . For a client to use a <b>SPOT</b> , the <b>SPOT</b> must support the network interface type and platform of the client's primary interface.
User Action	Install the appropriate device support into the <b>SPOT</b> , which will allow the <b>SPOT</b> to support the client's primary interface type and platform, or choose a different <b>SPOT</b> that supports the client's primary interface type and platform.
Message Explanation	0042-059 In an attribute assignment (in the form of <code>attr=value</code> ), the <i>value</i> you have specified represents a NIM object whose type conflicts with the object type of the specified <i>attr</i> .
User Action	Try the operation again using the <i>attr</i> that corresponds to the type of object that <i>value</i> represents.
Message Explanation	0042-060 You have specified multiple attribute assignments for an attribute that may only be specified once.
User Action	Try the operation again, using only one instance of the attribute.
Message	0042-061







**Explanation** You have requested an operation to be performed on a NIM resource object that is currently allocated for client use. NIM is not allowing this operation to be performed because it may interrupt the client's use of the resource.

**User Action** Try the operation again when the resource is not allocated for client use. If necessary, try the **force** option (-F flag) to disregard the preventive check by NIM. In some cases, NIM will allow the operation to be performed.

**Message** 0042-062

**Explanation** The NIM object that was operated on is missing something that is required for its definition to be complete.

**User Action** List information about the object using the **lsnim** command. Each item that is missing from the object's definition will be represented by a missing attribute. Perform the appropriate NIM operation that will add the missing item to the object's definition. For a **SPOT**, if network boot images are missing, apply the **check** operation to the **SPOT**. If software filesets are missing from a **SPOT**, allocate an **lpp\_source** that contains the required filesets and apply the **cust** operation to the **SPOT**.

**Message** 0042-063

**Explanation** Some NIM operations require access to one or more NIM resources to complete successfully. This access is granted through the **allocate** operation. In this case, you have not allocated all the resources that are required for this operation.

**User Action** Allocate all the required resources and try the operation again. For a list of required and optional resources for a given operation, enter:

```
lsnim -q Operation ObjectName
```

OR

```
lsnim -q Operation -t ObjectType
```

**Message** 0042-064

**Explanation** The machine that is the target of the requested operation currently serves a NIM resource that is allocated for client use. The requested operation cannot be performed until all resources that the target serves have been deallocated for use.

**User Action** Deallocate all resources that the target serves and try the operation again.

**Message** 0042-065

**Explanation** You have specified a name that is reserved for NIM internal use only.

**User Action** Try the operation again using a different name. To determine what names are reserved, enter:

```
lsnim -a reserved
```

**Message** 0042-066

**Explanation** You have specified one or more characters that are not allowed in NIM object names. NIM uses regular expressions to perform many of its operations, so any character that has special meaning for regular expressions cannot be used (for example, ^). Also, any character that has special meaning to the shell cannot be used (for example, /).

**User Action** Try the operation again using valid characters.

**Message** 0042-067

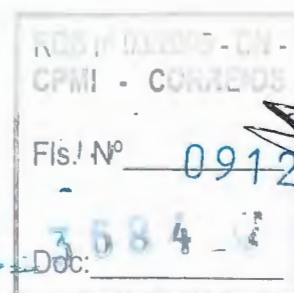
**Explanation** You have requested an operation to be performed on a NIM object that has been reserved for NIM internal use only.

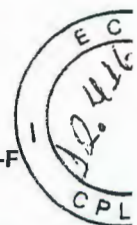
**User Action** Try the operation again, using a NIM object that is not reserved. To determine what objects are reserved, enter:

```
lsnim -a reserved
```

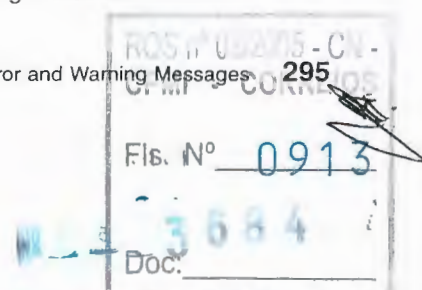
**Message** 0042-069

**Explanation** The requested operation cannot be performed at this time because it conflicts with the current NIM state of the target. NIM uses states to synchronize NIM activity so that operations don't interfere with each other.





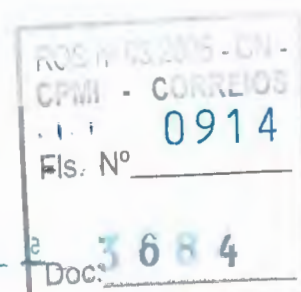
User Action	<p>Try the operation again when the state changes or, if necessary, try using the <b>force</b> option (-F flag). In some cases, NIM will allow you to override this state checking.</p> <p>If you encounter this error as a result of trying to remove, using the <b>reset</b> operation, the <b>boot</b> resource from a client that incorrectly has a state of "ready for a NIM operation", you can remove the <b>boot</b> resource from the NIM master by entering:</p> <pre>/usr/lpp/bos.sysmgmt/nim/methods/m_dealloc_boot client_name</pre> <p>where <i>client_name</i> is the name of the NIM object for the client.</p>
Message	0042-073
Explanation	To perform customization on a machine, NIM constructs a shell script that is executed on the target. To construct this script, some type of resource that can be used for customization must be used. In this case, NIM could not create the customization script because no resources have been allocated to the target that could be used for customization purposes.
User Action	<p>Allocate one or more resources that can be used for customization and try the operation again. To display the subclass of resources that can be used for customization, enter:</p> <pre>lsnim -p -s cust_res</pre>
Message	0042-074
Explanation	You have specified an attribute assignment in which the <b>value</b> represents a relative path name. NIM only allows absolute path names (that is, path names that begin with /) to be used.
User Action	Try the operation again, using an absolute path name.
Message	0042-075
Explanation	The requested operation requires that a NIM resource be exported for a machine's use. In this case, NIM attempted to export the resource but an error was returned by an NFS utility.
User Action	Fix the error condition that the NFS utility reported and try the operation again.
Message	0042-076
Explanation	You have specified a port number that is already in use.
User Action	<p>Try the operation again, using a port number that is currently not being used. Check the <b>/etc/services</b> file.</p> <p><b>Note:</b> NIM uses both the specified port number and its successor. Therefore, ensure that the port number after the specified port number is also free.</p>
Message	0042-077
Explanation	The <b>niminit</b> command is used to join the NIM environment. When executed, this command attempts to add routing information that the NIM master has determined the client needs to participate in the NIM environment. In this case, one or more of the required routes could not be added.
User Action	Perform the appropriate network diagnostic task to determine why the route could not be added.
Message	0042-078
Explanation	You have specified a change to a NIM routing attribute in which the destination network is different from its current value. This is not allowed because only the gateway field of the routing attribute may be changed.
User Action	If you are trying to change the connectivity between NIM networks, then you must remove the current NIM route by supplying a NULL value for the appropriate routing attribute. Otherwise, specify the same destination network when attempting to change the gateway field of the routing attribute.
Message	0042-079
Explanation	In the NIM environment, one resource may depend on another for information. In this case, an allocated resource has a dependency on the resource you have specified for deallocation.
User Action	Deallocate the resource that is dependent on the resource causing the error.







Message	0042-081
Explanation	NIM uses NFS to make remote resources available for client use. To avoid NFS export errors, NIM enforces some restrictions on where a resource can be defined. In general, a NIM resource cannot be defined within a directory that is already a NIM resource. Conversely, a NIM resource cannot be defined for a directory that already contains an existing NIM resource.
User Action	Move the resource to a location that adheres to NIM export rules and try the operation again.
Message	0042-083
Explanation	Each network communications adapter has an associated network hardware address that is unique. In this case, you attempted to define a NIM network interface using a network hardware address already being used by a NIM machine object.
User Action	Only one NIM interface attribute may be defined for each network communications adapter a client might have. If you are attempting to add another interface definition, then verify that the hardware address is correct. If so, then you must first change the interface attribute that is currently using that address. If not, try the operation again with the correct hardware address.
Message	0042-084
Explanation	The machine has already been configured to be a NIM master.
User Action	If you want to reconfigure the machine as a NIM master, enter <code>nim -o unconfig master</code> , then <code>deinstall</code> and <code>reinstall</code> the master fileset. You may then run the <code>nimconfig</code> command.
Message	0042-086
Explanation	You have attempted to add a NIM route between two NIM networks that already have a NIM route between them. Only one NIM route can be specified between any two NIM networks.
User Action	If you are attempting to change NIM routing, delete the existing NIM route and try the operation again.
Message	0042-093
Explanation	NIM attempted to create a directory, and the <code>mkdir</code> command returned an error.
User Action	Fix the error reported by the <code>mkdir</code> command and try the operation again.
Message	0042-109
Explanation	To complete the requested operation, NIM requires information about one or more file systems about which it was unable to obtain information.
User Action	Verify that the file systems exist. If not, either specify the correct path name when performing the NIM operation or redefine the NIM environment so that all the participating file systems exist.
Message	0042-111
Explanation	When a sequence number is specified for a NIM attribute, it must be within a specific range. You have specified a sequence number that falls outside of the acceptable bounds.
User Action	Try the operation again using a sequence number that is within the acceptable bounds.
Message	0042-113
Explanation	To complete the requested operation, NIM requires information about the size of one or more objects, which NIM was unable to determine.
User Action	If the object is a file or directory that does not exist, then create the file or directory and try the operation again.
Message	0042-118
Explanation	You have requested to change characteristics of a NIM network on which there is currently one or more active NIM operations. NIM is not allowing the change because changing the network characteristics at this time could result in failures in the active operations.
User Action	Wait until the NIM resources allocated to machines that use the network being changed have been deallocated and try the operation again.



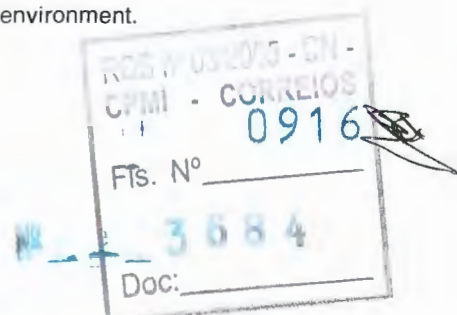


Message	0042-121
Explanation	An invalid value has been specified.
User Action	Try the operation again, using a valid value.
Message	0042-124
Explanation	An NFS option was specified that is not supported.
User Action	Try the operation again using valid NFS options. Refer to NFS Problem Determination in <i>AIX 5L Version 5.2 System Management Guide: Communications and Networks</i> .
Message	0042-129
Explanation	An invalid resource type was specified for this operation.
User Action	Use the <b>lsnim -q Operation -t TargetType</b> command to view a list of required and optional resources for <i>Operation</i> when applied to <i>TargetType</i> .
Message	0042-130
Explanation	You have specified an attribute that cannot be used for this requested operation.
User Action	Try the operation again, without using the attribute you specified.
Message	0042-131
Explanation	You have specified two or more attributes that conflict with each other.
User Action	Try the operation again, using only one of the attributes.
Message	0042-132
Explanation	You have specified a <b>value</b> for an attribute assignment that is invalid in the context in which the operation is being performed.
User Action	Try the operation again, using a different <b>value</b> for the attribute assignment.
Message	0042-133
Explanation	The physical entity that is represented by the NIM resource object you have requested to be deleted could not be deleted.
User Action	Delete the file or directory, using the <b>rm</b> command.
Message	0042-134
Explanation	The operation you requested requires the designated target to reboot using a network boot image. NIM has automatically initialized the environment to enable the target to do this; however, NIM was unable to force the target to load the network boot image.
User Action	Intervention at the target is required. Follow the procedures for initiating a BOOTP request.
Message	0042-135
Explanation	To synchronize NIM operations that can be initiated from a client or on the master, NIM keeps track of which machine (the client or the master) is used to allocate the first resource to the client; this machine is said to be in control. For example, if the first resource allocation occurs from the client, then the client is in control. Once a machine has control, it remains in control until all resources for that client have been deallocated. You have requested an operation to be performed from a machine that is currently not in control of the specified target.
User Action	Perform the desired operation from the machine that is in control of the target, or from the controlling machine deallocate the resources (to remove the control), or override this behavior by using the <b>force</b> (-F flag) option when performing the operation from the master.
Message	0042-136
Explanation	The requested operation cannot be performed because a NIM route does not exist between two machines that participate in this operation.
User Action	Establish a NIM route between the networks.
Message	0042-137



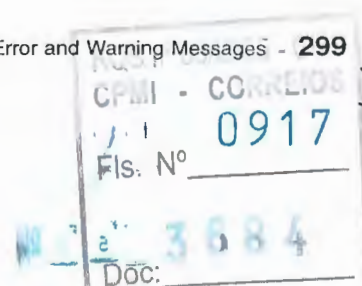


Explanation	The <code>/etc/niminfo</code> file contains information about the NIM environment that all NIM commands require. In this case, the <code>/etc/niminfo</code> file is missing some information that is required to continue, which indicates that the file has been corrupted.
User Action	Reinitialize the NIM environment.
Message	0042-138
Explanation	Unable to update the <code>rhost</code> file.
User Action	Edit the <code>\$HOME/.rhosts</code> file for root on the client machine to add an entry for the host name of the NIM master.
Message	0042-139
Explanation	The process of installing a machine prevents any attached disks from being used as the source for installable images. You have allocated a resource to the target of the install operation that is served by the target itself.
User Action	Deallocate the resource, allocate another resource of this type that is served by another machine, and try the operation again.
Message	0042-140
Explanation	You have requested that a machine object be removed from the NIM environment and this has been done; however, NIM was unable to remove the <code>/etc/niminfo</code> file on the machine that has been removed from the NIM environment.
User Action	Remove the <code>/etc/niminfo</code> file from the machine that was removed from the NIM environment. <b>Note:</b> Verify that the <code>.rhost</code> permissions for the master have been removed from the client.
Message	0042-141
Explanation	By specifying an attribute assignment with a NULL value, you have requested NIM to remove the specified <code>attr</code> . However, in this case, the specified <code>attr</code> is not currently part of the specified object's definition.
User Action	Try the operation again, using an attribute that is part of the object's definition.
Message	0042-142
Explanation	All attribute values must be unique. You have specified a <code>value</code> in an attribute assignment that already exists.
User Action	Try the operation again, using a unique <code>value</code> for the attribute.
Message	0042-143
Explanation	Some NIM attributes can only be added to an object's definition once. In this case, you have specified an attribute of this type when one already exists for the specified object.
User Action	Only one attribute of this type can be used in the object's definition. Perform the change operation on the object if you want to replace the current value with a new one.
Message	0042-144
Explanation	Some NIM attributes require a unique sequence number so that NIM can distinguish between multiple attributes of that type. In this case, you have specified a sequence number that is already being used.
User Action	Try the operation again, using a sequence number that is not currently being used. To display the sequence number that are being used, enter: <code>lsnim -a AttributeName ObjectName</code>
Message	0042-145
Explanation	You have specified an attribute that does not exist in the NIM environment.
User Action	Try the operation again, using a valid NIM attribute. To display a list of valid attribute names, enter: <code>lsnim -p -s info_subclass</code>
Message	0042-146
Explanation	You have specified an object type that does not exist in the NIM environment.





User Action	Try the operation again, using a valid NIM object type. On the NIM master, the <b>lsnim</b> command can be used to display the valid NIM object types.
Message	0042-147
Explanation	You have attempted to execute a NIM command on the NIM master that can only be executed on NIM clients.
User Action	Execute the command on a NIM client.
Message	0042-148
Explanation	The information contained in the specified attribute is no longer valid.
User Action	Change the information in the attribute to reflect valid information and try the operation again.
Message	0042-150
Explanation	Any directory used to store NIM resources must be local to the machine that serves those resources. This is required because NIM can only NFS export local directories. In this case, you have specified a directory that is not local to the designated server of the directory. NIM has obtained this information from the file system of the designated server and the <b>vfstype</b> listed corresponds to values in the <b>/usr/include/sys/vmount.h</b> file.
User Action	Either copy the desired resources onto the designated server and perform the operation again, or specify the correct server when performing the operation.
Message	0042-151
Explanation	For NIM to use a file, it must be of a specific type. In this case, you have specified a file whose type cannot be used by NIM. NIM has obtained this information from the file system of the designated server of the file and the file type corresponds to values in the <b>/usr/include/sys/mode.h</b> file.
User Action	Change the file type of the file and try the operation again.
Message	0042-152
Explanation	When an <b>installp</b> operation is performed on a <b>SPOT</b> , the root directories of all diskless and dataless clients that use that <b>SPOT</b> must be synchronized with the changes made within the <b>SPOT</b> . In this case, one or more errors occurred when performing the <b>root sync</b> operation on a root directory.
User Action	Investigate why some of the root syncs failed and perform the operation again. The <b>nim.installp</b> log for the client root is located in <b>RootResrcParentDir/ClientName/var/adm/ras</b> .
Message	0042-153
Explanation	For NIM to use a file, it must have specific file permissions. In this case, you have specified a file whose permissions conflict with those required by NIM. NIM has obtained this information from the file system of the designated server of the file, and the value of the file permissions comes from the <b>/usr/include/sys/mode.h</b> file.
User Action	Change the file permissions of the file and try the operation again.
Message	0042-154
Explanation	For NIM to use a file, it must exist. You have specified a file that does not exist.
User Action	Create the file and try the operation again.
Message	0042-155
Explanation	For NIM to keep diskless and dataless root directories in sync with their corresponding <b>SPOTs</b> , NIM requires that the client's root directory be served from the same machine as its <b>SPOT</b> . In this case, you have requested a resource to be allocated that violates that requirement.
User Action	Try the operation again using resources that do not violate the NIM requirement.
Message	0042-156
Explanation	You have requested an operation to be performed that involves a directory that does not exist.
User Action	Create the missing directory and try the operation again.







**Message** 0042-157  
**Explanation** The operation you have requested could not be performed because a required file could not be accessed.  
**User Action** Create the missing file and try the operation again. For example:

- If the missing file is a boot image with a name whose format is *SpotName.NetworkInterface.Platform* (for example, *myspot.tok.up*), recreate the boot image by performing the check operation on the **SPOT**.
- If the missing files are directories with which **root** or **paging** resources are associated, delete the resource definition with the **remove** operation, create the directories, and then redefine the resource.
- If a **SPOT**'s **image.template** file is missing, this indicates that the **SPOT** has been corrupted or was not constructed successfully. To recover, you may need to remove and rebuild the **SPOT** with the **remove** and **define** operations.

**Message** 0042-158  
**Explanation** The operation you have requested requires NIM to modify a file that it was unable to modify successfully.  
**User Action** Check the file permissions on the file and try the operation again.

**Message** 0042-159  
**Explanation** Required software is missing which prevents the target machine from acting as a **SPOT** server.  
**User Action** Install the missing software and retry the operation.

**Message** 0042-160  
**Explanation** The operation you requested requires the construction of network boot images and NIM was unable to do that.  
**User Action** Fix the problem that prevented the network boot images from being constructed and try the operation again.

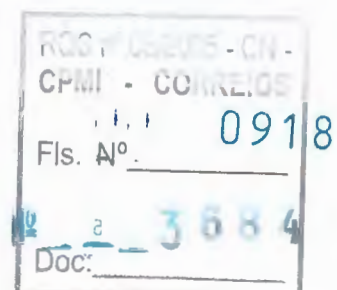
**Message** 0042-161  
**Explanation** There is insufficient free disk space to complete the requested operation.  
**User Action** Increase the amount of available space, as detailed in the error message.

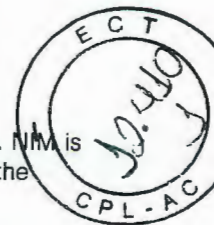
**Message** 0042-162  
**Explanation** To perform the requested operation, NIM requires an **lpp\_source** type resource object that has the **simages** attribute as part of its definition. This attribute is used to designate that an **lpp\_source** contains the total set of optional packages that are required to support NIM install operations. In this case, you have not supplied an **lpp\_source** that fulfills this requirement.  
**User Action** Try the operation again using an **lpp\_source** that has the **simages** attribute in its definition.

**Message** 0042-163  
**Explanation** NIM coordinates access between a client and the server of the resource. To do this, NIM must identify a network interface that can be used by the client. This becomes a complex problem when the server has more than one network interface. NIM uses a connectivity algorithm to establish which network interface to use. This error message occurred because the connectivity algorithm detected a problem with the client's routing and the interface the algorithm has selected to use. NIM does not allow the interface on the server that the client uses as a gateway to be used to serve resources because the operation requiring the resource could fail.  
**User Action** If the server has other network interfaces that are not known to NIM, change the server machine object to add the interfaces.

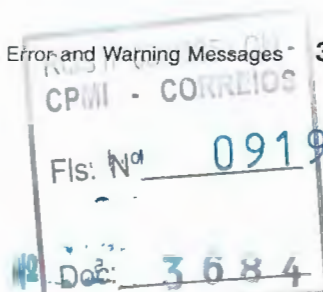
Define a NIM route between the client's primary network and one of the other networks to which the server connects.

**Message** 0042-164





Explanation	Some NIM operations do not allow the source of installable images to be a CD-ROM. NIM is not always able to construct an environment that supports the use of a CD-ROM for the operation being performed. This is true for the operation you tried to perform.
User Action	Try the operation again using a different source for installable images.
Message	0042-165
Explanation	Some attributes can only be specified together; others are mutually exclusive. In this case, you specified one or more attributes that conflict.
User Action	Try the operation again, omitting the attribute that was in conflict. For example, the <b>ring_speed</b> and <b>cable_type</b> attributes cannot be used with the same <b>if</b> attribute; the one you should use depends on the type of network interface referenced by the corresponding <b>if</b> attribute.
Message	0042-166
Explanation	The <b>if</b> attribute specifies network interface information, which includes a reference to the network object that the interface connects to. In this case, you have omitted a required attribute which is associated with the <b>if</b> attribute.
User Action	Try the operation again, including the required attribute. For example, the <b>ring_speed</b> attribute corresponds with the Token-Ring network interface, and the <b>cable_type</b> attribute corresponds with the Ethernet network interface.
Message	0042-167
Explanation	The device which you have specified as the source for the IPL ROM emulation, does not contain a valid, bootable image of the IPL ROM emulation.
User Action	If the specified device has media in it, this media either does not contain the IPL ROM emulation, or the media has been corrupted. Remake the IPL ROM emulation, and try the operation again. If the specified device has no media in it, make the IPL ROM emulation, put it in the device, and try the operation again.
Message	0042-168
Explanation	You have specified that the originating and destination network are the same. Machines that are on the same network do not need routing to communicate; therefore, adding a route from a network to itself is not allowed.
User Action	Specify a different originating and destination network when adding a NIM route.
Message	0042-169
Explanation	You have allocated an <b>lpp_source</b> , but you have not specified which filesets are to be installed using that <b>lpp_source</b> .
User Action	Specify the filesets to install using the <b>filesets</b> attribute in the command, or by allocating an <b>installp_bundle</b> that contains a list of the filesets to install.
Message	0042-170
Explanation	You entered a platform type that is not known to NIM.
User Action	The valid platform types are <b>rs6k</b> , <b>rs6ksmp</b> , and <b>rspc</b> . Correct the platform type attribute and try the operation again.
Message	0042-171
Explanation	Not all platform types are supported on all configuration types. For example, the diskless configuration type is not supported on the platform type <b>rs6ksmp</b> .
User Action	Use the correct platform type and try the operation again.
Message	0042-172
Explanation	You have specified the incorrect name of the machine object for the NIM client machine. When the <b>niminit</b> command is used to rebuild the <b>niminfo</b> file, the master registration process checks the CPU ID of the machine with the value stored in the NIM database for the named machine. If the stored value does not match the value passed by <b>niminit</b> , this message is issued.
User Action	Use the correct name and try the command again.







**Message** 0042-173  
**Explanation** You specified that the **installp** command should expand file systems (using the **-X** flag) while specifying that NIM should not auto expand (using the **auto\_expand** attribute). This is not an allowable combination for the command invoked.  
**User Action** Use either the **-X** flag or the **auto\_expand** attribute, but not both.

**Message** 0042-174  
**Explanation** You specified an invalid value for an attribute whose only valid values are **yes** and **no**.  
**User Action** Retry the operation with a value of **yes** or **no** for the attribute indicated.

**Message** 0042-175  
**Explanation** An unexpected result has been returned from a command that NIM tried to execute.  
**User Action** Fix the problem that caused the executed command to fail and try the operation again.

If the command failed due to a shortage of space, its error messages indicating this should be displayed. Expand the indicated file system, (for most NIM operations use the **auto\_expand** attribute) and retry the operation. If a space failure occurred during **SPOT** creation, and if the **bosboot** command failed to make boot images as a result, increase the free space and run the **check** operation.

If the command listed by NIM in this message is the **installp** command, check the **nim.installp** log for failure and recovery information. (For standalone client operations, this is located in the **/var/adm/ras** directory of the client. For **SPOT cust** and **maint** operations, this is located in **SPOTParentDir/SPOTName/usr/lpp/bos/inst\_root/var/adm/ras** on the **SPOT**. For diskless and dataless clients, this is located in **RootResrcParentDir/ClientName/var/adm/ras**.

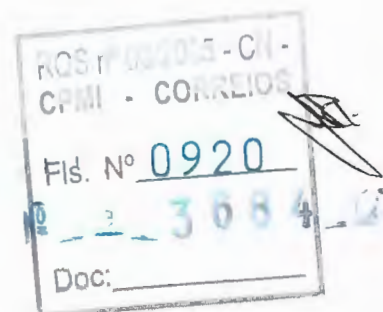
**Message** 0042-176  
**Explanation** The resource cannot serve as a support image (**simages**)**lpp\_source**. When an **lpp\_source** serves as a support image resource, it contains a minimal set of software packages for facilitating installation and the use of the base operating system.  
**User Action** No action is necessary if this resource does not need to serve as a support images **lpp\_source**. If the resource needs to be a support images **lpp\_source**, add the missing software to the **lpp\_source**. If the **lpp\_source** is a directory, you can do this by copying the missing packages to the location of the **lpp\_source** and running the **check** operation.

**Message** 0042-177  
**Explanation** The operation you requested could not be completed due to insufficient free space in one or more file systems.  
**User Action** Make more space available if possible, by extending the file system displayed. For most NIM operations, the **auto\_expand** attribute is available to automatically expand file systems.

**Message** 0042-178  
**Explanation** The **if** attribute is made up of four fields. The fourth field is optional in most cases. In this case, the network object that you specified (in field *one*) has more than one type of network. In this case, NIM requires that the fourth field has a value that specifies the logical device name of the network adapter.  
**User Action** Add the appropriate value to the **if** attribute, and try the operation again.

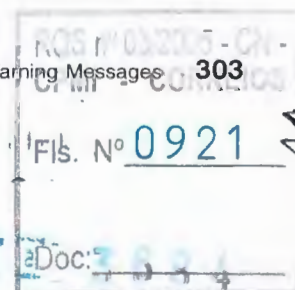
**Message** 0042-179  
**Explanation** You are attempting to remove an **if** or **other\_net\_type** attribute on which one or more NIM clients have a dependency.  
**User Action** If this is not a mistake, remove the NIM clients that are dependent on the network, or remove the **if** attribute from the NIM client object definition.

**Message** 0042-180  
**Explanation** The address of the machine that is being defined is not connected to the network that is represented by the specified network object.





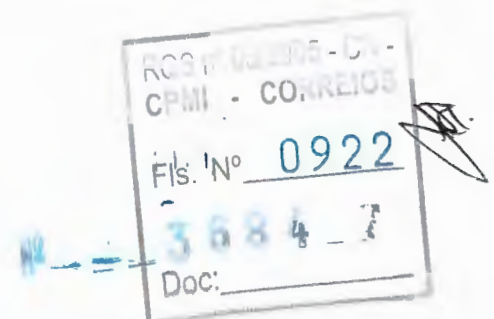
<b>User Action</b>	Define a network object that represents the physical network to which the machine is connected. Use this network object when defining the machine.
<b>Message</b>	0042-181
<b>Explanation</b>	The <b>fix_query_flags</b> attribute has an illegal value. Use <b>lsnim -Pa fix_query_flags</b> for a list of legal values.
<b>User Action</b>	Determine the correct flags and retry the operation.
<b>Message</b>	0042-182
<b>Explanation</b>	A resource of one type cannot be allocated for the current operation at the same time as a resource of another type. Allocate one or the other, but not both.
<b>User Action</b>	The resources specified are mutually exclusive. Determine which one is needed for the operation, and omit the other.
<b>Message</b>	0042-183
<b>Explanation</b>	An attribute cannot be specified for the current operation when a type of resource is allocated. Use one or the other, but not both.
<b>User Action</b>	The attribute and the resource specified are mutually exclusive. Determine which one is needed for the operation, and omit the other.
<b>Message</b>	0042-184
<b>Explanation</b>	The network address ( <b>net_addr</b> ) or subnet mask ( <b>snm</b> ) cannot be changed for the network, because NIM clients are currently defined as being connected to that network. Remove the client definitions before changing the network.
<b>User Action</b>	The <b>nimdef</b> command can be used to quickly redefine NIM clients after they have been removed to update the network definition.
<b>Message</b>	0042-185
<b>Explanation</b>	Failed to link or copy files. Check permissions and file system space.
<b>User Action</b>	Verify that space and inodes are available for the files and links specified in the error message.
<b>Message</b>	0042-186
<b>Explanation</b>	Failed to copy setup programs. Either start NFS on the client or free 1000 512-byte blocks in the file system.
<b>User Action</b>	Programs required to set up the operation could not be copied to the client system. Either start NFS on the client, or increase space in the file system specified in the error message.
<b>Message</b>	0042-187
<b>Explanation</b>	Failed to expand file system.
<b>User Action</b>	Attempt to manually expand the file system specified in the error message, then retry the operation.
<b>Message</b>	0042-188
<b>Explanation</b>	Failed to NFS mount.
<b>User Action</b>	Verify that NFS is running on both the resource server and the client specified in the error message. Retry the operation when the NFS problems have been resolved.
<b>Message</b>	0042-189
<b>Explanation</b>	Failed saving existing boot image. Check space in the file system.
<b>User Action</b>	Increase space in the file system specified by the error message, and retry the operation.
<b>Message</b>	0042-190
<b>Explanation</b>	The key is <i>not</i> in the NORMAL position. Unattended installation cannot complete unless the key is in the NORMAL position.
<b>User Action</b>	Turn the key on the client machine to the NORMAL position and retry the operation.
<b>Message</b>	0042-191





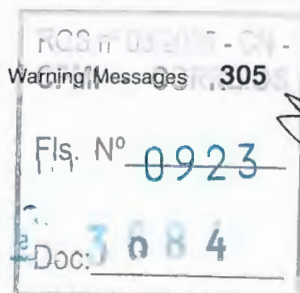


Explanation	Unable to write the IPLROM emulation.
User Action	The <b>mkboot</b> command failed to write the IPLROM emulation on the client. Boot the client manually over the network to begin the BOS installation.
Message	0042-192
Explanation	Unable to find boot logical volume.
User Action	Verify that a boot logical volume is defined for the machine. NIM attempts to use the <b>lslv -l hd5</b> command to determine the boot logical volume.
Message	0042-193
Explanation	The client does not have an <b>.rhosts</b> entry for the master, or the client host ID is not resolvable.
User Action	Verify that the client host name is resolvable by the master. Then verify that an entry exists for the master in the <b>\$HOME/.rhosts</b> file for root on the client machine.
Message	0042-194
Explanation	The client does not allow NIM <b>push</b> operations. Remove <b>/etc/nimstop</b> on %s if <b>push</b> operation is necessary.
User Action	On the client machine, run the <b>nimclient -p</b> command to re-enable master push permissions.
Message	0042-195
Explanation	Unable to order boot device list.
User Action	An error was returned by the <b>bootlist</b> command on the client. If a network boot must be performed for a <b>bos_inst</b> , <b>diag</b> , or <b>maint_boot</b> operation, manually set the boot list and reboot the client, or follow the normal procedure to boot the client over the network.
Message	0042-196
Explanation	The <b>set_bootlist</b> attribute is only valid when used in combination with the <b>no_client_boot</b> or <b>boot_client</b> attributes.
User Action	Only specify the <b>set_bootlist</b> attribute to the <b>nim</b> command when changing the default behavior with the <b>no_client_boot</b> or <b>boot_client</b> attributes.
Message	0042-197
Explanation	If the target machine has more than one interface for a given network type, the network adapter's logical device name must be specified in the <b>if1</b> attribute of the target machine's NIM definition when using the <b>force_push</b> attribute.
User Action	Modify the client's <b>if1</b> attribute using the NIM <b>change</b> operation. Change the <b>if1</b> attribute to include one of the client's network adapter logical device names listed in the error message.
Message	0042-198
Explanation	When converting a machine's <b>/usr</b> file system to a <b>SPOT</b> , the bos image on the media ( <b>lpp_source</b> ) being used to create the <b>SPOT</b> must match the bos image that was used to install the machine.
User Action	When defining the <b>/usr SPOT</b> , use the same installation media that was used to install the machine originally. For example, if a machine was originally installed with AIX 4.3.2 and then updates were applied to bring the machine to AIX 4.3.3, the installation media that should be used when defining the <b>/usr SPOT</b> on the machine would still need to be the AIX 4.3.2 product media.
Message	0042-199
Explanation	The <b>no_client_boot</b> and <b>boot_client</b> attributes may not be specified together.
User Action	To avoid the possibility of giving conflicting instructions to the NIM command, do not supply both the <b>no_client_boot</b> and <b>boot_client</b> attributes in the same NIM operation.
Message	0042-204
Explanation	The <b>mk_image</b> and <b>source</b> attributes are only valid when specified together.





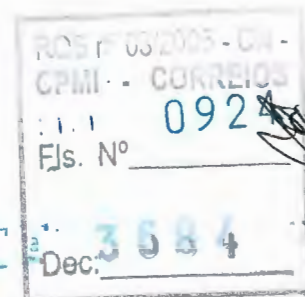
User Action	When creating a <b>mksysb</b> resource from a running client machine, use the <b>mk_image=yes</b> attribute to indicate that a <b>mksysb</b> should be created, and use the <b>source=ClientName</b> attribute to specify the name of the client that is to be backed up.
Message	0042-205
Explanation	The <b>bos.sysmgmt.sysbr</b> fileset must be installed on the client to perform the system backup. You may install this fileset with the NIM <b>cust</b> operation.
User Action	Install the <b>bos.sysmgmt.sysbr</b> fileset on the client machine before retrying the operation.
Message	0042-206
Explanation	There is already a resource allocated.
User Action	Only one resource of the type specified can be allocated to the client. Deallocate the first resource before attempting to allocate the other.
Message	0042-207
Explanation	Unable to allocate a resource to a client.
User Action	Look for other NIM error messages that may accompany this error and which may provide more information about the problem. Verify that the resource specified is NFS-exportable to the client.
Message	0042-208
Explanation	Unable to lock a client. This could mean that the client is already locked, or the name given does not refer to a valid NIM client.
User Action	If another NIM operation is being performed on the same client, wait for the process to complete before retrying the operation. If no other NIM operations are being performed, stop and restart the <b>nimesis</b> daemon to remove locks.
Message	0042-209
Explanation	The <b>mksysb_flags</b> attribute contains an illegal value. Use the <b>lsnim -Pa mksysb_flags</b> command to get a list of legal values.
User Action	Specify the correct values for the <b>mksysb_flags</b> attribute, and retry the operation.
Message	0042-210
Explanation	The maximum space required for the backup is greater than the amount of free space in the target file system. To ignore space requirements, use the <b>-F</b> flag when defining the <b>mksysb</b> resource.
User Action	Either increase the space of the target file system where the <b>mksysb</b> is to be created, or use the <b>-F</b> flag as specified in the error message.
Message	0042-211
Explanation	The member already exists in group.
User Action	No additional action is required, since the member is already added to the group.
Message	0042-212
Explanation	The member was not added to the group, because it is not a valid NIM name.
User Action	The name of a member to add to a group was invalid. Verify that the member was specified correctly.
Message	0042-213
Explanation	The group was not created, because it did not contain any valid members.
User Action	A group must contain at least one member. Redefine the group with valid members to add it to the NIM environment.
Message	0042-214
Explanation	Unable to add a member to a group.
User Action	Look for other NIM error messages that may accompany this error and which may provide more information about the problem.







Message	0042-215
Explanation	An invalid log type for the <b>showlog</b> operation was specified.
User Action	Specify one of the valid log types listed in the error message.
Message	0042-216
Explanation	An invalid log type for the <b>showlog</b> operation was specified for a <b>SPOT</b> .
User Action	Specify one of the valid log types listed in the error message.
Message	0042-217
Explanation	An invalid log type for the <b>showlog</b> operation was specified for a diskless or dataless machine.
User Action	Specify one of the valid log types listed in the error message.
Message	0042-218
Explanation	The log file is either empty or does not exist.
User Action	No information is available in the log file for the machine or <b>SPOT</b> specified.
Message	0042-219
Explanation	The object is incompatible with the group.
User Action	The object cannot be added to the group, because its type is not allowed in the group. Machine groups can only contain one type of NIM client, and that type is determined by the first member added. Resource groups can only contain members whose types are resources.
Message	0042-220
Explanation	You cannot have more than one resource of the specified type in a resource group.
User Action	You must remove the current member with the specified type from the resource group before the new member with the same type can be added.
Message	0042-221
Explanation	The group <i>GroupName</i> is being removed, because its single remaining member was removed during this operation.
User Action	A group cannot be empty. Redefine the group with at least one member if it should remain in the NIM environment.
Message	0042-222
Explanation	An unknown error occurred allocating resources to the machine.
User Action	Look for other NIM error messages that may accompany this error and which may provide more information about the problem. Verify that the resource specified is NFS-exportable to the client.
Message	0042-223
Explanation	Invalid input file. The file either cannot be read, is empty, or contains no valid entries.
User Action	Verify that the file specified in the error message is the correct file for the operation.
Message	0042-224
Explanation	The limit on the length of a line in an NFS exports file was exceeded. The <b>export</b> operation cannot be performed.
User Action	Manually edit the <b>/etc/exports</b> and <b>/etc/xtab</b> files to remove any obsolete entries. The number of hosts to which NIM can NFS-export a resource can also be increased by setting the <b>restrict_nfs_exports</b> attribute to <b>no</b> on the master by running the <b>nim -o change -a restrict_nfs_exports=no master</b> command.
Message	0042-225
Explanation	An error occurred while updating the exports file. Check for corruption in the file.



**User Action** Manually edit the `/etc/exports` and `/etc/xtab` files to fix any file corruption problems. Attempt to determine why NIM was unable to successfully update the files. Check file and directory permissions, and verify that file systems are not full.

**Message** 0042-226  
**Explanation** A timeout occurred while attempting to initiate the operation on the client. The operation may not have started successfully.

**User Action** If the operation that was performed was **bos\_inst**, the client only needs to be rebooted manually over the network to begin the installation. For all other operations, the problem is most likely due to network communication problems between the master and the client. Verify that the client is reachable by the master and that **rsh** permission is still granted by the client to the master.

**Message** 0042-227  
**Explanation** The state of the machine indicates that it may not be ready for certain NIM operations.  
**User Action** Check to see if any NIM operations are still being performed on the machine. If not, reset the state of the machine with the **nim -Fo reset MachineName** command. This returns the machine to the **ready** state so NIM operations can be performed on it. The **reset** operation does not deallocate resources, so deallocate resources if necessary using the **nim deallocate** operation.

**Message** 0042-228  
**Explanation** Invalid release level.  
**User Action** The release level of the resource is incomplete, or incorrectly specified. The level of the resource can be obtained by running the **lsnim -l ResourceName** command and viewing the **version**, **release**, and **mod** attributes. To correct the problem, either recreate the resource, or modify the NIM database to contain the correct level using the command on the NIM master: **/usr/lpp/bos.sysmgmt/nim/methods/m\_chattr -a Attribute=Value ResourceName**, where **Attribute** is **version**, **release**, or **mod**; **Value** is the correct value; and **ResourceName** is the name of the resource with the incorrect level specification.

**Message** 0042-229  
**Explanation** When installing a system using a **mksysb** as the source for the installation, the level of the **SPOT** used for the installation must match the level of the **mksysb** image being installed. The release levels of the **SPOT** and the **mksysb** do not match.

**User Action** Create a **SPOT** that matches the level of the **mksysb** being installed, and use that **SPOT** when performing a **mksysb** BOS installation. The level of **mksysb** and **SPOT** resources can be obtained by running the **lsnim -l ResourceName** command and viewing the **version**, **release**, and **mod** attributes.

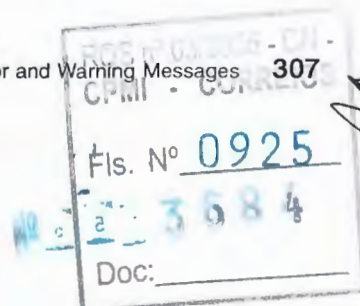
**Message** 0042-230  
**Explanation** When installing a system using a **mksysb** as the source for the installation, the level of the **SPOT** used for the installation should match the level of the **mksysb** image being installed. If this convention is not followed, the installation may not complete successfully.

**User Action** Create a **SPOT** that matches the level of the **mksysb** being installed, and use that **SPOT** when performing a **mksysb** BOS installation. The level of **mksysb** and **SPOT** resources can be obtained by running the **lsnim -l ResourceName** command and viewing the **version**, **release**, and **mod** attributes.

**Message** 0042-231  
**Explanation** A temporary list of software that should be installed is created and used for this operation. The list could not be created.

**User Action** Check previous error messages to understand why the error occurred. Correct the problem and try the operation again.

**Message** 0042-232  
**Explanation** A temporary **installp\_bundle** resource is created and used for this operation. The temporary resource could not be created.





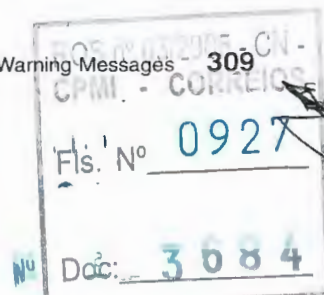


<b>User Action</b>	Check previous error messages to understand why the creation of the resource failed. Correct the problem and try the operation again.
<b>Message</b>	0042-233
<b>Explanation</b>	The operation cannot be performed because the NIM Master is already initialized.
<b>User Action</b>	Unconfigure the NIM Master and try the operation again.
<b>Message</b>	0042-234
<b>Explanation</b>	You cannot restore a NIM database backup onto a machine that has an earlier level of the NIM master fileset installed. For example, a NIM database backup of a system with level 4.2.0.0 of the NIM master cannot be restored to a system that has a level of the NIM master lower than 4.2.0.0.
<b>User Action</b>	Install a level of the NIM master fileset that is at the same level or a later level than that from which the backup was created. Then attempt to restore the NIM database backup.
<b>Message</b>	0042-235
<b>Explanation</b>	An image source was not specified for creating the <b>SPOT</b> .
<b>User Action</b>	Specify a device containing installation images or specify an <b>lpp_source</b> with the <b>simages</b> attribute for creating the <b>SPOT</b> .
<b>Message</b>	0042-236
<b>Explanation</b>	A name for the <b>lpp_source</b> and/or a directory to contain the <b>lpp_source</b> was not specified for the <b>lpp_source</b> that will be created.
<b>User Action</b>	Specify a name and a directory for the <b>lpp_source</b> and try the operation again.
<b>Message</b>	0042-237
<b>Explanation</b>	A name for the <b>SPOT</b> and/or a directory to contain the <b>SPOT</b> was not specified for the <b>SPOT</b> that will be created.
<b>User Action</b>	Specify a name and a directory for the <b>SPOT</b> and try the operation again.
<b>Message</b>	0042-238
<b>Explanation</b>	A parent directory was not specified for the diskless and dataless machine resources that will be created.
<b>User Action</b>	Specify a directory for the diskless/dataless machine resources and try the operation again.
<b>Message</b>	0042-239
<b>Explanation</b>	A name for the resource and/or directory to contain the resource was not specified for the resource that will be created.
<b>User Action</b>	Specify a name and a directory for the resource and try the operation again.
<b>Message</b>	0042-240
<b>Explanation</b>	A parent directory was not specified for the diskless and dataless machine resources that will be created.
<b>User Action</b>	Specify a directory for the diskless/dataless machine resources and try the operation again.
<b>Message</b>	0042-241
<b>Explanation</b>	The size and/or volume group was not specified for the creation of a new file system to contain a NIM resource.
<b>User Action</b>	Specify both the size and volume group for the file system and try the operation again.
<b>Message</b>	0042-242
<b>Explanation</b>	The size and/or volume group was not specified for the creation of a new file system to contain diskless and dataless machine resources.
<b>User Action</b>	Specify both the size and volume group for the file system and try the operation again.
<b>Message</b>	0042-243





Explanation	An attempt was made to create the same file system twice: once for an <b>lpp_source</b> and once for a <b>SPOT</b> .
User Action	Specify a different directory for either the <b>lpp_source</b> or the <b>SPOT</b> . This will cause different file systems to be created for the resources. If a new file system really should be created to contain both resources, then only specify that the file system should be created for one of the resources, but specify the same directory for both resources.
Message	0042-244
Explanation	An attempt was made to create the same file system twice: once for an <b>lpp_source</b> and once for diskless/dataless machine resources.
User Action	Specify a different directory for either the <b>lpp_source</b> or the diskless/dataless resources. This will cause different file systems to be created for the resources. If a new file system really should be created to contain both sets of resources, then only specify that the file system should be created for one of the resources, but specify the same directory for both resources.
Message	0042-245
Explanation	An attempt was made to create the same file system twice: once for a <b>SPOT</b> and once for diskless/dataless machine resources.
User Action	Specify a different directory for either the <b>SPOT</b> or the diskless/dataless resources. This will cause different file systems to be created for the resources. If a new file system really should be created to contain both sets of resources, then only specify that the file system should be created for one of the resources, but specify the same directory for both resources.
Message	0042-246
Explanation	Not enough space on the volume group to create the specified file system.
User Action	Specify a different volume group for the file system to be created and try the operation again.
Message	0042-247
Explanation	Creation of the file system failed.
User Action	Check the previous output for error messages to understand what caused the file system creation to fail. Correct the error and try the operation again.
Message	0042-248
Explanation	An error occurred during file system creation.
User Action	Check the previous output for error messages to understand what caused the file system creation to fail. Correct the error and try the operation again.
Message	0042-249
Explanation	NIM master initialization failed.
User Action	Check the previous output for error messages to understand what caused the configuration of the NIM master to fail. Correct the error and attempt to reinitialize the master. The most frequent cause of this failure is that the master is already initialized. The master can be unconfigured with the <b>nim -o unconfig master</b> command and reinitialized. However, this should be done with extreme caution, since unconfiguring the master will remove all definitions from the NIM database.
Message	0042-250
Explanation	Unable to continue with configuration.
User Action	Check the previous output for error messages to understand what caused the configuration to fail. Correct the error and attempt to configure the system again from the point of failure.
Message	0042-251
Explanation	A route cannot be added to the network, because a required default route is missing. Add a default route to the network, and try this operation again.
User Action	Add a default route to the network specified in the error message, and retry the operation.
Message	0042-252







**Explanation** Unable to locate a matching network.  
**User Action** The **find\_net** keyword was used in the **if** attribute of the machine. However, no matching network was found. Either define the network prior to defining the machine interface, or use the **net\_definition** attribute in conjunction with the **find\_net** keyword to define the network while the interface is being defined.

**Message** 0042-253  
**Explanation** You cannot use the **net\_definition** attribute when the **find\_net** keyword is not specified as the first field of the **if** attribute.

**User Action** The **net\_definition** attribute is invalid when using a known network in the **if** attribute. Specify the **find\_net** keyword in the **if** attribute, or omit the **net\_definition** attribute, and retry the operation.

**Message** 0042-254  
**Explanation** Invalid format for the specified value of **net\_definition**. The value of the attribute should be as follows:

*NetType*

Network type (for example, tok, ent, fddi, etc.).

*snmName*

Dotted decimal subnet mask for the network.

*Client\_gwName*

Optional default gateway IP address or host name used by the machine being defined to communicate with the master.

*Master\_gwName*

Optional default gateway IP address or host name used by the master to communicate with clients on other subnets.

*NetName*

Optional name given to the NIM definition created for the network. (Otherwise, a unique default name is used.)

If you want to specify *NetName* and if *Client\_gwName* or *Master\_gwName* are not applicable, specify 0 in their place. If *Client\_gwName* is 0, *Master\_gwName* cannot be nonzero.

**User Action** Correct the syntax error, and retry the operation.

**Message** 0042-255  
**Explanation** The master already has a default route, and the gateway you specified as being the default for the master is different from that which is already defined. Use the **change** operation if you want to modify the master's default gateway.

**User Action** To change the default gateway for a network, use the following command:

```
nim -o change -a routingX="default GtName" NetName
```

where *X* is the sequence number for the **routing** attribute; *GtName* is the default gateway to use; and *NetName* is the name of the master's network.

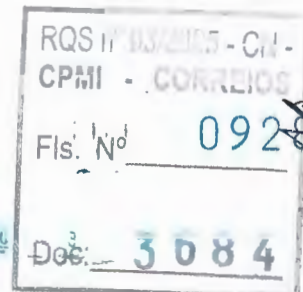
**Message** 0042-256  
**Explanation** A default route already exists for the network. You can modify the default gateway, but you cannot define more than one default route.

**User Action** To change the default gateway for a network, use the following command:

```
nim -o change -a routingX="default GtName" NetName
```

where *X* is the sequence number for the **routing** attribute; *GtName* is the default gateway to use; and *NetName* is the name of the network to modify.

**Message** 0042-257  
**Explanation** You cannot specify the **net\_definition** attribute without specifying the **if** attribute when changing a machine definition.

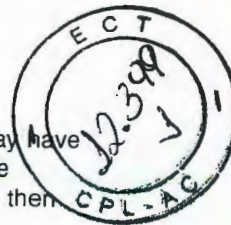




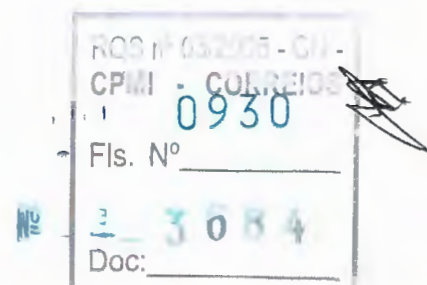
User Action	The <b>net_definition</b> must reference a machine interface, so specify an <b>if</b> attribute when using the <b>net_definition</b> attribute.
Message	0042-258
Explanation	You cannot specify the <b>net_definition</b> attribute when creating or modifying more than one <b>if</b> attribute in the same <b>change</b> operation. Use two separate operations.
User Action	To avoid ambiguity, manipulate only one machine interface ( <b>if</b> attribute) at a time when using the <b>net_definition</b> attribute.
Message	0042-259
Explanation	The value of <b>default_res</b> specified on the master's database definition is not a valid NIM resource group.
User Action	Specify a valid NIM resource group as the default resource. Obtain a list of resource groups by running the <b>lsnim -t res_group</b> command.
Message	0042-260
Explanation	The <b>default</b> attribute is only applicable when manipulating a resource group.
User Action	Setting the <b>default=yes/no</b> attribute on a resource group makes it the default set of resources to use in NIM operations. The <b>default</b> attribute is invalid when used as an attribute in other NIM operations.
Message	0042-261
Explanation	Illegal use of the <b>async</b> attribute. This attribute can only be specified for the <b>lppchk</b> operation when the target is a standalone machine or a group of standalone machines.
User Action	Omit the <b>async</b> attribute when performing the <b>lppchk</b> operation, unless the target is a standalone machine or a group of standalone machines.
Message	0042-262
Explanation	The file name of the client definition file is missing for this operation.
User Action	Specify the client definition file that should be used to add machines to the NIM environment. For more information, see "Network Installation Management Commands Reference" on page 196.
Message	0042-263
Explanation	The <b>netboot_kernel</b> attribute can only be assigned a value of <b>up</b> or <b>mp</b> .
User Action	Correct the value specified for the <b>netboot_kernel</b> attribute.
Message	0042-264
Explanation	The image source that was used to define the <b>lpp_source</b> is missing one or more requested packages.
User Action	Installation images were not copied into the <b>lpp_source</b> directory. The source for installation images may not contain all of the filesets specified to populate the <b>lpp_source</b> . Copy the missing installation images to the <b>lpp_source</b> directory, and then perform the NIM <b>check</b> operation on the <b>lpp_source</b> .
Message	0042-265
Explanation	The image source that was used to define the <b>lpp_source</b> is missing one or more items from the list of default packages.
User Action	Installation images were not copied into the <b>lpp_source</b> directory. The source for installation images may not contain all of the default filesets used to populate the <b>lpp_source</b> . Copy the missing installation images to the <b>lpp_source</b> directory, and then perform the NIM <b>check</b> operation on the <b>lpp_source</b> .
Message	0042-266
Explanation	Requested packages are missing from the defined <b>lpp_source</b> .

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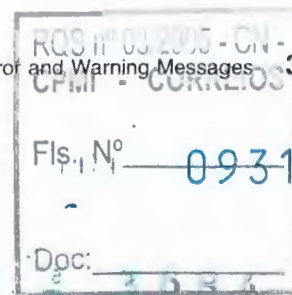


User Action	Installation images were not copied into the <b>lpp_source</b> directory. The fileset names may have been specified incorrectly, or the source for installation images may not contain all of the specified filesets. Copy the missing installation images to the <b>lpp_source</b> directory, and then perform the NIM <b>check</b> operation on the <b>lpp_source</b> .
Message	0042-267
Explanation	The defined <b>lpp_source</b> does not have the <b>simages</b> attribute, because one or more packages are missing.
User Action	Copy the missing installation images to the <b>lpp_source</b> directory, and perform the NIM <b>check</b> operation on the <b>lpp_source</b> to add the <b>simages</b> attribute.
Message	0042-268
Explanation	The operation cannot be performed, because all members of the target group specified are currently excluded from operations on the group. You must unmark (or include) excluded group members before proceeding.
User Action	Perform the NIM <b>select</b> operation on the group to include members in further operations.
Message	0042-269
Explanation	Only one type of verification can be performed at a time when verifying installed filesets on a NIM client.
User Action	Disable or deselect all but one verification option and try the operation again.
Message	0042-270
Explanation	The operation is only supported on <b>SPOTs</b> and NIM clients installed with a version and release level of AIX 4.2 or greater.
User Action	The NIM client fileset on the target is at an earlier level and does not support the attempted operation. The client software on the target must be upgraded before the operation can be performed.
Message	0042-271
Explanation	A resource matching the type is already allocated. You cannot allocate more than one resource of this type to a machine.
User Action	Deallocate the first resource before attempting to allocate the second. It may be necessary to reset the machine before the resource can be deallocated.
Message	0042-272
Explanation	A value specified is not a valid value for <b>default_re</b> because it is not a valid NIM resource group.
User Action	Specify a different resource group for the <b>default_res</b> attribute, or correct the resource group in question.
Message	0042-273
Explanation	A value specified cannot be used as the location for the <b>mksysb</b> image because it is a directory. You must specify the filename where the <b>mksysb</b> image currently resides or will reside after creation.
User Action	Specify a file name instead of a directory for the location of the <b>mksysb</b> resource.
Message	0042-274
Explanation	The <b>-e</b> flag in the <b>mksysb_flags</b> attribute and the <b>exclude_files</b> attribute cannot be specified together. Specify the <b>-e</b> flag with the <b>mksysb_flags</b> attribute to exclude the files in <b>/etc/exclude.rootvg</b> from the backup, or specify an <b>exclude_files</b> attribute.
User Action	Do not specify both the <b>-e mksysb</b> flag and an <b>exclude_files</b> resource when performing this operation.
Message	0042-275
Explanation	Unable to obtain possession of a lock file. If no NIM operations are currently in progress, remove the file and repeat the operation.





User Action	Use the <b>ps -ef   grep nim</b> command to list the running NIM processes on the system. If any NIM processes other than the <b>nimesis</b> daemon are running, wait for them to finish and then remove the file specified by the error message.
Message	0042-276
Explanation	A fileset must be installed before this operation can be performed.
User Action	Install the fileset listed in the error message before retrying the operation. Generally, the fileset needs to be installed on the client system. However, depending on the operation being performed, the NIM master may also need to have the fileset installed before the operation will succeed.
Message	0042-277
Explanation	Diskless and dataless machines cannot be defined with a primary network install interface residing on a generic NIM network. It is presumed that a network adapter defined on a generic NIM network does not support network boot.
User Action	To define the systems as diskless or dataless clients, they must first be connected to a NIM network that is known to support network boot, such as ethernet, token-ring, or FDDI.
Message	0042-278
Explanation	The interface specified does not correspond to a network adapter that is known to support network boot. As a result, the NIM master has been defined on a generic NIM network. Network boot-dependent operations, such as base operating system installation, will not be possible on any NIM client whose primary network install interface is defined on the same network as the NIM master.
User Action	Operations that rely on network boot capability cannot be performed on clients on generic NIM networks. Such operations must be performed using local media on the system.
Message	0042-279
Explanation	The interface specified maps to a subnet which has been defined as a generic NIM network. It will not be possible to perform network boot-dependent operations, such as base operating system installation, on the machine definition created by this operation.
User Action	Operations that rely on network boot capability cannot be performed on clients on generic NIM networks. Such operations must be performed using local media on the system.
Message	0042-280
Explanation	Specify a complete date and time for the scheduled operation in the form: YYMMDDhhmm.
User Action	Use the format described in the error message to correctly schedule a date and time for the operation.
Message	0042-281
Explanation	The <b>/usr</b> file system on the specified server cannot be converted to a NIM <b>SPOT</b> . Either the <b>RM_INST_ROOTS</b> variable was set to <b>yes</b> in a <b>bosinst.data</b> file during initial installation of the machine or <b>inurid -r</b> was subsequently invoked. The only way to create a <b>SPOT</b> on this machine is to specify the location to be something other than <b>/usr</b> or reinstall the machine and then create a <b>SPOT</b> in <b>/usr</b> .
User Action	The system is unable to support the creation of a <b>/usr SPOT</b> . A <b>non-usr SPOT</b> may be created on the system by specifying a different value for the <b>location</b> attribute.
Message	0042-282
Explanation	The BOS installation has been enabled but could not be initiated, because the following file was not found on the target. To start the installation, do one of the following: <ol style="list-style-type: none"><li>1. Initiate a network boot operation from the target.</li><li>2. Correct the state of the target with NIM's <b>reset</b> operation and invoke the <b>bos_inst</b> operation again using one of the following:<ol style="list-style-type: none"><li>a. The Force Push option (<b>-a force_push=yes</b>)</li><li>b. After installing and configuring the <b>bos.sysmgt.nim.client</b> fileset on the target.</li></ol></li></ol>







**User Action** The NIM client fileset is not properly installed and configured on the target system. Follow the directions specified in the error message to correct the problem.

**Message** 0042-283

**Explanation** The existence of a file on the server indicates that a NIM **SPOT** may still be mounted in a subdirectory which will be removed by this operation. Before attempting the operation again, unmount the **SPOT**'s directory along with any other directories that may be mounted beneath the directory being removed.

**User Action** Failure to do so will result in loss of data on the **SPOT** server.  
A **SPOT** operation failed, and NIM was unable to unmount all the directories mounted into the **SPOT**. Manually unmount the directories specified in the error message before retrying the operation. The **mount** command can be used to list the directories mounted on the system, and the **unmount** command can be used to unmount directories. Use the **-f** option with the **unmount** command if necessary to force the unmount.

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## Chapter 27. NIM Troubleshooting

This chapter suggests solutions for network boot problems and describes procedures for producing debug output for NIM BOS installations. Refer to Chapter 26, "NIM Error and Warning Messages", on page 287 for information about error messages.

### Debugging a Network Boot Problem

If a client machine is unable to network boot from its boot server, there may be a problem in one or more of the network boot stages. The network boot stages are listed in the following tasks:

- "Verifying Network Communication Between the Client and Server"
- "Obtaining the Boot Image from the Server"
- "Running the Boot Image on the Client" on page 316.

### Verifying Network Communication Between the Client and Server

Before initiating the network boot on the client, do the following to verify network communication between the client and the server:

1. Perform a ping test from the client **bootp** menus.
2. If the ping test fails, verify that the client, server, and gateway addresses are specified correctly.
3. If the addresses are correct, try to ping the server from a different machine in the client's subnet. If the server can be pinged from another machine, the network adapter on the boot client may be faulty.
4. If the server cannot be pinged from another machine in the client's subnet, there may be routing problems between the client and the server, or network communications on the server may be faulty. For information on network-debugging procedures, refer to TCP/IP Problem Determination in the *AIX 5L Version 5.2 System Management Guide: Communications and Networks*.

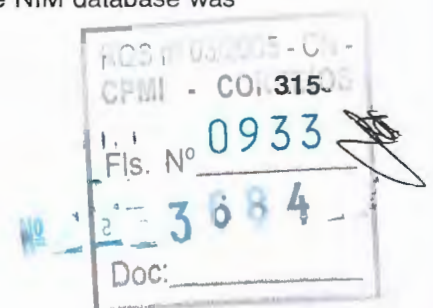
### Obtaining the Boot Image from the Server

1. If the ping test is successful, perform a network boot of the client. When a network boot is initiated on a client, a **bootp** request packet is sent from the client to the server. The server then replies with a packet to the client. The client machine displays the number of packets sent and received for the **bootp** request. If a packet is sent from the client, but none is received, another packet will be sent. If **bootp** packets continue to be sent but not received, the boot server may not be responding to the request.
2. From the **bootp** server, view the **/etc/bootptab** file on the server. It should contain an entry for the client machine with the following information:

```
hostname_of_client
bf=boot_file
ip=client_ip_address
ht=network_type
sa=boot_server_address
sm=client_subnet_mask
ha=network_adapter_hardware_address (required only if bootp requests are sent by broadcasting)
```

If an entry does not exist, either the NIM command used to set up the current operation failed, or the machine was reset before the boot operation could occur. Rerun the NIM **bos\_inst**, **diag**, or **maint\_boot** operation to prepare the server for the client boot request.

If the entry exists in **/etc/bootptab**, verify that the specified data is correct. If a field contains incorrect data, the information that was used to define the machine or network in the NIM database was







probably incorrect. Correct this problem by resetting the client machine, correcting the invalid data in the client or network definition, retrying the NIM operation, and rebooting the client.

3. If the **/etc/bootptab** file is correct, verify that the **inetd** daemon is running. If it is not running, start it and retry the network boot from the client. If the **inetd** daemon is running, it should automatically start the **bootpd** daemon when the **bootp** request is received at the server.
4. If the **bootpd** daemon is not started, verify that the **bootps** entry in the **/etc/inetd.conf** file is not commented out. If it is commented out, uncomment it and restart **inetd** with the **refresh -s inetd** command. Retry the network boot from the client.
5. If a **bootp** reply is still not received at the client, manually start the **bootpd** daemon in debug mode:
  - a. Comment out the **bootps** entry from the **/etc/inetd.conf** file on the server.
  - b. Stop all running **bootpd** processes.
  - c. Restart **inetd** using the **refresh -s inetd** command.
  - d. Start **bootpd** from the command line, using the **/usr/sbin/bootpd -s -d -d -d** command.
6. Retry the network boot from the client. If no output is displayed from the running **bootpd** command, the client **bootp** request is not reaching the server. Verify that the addresses specified in the **bootp** menus are correct. If they are correct, perform network debugging procedures to determine why the packet is not reaching the server.

If the server receives the client **bootp** request, the running **bootpd** command displays output matching the client data in the **/etc/bootptab** file. Verify that the specified addresses are correct. This information is sent back to the client in the **bootp** reply.
7. If the client is still not receiving the **bootp** reply, perform network-debugging procedures to determine why the reply packet is not reaching the client.

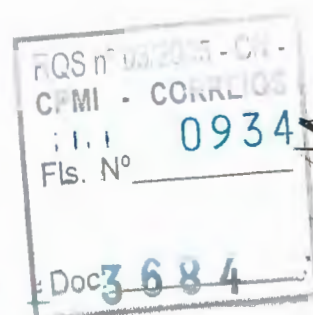
After the client receives the **bootp** reply, it will **tftp** the boot image from the server.  
The number of **tftp** packets transferred to the client will be displayed at the client machine.  
The boot image has been successfully retrieved at the client machine when the LED shows 299 on **rs6k**-platform machines or when the bottom third of the screen turns gray on other platform machines.
8. If the **tftp** of the boot image does not complete successfully, the client may be trying to get the wrong boot image. Verify that the client definition in the NIM database shows the correct platform and kernel type. If the data is incorrect, correct it, reset the client machine, rerun the NIM operation, and reboot the client over the network.
9. Verify that the **/tftpboot** directory on the boot server contains a link with the client name to the correct boot image. If the link does not exist, reset the client machine, rerun the NIM operation, and reboot the client over the network.
10. If the link with the client name is pointing to the correct boot image and the **tftp** of the boot image does not complete successfully, the boot image may be corrupted. Re-create the boot image by performing a NIM **check** operation with the **force** flag on the **SPOT**. If the client is not an **rs6k**-platform machine, also make sure the client has the latest version of the firmware installed.

## Running the Boot Image on the Client

After the client machine has successfully received the boot image from the server, the most common errors encountered are hangs with the LED showing 608, 611, or 613. Some machines may not have LED displays. Debugging such problems on these machines will require using debug-enabled boot images. For information on building debug boot images, see "Producing Debug Output from the BOS Installation Program" on page 319.

608

Explanation      **tftp** retrieve of client info file failure.







<b>Action</b>	If a 608 hang is encountered, verify that the <i>ClientName.info</i> file exists in the <i>/tftpboot</i> directory. If it does not exist, retry the NIM operation to create it. If it does exist, verify that <i>tftp</i> access to the <i>/tftpboot</i> directory is not restricted in the <i>/etc/tftpaccess.ctl</i> file. It is also possible that the network adapter was not configured properly in the boot environment. Use debug-enabled network boot images to look for errors in the boot environment. If the client is not an <i>rs6k</i> -platform machine, make sure that it has the latest version of firmware installed.
<b>611</b>	
<b>Explanation</b>	Remote mount of NFS file system failure.
<b>Action</b>	611 hangs occur when the client machine is unable to mount a resource from a server. Ensure that NFS is running on the resource server. Verify that the resources specified for the operation are exported properly by checking the <i>/etc/exports</i> and <i>/etc/xtab</i> files on the server. Also, confirm that the resources have permissions set correctly for reading. Debug-enabled network boot images can also be used to determine exactly which <b>mount</b> command is failing on the client.
<b>613</b>	
<b>Explanation</b>	Failure setting up route tables.
<b>Action</b>	613 hangs usually occur because a route is incorrectly defined for a network in the NIM database. Verify that the correct gateways are specified between networks, and all gateways are functional. Use debug-enabled network boot images to determine which routes could not be defined.

---

## Producing Debug Output for NIM BOS Installations

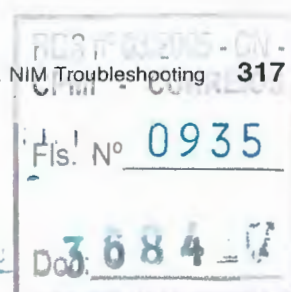
Due to problems in the network or in the NIM configuration, clients may fail to boot or install properly. When this happens, it may be necessary to produce debug information in order to determine the cause of the problem. If a client machine fails to configure properly from the network boot image, debug output from the boot image can be obtained by building the debug-enabled image and attaching a *tty* to the client system. This will display the commands and output that are run while the client is configured before further processing is done by AIX.

If the system has been booted from the network boot image, but failures are still occurring during a BOS installation, it may be necessary to collect debug information from the BOS installation program. The commands and output from the BOS installation program will automatically be displayed on the *tty* if the boot image was built debug-enabled. If the boot image was not built for debugging, output can be obtained by either setting a value in a *bosinst.data* file or by entering special codes at the installation menus.

When problems arise during a NIM BOS installation, you will most likely get system hangs. Viewing the debug output can be useful, because you will be able to see the commands that failed. The problem may be a misconfiguration of the network adapter or an inability to perform an operation from the client to the server. By examining the debug output, you can determine what failed and make corrections to avoid the error in the future.

You will see the **showled** command running in the debug output. This command displays status values on the LEDs on the front of the machine. Frequently, known problems and solutions are referenced by the LED value that is displayed when a problem occurs. Some machines do not have LEDs for displaying such information. Therefore, when debugging problems on such machines, give special attention to observing the values that the **showled** commands are displaying.

Obtaining debug information from a network installation can save you time in determining the root cause of a problem. Usually, the problem will be an incorrect definition in the NIM environment that can be found without the debug information. However, with the debug information, you can significantly reduce the scope of the investigation.







## Producing Debug Output from a Network Boot Image

To create debug versions of the network boot images, do the following:

1. Use the Web-based System Manager or SMIT interfaces or run the following command:

```
nim -Fo check -a debug=yes SPOTName
```

where *SPOTName* is the name of your **SPOT**.

2. Obtain the address for entering the debugger by doing the following:

From Web-based System Manager:

- a. From the NIM Resources container, double-click the **SPOT** resource to open the properties notebook.
- b. Click the Boot Image Information tab in the properties notebook to obtain the address.

Alternatively, you can use the following command to get the address:

```
lsnim -a enter_dbg SPOTName
```

where *SPOTName* is the name of your **SPOT**. The displayed output will be similar to the following:

spot1:

```
enter_dbg = "chrp.mp 0x001840d4"
enter_dbg = "chrp.up 0x00160b7c"
enter_dbg = "rs6k.mp 0x001840d4"
enter_dbg = "rs6k.up 0x00160b7c"
enter_dbg = "rspc.mp 0x001840d4"
enter_dbg = "rspc.up 0x00160b7c"
```

Write down the **enter\_dbg** address for the client you are going to boot. For example, if your client is an **chrp**-uniprocessor machine, you would write down the address 160b7c.

3. Attach a tty device to your client system (port 1).
4. Set up and perform the NIM operation that will require the client to boot over the network. Boot the client over the network.
5. After the client gets the boot image from the **SPOT** server, the debug screen will appear on the tty. At the > prompt, enter:

```
st Enter_dbg_Value 2
```

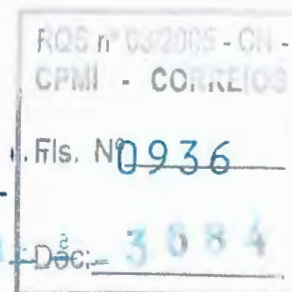
where *Enter\_dbg\_Value* is the number you wrote down in step 2 as your machine type's **enter\_dbg** value. Specifying a 2 at the address of the **enter\_dbg** value prints the output to your tty.

6. Type g (for go) and press Enter to start the boot process.
7. Use Ctrl-s to temporarily stop the process as you watch the output on the tty. Use Ctrl-q to resume the process.
8. To rebuild your boot images in non-debug mode, use the following command:

```
nim -Fo check SPOTName
```

where *SPOTName* is the name of your **SPOT**.

If the boot image is left in debug mode, every time a client is booted from these boot images, the machine will stop and wait for a command at the debugger ">" prompt. If you attempt to use these debug-enabled boot images and there is not a tty attached to the client, the machine will appear to be hanging for no reason.





## Producing Debug Output from the BOS Installation Program

There are two ways to obtain debug output from the BOS installation program. Method A involves entering a special value at one of the installation menus and Method B uses a **bosinst\_data** resource to tell the installation program to display debug output. Both methods are described as follows:

### Method A: To Produce Debug Output Without Using a **bosinst\_data** Resource

1. To enable debugging for the BOS installation program, start by performing all the processing you would normally do to install a client.

Because you are not using a **bosinst\_data** resource, you will be prompted to supply information about the installation to the BOS installation program.

2. Select your console.
3. Select your language.
4. The **Welcome to Base Operating System Installation and Maintenance** menu is displayed. Instead of selecting one of the options, type 911 at the prompt and press Enter.
5. Continue the normal procedure for selecting options and specifying data until the installation begins. Debug output will be sent to the client's display while the installation proceeds.

### Method B: To Produce Debug Output When Using a **bosinst\_data** Resource

1. To enable debugging for the BOS installation program, set the value **BOSINST\_DEBUG = yes** in the **control\_flow** stanza of the **bosinst.data** file that you are using for your **bosinst\_data** resource.

A minimum **bosinst.data** file for debugging purposes would contain the following lines:

```
control_flow:
  BOSINST_DEBUG = yes
```

2. In addition to the processing you would normally do to install a client, include the modified **bosinst\_data** resource as a resource for the operation.

After the client boots over the network, it will use the **bosinst\_data** resource to obtain settings for the installation. If the only data specified in your **bosinst.data** file is **BOSINST\_DEBUG = yes**, you will be prompted for the remaining required information before the installation will continue. Debug output will be sent to the client's display while the installation continues.

---

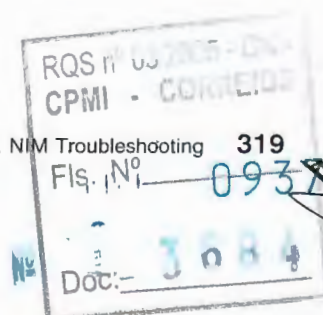
## Port Number Conflicts with NIM and Other Applications

When the NIM Master is configured, two port numbers are selected to be used by the **nimesis** daemon for client communications. The default port numbers are 1058 and 1059. If either port is taken by another application, the **nimesis** daemon will not run and **nimclient** commands will fail with an error similar to the following:

**0042-006 nimclient: (To master) rcmd connection refused**


If the **nimesis** daemon cannot be started, it may be necessary to stop the other applicants on the system to free the port.

Rebooting the system will usually eliminate the problem, because when a machine is booted, the **nimesis** daemon is started very early by **init** and the likelihood that the ports are taken will be very small.

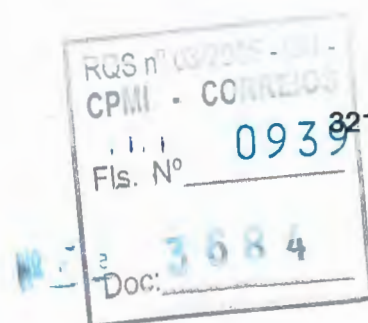




RCS n° 000005 - CH -	
CPMI - CORRIGEND	
Fils. N° 0938	
No.	3684
Doc.	



## Part 4. Appendixes





RQS nº 03 2003 - CN -  
CFMI - CORREIOS  
Fls. Nº 0940  
Doc: 3684

*[Handwritten signature]*

## Appendix A. Network Boot



Note that in the examples, tok0 and ent0 are adapter names. Do not use network names, such as tcp0, en0, or et0.

If an rs6k machine is not running, it is possible to determine whether IPL ROM emulation is required by booting the machine with the key turned to Secure. If the LEDs on the front of the machine eventually stop at 200, no emulation is needed.

To create IPL ROM emulation, see "Creating IPL ROM Emulation Media" on page 326. If you are using NIM on machines that must use IPL ROM emulation to boot from a network adapter, you should always initiate the boot once from the IPL menus from a system console on the client. This writes the necessary addresses to NVRAM, avoiding a problem with seeing alternating LEDs 227 and 229 during the network boot on older hardware. After initiating the network boot/install from the client via this method once, the problem is automatically corrected and subsequent network boot/installation may be initiated from the NIM master.

The platform and kernel type of a client determines the procedure required to boot the machine over the network.

To determine the platform of a running machine, use the **bootinfo -p** command if the machine is running AIX Version 4.2 or later. If the machine is running AIX 4.1, use the **bootinfo -T** command.

To determine the kernel type of a running machine, use the **bootinfo -z** command.

### Booting a Machine Over the Network

If you are booting an rs6k machine with an up kernel, use Method A. If you are booting an rs6k machine with an mp kernel, use Method B. For some models of rspc machines, you may use Method C. For all other platforms and kernel types, follow the procedures in your hardware documentation to perform the network boot.

#### Method A

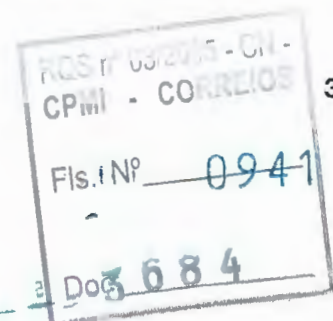
1. Begin with your machine turned off.
2. If your client requires IPL ROM emulation, insert the emulation disk into the diskette drive of the client, and turn on the machine with the hardware key in the Service position. When the **bootp** menus display, continue with step 3.

If your client does not require emulation, turn the key to the Secure position and turn on the machine. Watch the LEDs on the front of the machine. They will eventually stop changing and display 200. Then, change the key position to Service and quickly press the reset (yellow) button. When the **bootp** menus display, continue with step 3.

**Note:** On model numbers 570, 580, 58H, 59H, 591, and 595, the system powers on in the Secure mode, the power-on light does not come on, and the LED remains blank. The system performs no further operations until the key is set to the Normal or Service position. Refer to the documentation that came with your particular hardware model for more information about performing a network boot of the machine.

3. From the **bootp** main menu, choose the Select BOOT (Startup) Device option.
4. In the next menu, select the boot device.

Select the network adapter to be used. Choose the adapter with the correct network type (Ethernet, Token-Ring, etc.) and adapter characteristics (thick cable, twisted pair, 16 Mb data rate, 4 MB data rate, etc.).







5. Set or change the network addresses.

**Note:** You do not need to type the '.' characters in the IP addresses, but you must specify any leading '0' characters that make up parts of the addresses.

Specify the IP address of:

- The client machine you are booting in the client address field.
- Your **SPOT** server in the bootp server address field.
- Your client's gateway in the gateway address field.

After you specify the addresses, enter **99** to save the addresses and return to the main menu. If no gateway is used by the client to communicate with the boot server, you can leave this field empty.

If broadcasting will be used to obtain a boot image, leave these IP addresses empty.

6. From the main menu, select the Send Test Transmission (PING) option.
7. Verify that the displayed addresses are the same as the addresses you specified for your boot device. If the addresses are incorrect, enter **99** to return to the main menu. Then, go back to step 3. If the addresses are correct, select the **START THE PING TEST** option. If the ping test fails, verify that the addresses are correct, and perform network problem determination if necessary. If the ping test completes successfully, enter **99** to return to the main menu.
8. From the main menu, select the Exit Main Menu and Start System (BOOT) option.
9. Turn the hardware key to the Normal position, and press Enter to boot your client over the network.

## Method B (Booting Micro Channel-Based, Symmetric Multiprocessor Systems)

1. Turn the key mode switch to the Secure position.
2. Turn the power switch on the system unit to the On position.
3. When the LED displays 200, turn the key mode switch to the Service position.
4. Press the Reset button once.

The LED persistently displays 260, 261, or 262, and The Maintenance Menu screen appears.

5. Select the **System Boot** option on the Maintenance Menu screen.
6. Select the **Boot from Network** option from the sub-menu. The MAIN MENU is displayed.
7. Select the **Select BOOT (Startup) Device** option on the MAIN MENU screen.
8. Select the network adapter from which the machine will boot. If there are multiple network adapters installed, type 88 and press the Enter key to view the other entries. Type a number from the list and press the Enter key.

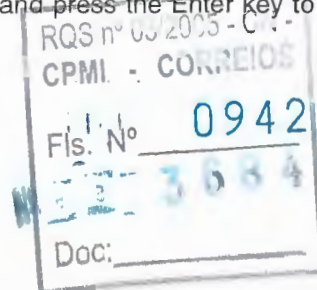
**Note:** If you are using a Token-Ring network, select the number that corresponds to the correct ring speed for your environment.

9. If a network adapter is selected, the SET OR CHANGE NETWORK ADDRESSES screen is displayed next. The hardware address for the network adapter is displayed in the hardware address field. Record the hardware address for defining the NIM machine object.

If this client and the BOOTP server are on the same LAN, leave the IP address fields as zeros for the BOOTP request to be broadcasted over the LAN. If there are multiple BOOTP servers on the LAN or the client is on a different network to the server, enter the client and server IP addresses. Type in the IP addresses using leading zeros to pad the network address fields, for example, 009.101.002.050. If this machine must use a gateway to reach the server, enter the IP address for the gateway.

Type 99 and press the Enter key to save the address information and return to the MAIN MENU.

10. (This step is optional.) Select the **Send Test Transmission (PING)** option on the MAIN MENU to test the network connection between the client and the server systems. Type 3 and press the Enter key to





start the ping test. If the ping test was not successful, check that the IP addresses are correct and that the physical network connections are sound. If the ping test was successful, type 99 and press the Enter key to return to the MAIN MENU.



11. Select the **Exit Main Menu and Start System (BOOT)** option.
12. Follow the instructions on the screen to turn the key mode switch to the Normal position and press the Enter key.

The BOOTP request will be issued, followed by a TFTP transfer of the network boot image.

## Method C (Booting an rspc Platform Machine)

1. Begin with your machine turned off.
2. If your system requires a System Management Services (SMS) diskette, insert it into the diskette drive of the client and turn on the machine. If you do not insert an SMS diskette at this time and one is required, you will be prompted to insert one later.
3. A graphics image is displayed on your screen. Press the **F4** key as icons begin to display from left to right on the bottom of your display.

**Note:** If the last icon is displayed prior to pressing the **F4** key, the normal mode boot list is used instead of the System Management Services diskette.

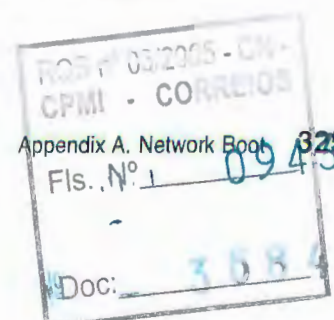
4. The System Management Services menu displays on your screen. Select the **Utilities** option.
5. From the System Management Services Utilities menu, select the **Remote Initial Program Load Setup** option.
6. From the Network Parameters screen, select the **IP Parameters** option.
7. Set or change the values displayed so they are correct for your client system.

**Note:** You do not need to specify any leading '0' characters, but you must specify the '.' characters in the IP addresses.

8. Specify the IP address of:
  - The client machine you are booting in the client address field.
  - Your **SPOT** server in the bootp server address field.
  - Your client's gateway in the gateway address field.

**Note:** If broadcasting will be used to obtain a boot image, leave these IP address fields empty.

9. Specify the subnet mask for your client machine if you are prompted for one in the subnet mask field. All machines in your subnet have the same subnet mask.
10. After you specify the addresses, press Enter to save the addresses and continue.
11. The Network Parameters screen is displayed. Select the **Ping** option.
12. Select the network adapter to be used as the client's boot device.
13. Verify that the displayed addresses are the same as the addresses you specified for your boot device.
14. If the addresses are incorrect, press Esc until you return to the main menu. Then, go back to step 5.
15. If the addresses are correct, press Enter to perform the ping test. The ping test may take several seconds to complete.
16. If the ping test fails, verify that the addresses are correct, and perform network problem determination if necessary. If the ping test completes successfully, press Enter to acknowledge the *success* message. Then, press Esc until you return to the System Management Services menu.
17. From the System Management Services menu, choose the **Select Boot Devices** option.







18. Select the network adapter to be used for the network boot from the list of displayed bootable devices. Be sure to select the correct network type (Ethernet, Token-Ring, etc.) and adapter characteristics (thick cable, twisted pair, 16 Mb data rate, 4 Mb data rate, etc.). After making your selection, the machine will boot over the network.

**Note:** When performing a BOS installation on a NIM client with a "rspc" platform, the machine may fail to boot from the network adapter if network traffic is heavy.

If the network boot was initiated from the NIM Master, the machine will eventually boot from the disk. If the network boot was initiated from the SMS (System Management Services) menus on the NIM client, the machine will return control to the SMS menus.

Contact your service representative to receive a firmware update to correct this problem.

---

## Creating IPL ROM Emulation Media

Use this procedure to create the IPL ROM emulation media on the NIM master for machines that do not have a BOOTP-enabled IPL ROM.

1. Insert a formatted diskette or a tape into the appropriate drive on the NIM master.
2. Enter:

```
bosboot -T rs6k \  
-r /usr/lpp/bos.sysmgmt/nim/methods/IPLROM.emulation \  
-d DeviceName -M both
```

where *DeviceName* can be *fd0*, */dev/fd0*, *rmt0*, or */dev/rmt0*. This operation requires that the **devices.base.rte** files be installed on the machine upon which the emulation media is being created.

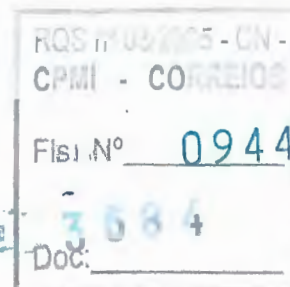
3. Insert the IPL ROM emulation media in the appropriate drive on the target machine.

## From Web-based System Manager

1. From the NIM container, from the NIM menu, select **Create IPL ROM Emulation Media**.
2. Use the dialog to complete the task; all fields are required.

## From SMIT

IPL ROM emulation can also be created using the **smit iplrom** fast path.



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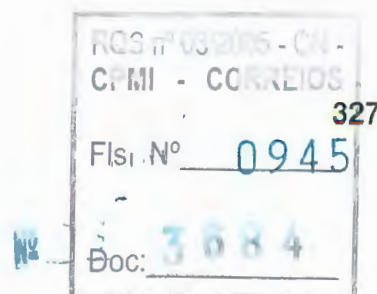
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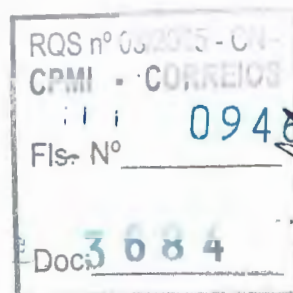
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## Glossary

**/usr file system.** Contains files and programs necessary for operating the machine.

**/tmp file system.** A shared storage location for files.

**/var file system.** Contains files that are variable on a per-client basis, such as spool and mail files.

**/ file system.** The root file system; contains files that contain machine-specific configuration data.

**APAR.** Authorized program analysis report. A report of a problem caused by a suspected defect in a current, unaltered release of a program.

**applet.** A program, intended for delivery over the Internet, which can be included in an HTML page, just as an image can be included.

**apply.** When a service update is installed or *applied*, it enters the applied state and becomes the currently active version of the software. When an update is in the applied state, the previous version of the update is stored in a special save directory. This allows you to restore the previous version, if necessary, without having to reinstall it. Software that has been applied to the system can be either *committed* or *rejected*. The **installp -s** command can be used to get a list of applied products and updates that are available to be either committed or rejected. See also *commit* on page 329 and *reject* on page 332.

**Base Operating System (BOS).** The collection of programs that controls the resources and the operations of the computer system.

**boot device.** The device that assigns the fixed disk within the root volume group (rootvg) that contains the startup (boot) image.

**bosinst.data.** The file that controls the actions of the BOS installation program.

**bundle.** A collection of software products available for installation.

**CD-ROM.** High-capacity, read-only memory in the form of an optically read compact disc.

**clean up.** The clean-up procedure instructs the system to attempt to remove software products

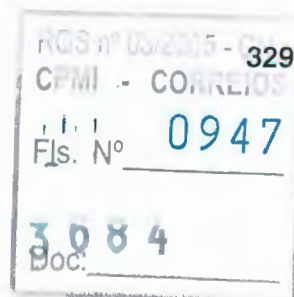
that were partially installed. The system also attempts to revert to the previous version of the removed product. If the system successfully reverts to the previous version, it becomes the currently active version. If this cannot be done, then the software product is marked as broken. After the clean up procedure is complete, you can attempt to install the software again.

**client.** In a distributed file system environment, a system that is dependent on a server to provide it with programs or access to programs.

**commit.** When you commit software updates, you are making a commitment to that version of the software product. When you commit a product update, the saved files from all previous versions of the software product are removed from the system, thereby making it impossible to return to a previous version of the software product. Software updates can be committed at the time of installation by using either the Web-based System Manager or SMIT interface (or by using the **-ac** flags with the **installp** command). Note that committing already applied software does not change the currently active version of the software product. It merely removes saved files for the previous version of the software product. Once a new version of a product update is committed, you cannot reject it if you want to return to the previous version of the code. To return to the previous version of the code, you must reinstall the base level of the software product and reapply any associated updates. You should not commit software updates until you are sure the update does not cause other problems or regressions. Compare to *apply* on page 329 and contrast with *reject* on page 332 and *remove* on page 333.

**complete overwrite installation.** An installation method that completely overwrites an existing version of the Base Operating System that is installed on your system. This procedure might impair recovery of data or destroy all existing data on your hard drives. Be sure to back up your system before doing a complete overwrite installation.

**Configuration Assistant.** A graphical interface application used to perform post-installation system configuration tasks.





**configure.** To describe to a system the devices, optional features, and program products installed on a system.

**console device.** During the installation of the Base Operating System (BOS), the system console is the display device at the system on which you are installing the software.

**corequisite.** A product or update that must be installed concurrently with another specified product or update.

**daemon.** A program that runs unattended in the background to perform a standard service. Some daemons trigger automatically to perform their task and others operate on a timed or periodic basis.

**dataless.** A workstation without local file systems or local boot images that accesses some of its resources remotely. Dataless clients use a local disk used for paging and dump devices.

**dependent.** A software product that requires another product or update to be installed *before* or *at the same time* it is installed. Contrast with *prerequisite* (page 332).

**destination disk.** The disk to which you are installing.

**directory.** A type of file containing the names and controlling information for other files or other directories.

**diskless.** A workstation without local file systems or local boot images that accesses some of its resources remotely. Diskless clients boot remotely from a diskless server and use the server for remote paging.

**display.** A computer output screen on which visual information is displayed.

**display device.** See *display* (page 330).

**environment.** (1.) The settings for shell variables and paths that are set when the user logs in. These variables can be modified later by the user. (2.) A named collection of logical and physical resources used to support the performance of a function.

**environment variable.** (1.) A variable that describes the operating environment of the

process. Common environment variables describe the home directory, command search path, the terminal in use, and the current time zone (the **HOME**, **PATH**, **TERM**, and **TZ** variables, respectively). (2.) A variable that is included in the current software environment and is therefore available to any called program that requests it.

**file.** The collection of related data that is stored and retrieved by an assigned name. Contrast with *special file* (page 333).

**file system.** The collection of files and file management structures on a physical or logical mass storage device, such as a diskette or minidisk.

**file tree.** The complete directory and file structure of a particular node, starting at the root directory. A file tree contains all local and remote mounts performed on directories and files.

**filesset.** An individually installable option or update. Options provide specific function and updates correct an error in, or enhance, a previously installed option.

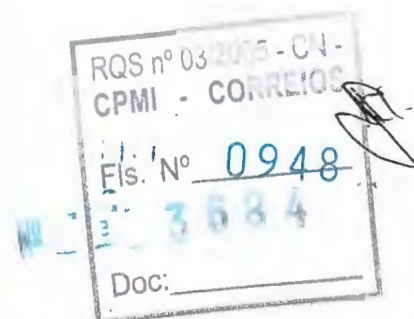
**fixed disk.** (1.) A flat, circular, nonremovable plate with a magnetizable surface layer on which data can be stored by magnetic recording. A rigid magnetic disk used in a fixed-disk drive. (2.) The term fixed disk is also used loosely in the industry for boards and cartridges containing microchips or bubble memory that simulate the operations of a fixed-disk drive.

**full path name.** The name of any directory or file expressed as a string of directories and files beginning with the root directory. See also *path name* (page 332).

**graphical user interface.** A type of computer interface consisting of a visual metaphor of a real-world scene, often a desktop. Within that scene are icons, representing actual objects, that the user can access and manipulate with a pointing device.

**hard disk.** See *fixed disk* (page 330).

**hardware.** The physical equipment of computing and computer-directed activities. The physical components of a computer system. Contrast with *software* (page 333).





**host.** (1.) The primary or controlling computer in a communications network. (2.) A computer attached to a network.

**host name.** The Internet address of a machine in the network. Also known as the host ID.

**HTML.** HyperText Markup Language is the tagging language that a web browser uses to interpret and display documents.

**hypertext.** A way of presenting information online with connections between one piece of information and another. These connections are called hypertext links. Thousands of these hypertext links enable you to explore additional or related information throughout the online documentation. See also *hypertext link* (page 331).

**hypertext link.** A connection between one piece of information and another. See also *hypertext* (page 331).

**icon.** A picture or graphical representation of an object on a display screen to which a user can point to with a device, such as a mouse, to select a particular operation or perform a certain action.

**initial program load (IPL).** (1.) The initialization procedure that causes an operating system to commence operation. (2.) The process by which a configuration image is loaded into storage at the beginning of a work day or after a system malfunction. (3.) The process of loading system programs and preparing a system to run jobs.

**input device.** The device that is the source of the software you are installing. The input device can be a tape drive, CD-ROM drive, diskette drive, or a directory.

**Installation Assistant.** An application used to perform system configuration tasks.

**installation image.** An installation image contains a copy of the software you are installing in backup format, as well as copies of other files the system needs to install the software product.

**Internet address.** The numbering system used in TCP/IP internetwork communications to specify a particular network or a particular host on that network with which to communicate. Internet addresses are commonly denoted in dotted decimal form.

**IPL.** See *initial program load* (page 331).

**license password.** The key that allows a software product to be used. A string encoded with license information for a software product.

**locale.** A subset of a user's environment that defines conventions for a specified culture, such as time formatting, numeric formatting, monetary formatting, and character classification, conversion, and collation.

**logical partition (LP).** (1.) One to three physical partitions (copies). The number of logical partitions within a logical volume is variable. (2.) A fixed-size portion of a logical volume. A logical partition is the same size as the physical partitions in its volume group. Unless the logical volume of which it is a part is mirrored, each logical partition corresponds to, and its contents are stored on, a single physical partition. See also *logical volume* (page 331).

**logical volume (LV).** A collection of physical partitions organized into logical partitions all contained in a single volume group. Logical volumes are expandable and can span several physical volumes in a volume group. See also *logical partition* (page 331), *volume group* (page 333), and *migration installation* (page 331).

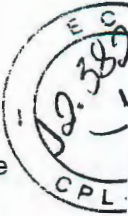
**maintenance level update.** The service updates that are necessary to upgrade the Base Operating System (BOS) or an optional software product to the current release level. See also *service update* (page 333).

**migration installation.** An installation method for upgrading AIX 3.2 or later to the current release while preserving the existing root volume group. This method preserves the /usr, /tmp, /var, and / (root) file systems, as well as the root volume group, logical volumes, and system configuration files. Migration is the default installation method for any machine that is running AIX 3.2 or later. See also *root volume group* (page 333) and *logical volume* (page 331).

**monitor.** (1.) A device that observes and verifies operations of a data processing system. (2.) Synonym for *display*.

**mount.** To make a file system accessible.

**name server.** A host that provides name resolution for a network. Name servers translate



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symbolic names assigned to networks and hosts into the efficient Internet addresses used by machines.

**Network File System (NFS).** A distributed file system that enables users to access files and directories located on remote computers and treat those files and directories as if they were local. NFS is independent of machine types, operating systems, and network architectures through the use of remote procedure calls (RPC).

**Network Installation Management (NIM).** An environment that provides installation and configuration of software within a network interface.

**new installation.** An installation method used when the fixed disk or disks you are installing BOS onto are empty. A fixed disk is considered empty if it does not contain any data or if it contains data not in a volume group.

**NIM.** See *Network Installation Management* (page 332).

**Object Data Manager (ODM).** A data manager intended for the storage of system data. The ODM is used for many system management functions. Information used in many commands and SMIT functions is stored and maintained in the ODM as objects with associated characteristics.

**option.** An installable unit of a software package. Software product options are separately installable units that can operate independently from other options of that software package.

**optional software.** Also referred to as *optional software products*. Software that is *not* automatically installed on your system when you install the Base Operating System (BOS). Optional software can be products packaged and sold with BOS. Optional software can also be separately purchased software products that are specially ordered and not sold as part of BOS. In either case, BOS must be installed on your system before you can install optional software.

**package.** An installable unit of a software product. Software product packages are separately installable units that can operate independently from other packages of that software product.

**paging.** (1.) The action of transferring instructions, data, or both between real storage and external

page storage. (2.) Moving data between memory and a mass storage device as the data is needed.

**path name.** A file name specifying all directories leading to the file. See also *full path name* (page 330).

**physical volume.** The portion of a single unit of storage accessible to a single read/write mechanism; for example, a drum, a disk pack, or part of a disk storage module.

**preinstalled.** Software that is installed by the manufacturer and ready to use.

**prerequisite.** A software product or a service update that must be installed *before* another software product or service update is installed. If you attempt to install software products or service updates *without* the required prerequisite software, a system message displays the names of required prerequisite software. Contrast with *dependent* (page 330).

**preservation installation.** An installation method used when a previous version of the Base Operating System (BOS) is installed on your system and you want to preserve the user data in the root volume group. However, this method overwrites the */usr*, */tmp*, */var*, and */* (root) file systems, so any user data in these directories is lost. System configuration must be done after doing a preservation installation.

**Preventive Maintenance Package (PMP).** A maintenance level update for your system. A PMP includes updates for the Base Operating System (BOS) and for each optional software product that is installed on your system.

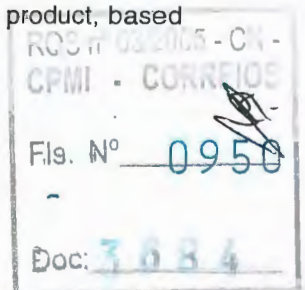
**primary language.** The primary locale you want your system to use for screen information.

**Problem Management Record (PMR).** A number assigned by a support center to a reported problem.

**product.** A software product is made up of software packages that are separately installable.

**reboot.** To reinitialize the execution of a program by repeating the initial program load (IPL) operation.

**reject.** To cause portions of applied updates from becoming permanent parts of the product, based





on the results of a test period. When you reject an applied service update, the update's files are deleted and the software vital product data (SWVPD) information is changed to indicate that the update is no longer on the system. The previous version of the software, if there is one, is restored and becomes the active version of the software. Contrast with *apply* (page 329) and *commit* (page 329).

**remove.** For a software option, the deletion of the option and all of its applied or committed updates from the system. The software vital product data (SWVPD) information is changed to indicate that the option has been removed from the system. Depending on the option, system configuration information is also cleaned up, although this is not always complete. If a previous version, release, or level of the option is on the system, the system does not restore the previous version. Only an option with its updates can be removed. Updates cannot be removed by themselves. See also *commit* (page 329).

**requisite.** A software product or a service update that must be installed with another software product or service update. If you attempt to install software products or service updates without the required software, a system message displays the names of required software.

**root user authority.** The unrestricted ability to access and modify any part of the operating system, usually associated with the user who manages the system.

**root volume group (rootvg).** A volume group containing the Base Operating System (BOS). See also *migration installation*. (page 331)

**server.** On a network, the computer that contains the data or provides the facilities to be accessed by other computers on the network.

**service update.** Software that corrects a defect in or adds new function to the Base Operating System (BOS) or to an optional software product. See also *maintenance level update* (page 331).

**SMIT.** See *System Management Interface Tool* (page 333).

**software.** Programs, procedures, rules, and any associated documentation pertaining to the operation of a system. Contrast with *hardware* (page 330).

**source.** A system, a program within a system, or a device that makes a request to a target. Contrast with *target* (page 333).

**special file.** Used in the operating system to provide an interface to input/output devices. There is at least one special file for each device connected to the computer. Contrast with *directory* (page 330) and *file* (page 330).

**stacked tape.** A bootable tape with multiple software images.

**System Management Interface Tool (SMIT).** A set of menu-driven services that facilitates the performance of such system tasks as software installation and configuration, device configuration and management, problem determination, and storage management. SMIT is provided in both a character-based curses interface and an AIXwindows-based graphical user interface.

**target.** A system, a program within a system, or a device that interprets, rejects, or satisfies, and replies to requests received from a source. Contrast with *source* (page 333).

**Transmission Control Protocol/Internet Protocol (TCP/IP).** A communications subsystem that allows you to set up local area and wide area networks.

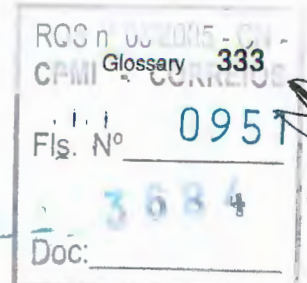
**Universal Coordinated Time (UCT).** The standard term for worldwide time-telling that has the same meaning as Greenwich Mean Time.

**update.** See *service update* (page 333).

**upgrade.** Software that fixes a defect in a previously released software product.

**verify.** The verify procedure instructs the system to verify the software you are installing. The system confirms that your software files are the correct length and contain the correct number of digits and characters. If any errors are reported, it might be necessary to install the software product again. The verification process can add a significant amount of time to the installation process.

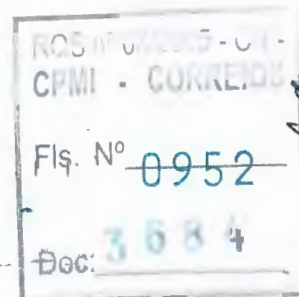
**volume group (VG).** A set of one or more physical volumes from which space can be allocated to one or more logical volumes. A collection of 1 to 32 physical volumes (read-write





fixed-disk drives) of varying size and type. See also *logical volume* (page 331).

**Web-based System Manager.** A graphical user interface (GUI) tool for managing systems. Based on the OO (Object Oriented) model, Web-based System Manager enables users to perform administration tasks by manipulating icons representing objects in the system, as an alternative to learning and remembering complex commands.



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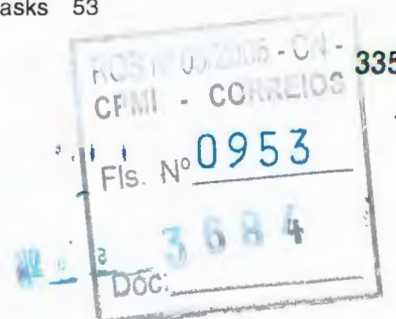
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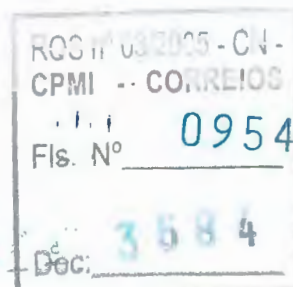


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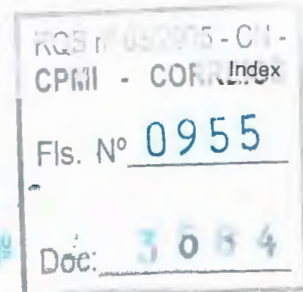


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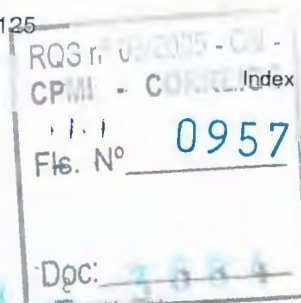
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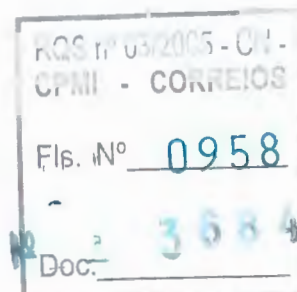


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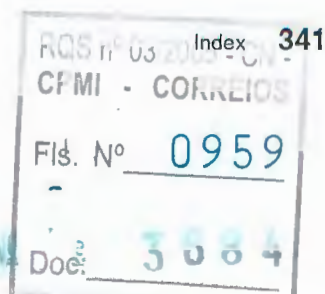
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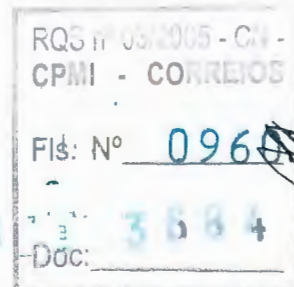


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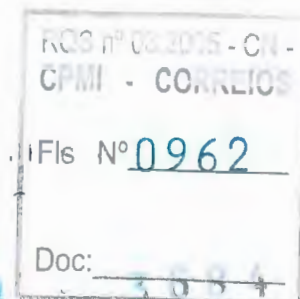
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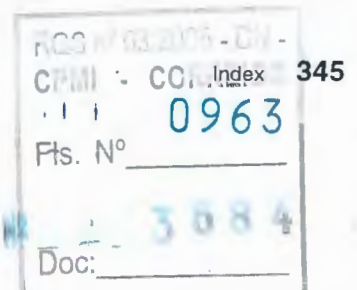


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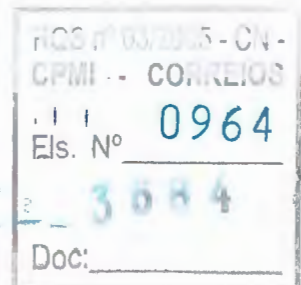
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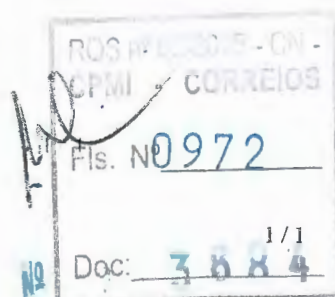
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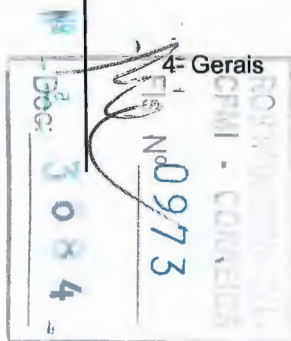


## ANEXO ROTEADOR TIPO 02 PARTE 1



**ROTEADOR TIPO 2**

ATRIBUTO	REQUISITOS DO EDITAL	ATRIBUTOS OFERTADOS	ATRIBUTOS OFERTADOS ADICIONALMENTE	CONFIRMA ATENDIMENTO (SIM / NÃO)	PÁGINA DA DOCUMENTAÇÃO TÉCNICA
1 - Router - Processamento	Capacidade mínima de 12Kpps	Capacidade de até 12.500pps	N/A	SIM	Anexo 21 - pag. 2
	Montado em bandejas instaladas no interior do Rack 19"	Serão montados em bandejas internas oferecidas juntamente com o Rack 19"	N/A	SIM	Ver Racks de 19" a serem fornecidos pela CONTRATADA
2 - Gerenciamento	Deverá ser gerencial via SNMP v1, v2 e v3, TELNET e acesso local.	Gerenciável por qualquer ferramenta SNMP	N/A	SIM	Anexo 20 - pag. 5 e 6 Anexo 20A - pag. 311 Anexo 20B - pag. 2
	Deverá possuir suporte a MIB II RFC 1213	Conforme Edital	N/A	SIM	Anexo 20A - pag.311
3 - Interfaces	Possuir no mínimo 01 interface Ethernet 10BaseT/100BaseTX, auto-negociável, integrada ao chassis, com conectores tipo RJ-45	Conforme Edital	N/A	SIM	Anexo 20 - pag. 2, 10
	Possuir no mínimo 02 interfaces seriais, sendo uma do tipo DCE e outra do tipo DTE, com conectores do tipo V.35 ou EIA/TIA-232, com compressão e encriptação de dados	Conforme Edital	N/A	SIM	Anexo 19 - pag. 3 Anexo 20C (todas as páginas)
	Cabos e acessórios	Estão contemplados todos os cabos e acessórios pertinentes	N/A	SIM	Anexo 22 - pag. 1-11
	Sinalização visual do funcionamento e "status" das portas	Led's indicativos para status e funções	N/A	SIM	Anexo 22 - pag. 1-4 até 1-9
	Atualização de softwares pela rede	Conforme Edital	N/A	SIM	Anexo 19I (todas as páginas)





Suportar e implementar recursos de QoS avançados tais como: CAR, Custom, Low Latency Fair Queueing e WFQ, BoD, RSVP, WRED, Policy based Routing (FRF.12) e cRTP	Conforme Edital	N/A	SIM	Anexo 20 - pág. 7 e 17
Implementar e permitir o roteamento entre VLANs suportando o padrão IEEE 802.1Q	Conforme Edital	N/A	SIM	Anexo 20 - pág. 7
Permitir VPN Tunneling com IPsec, L2TP e L2F	Conforme Edital	N/A	SIM	Anexo 20 - pág. 6
Permitir roteamento IP usando os protocolos OSPF, RIP, RIPv2 e BGP4, PIM-DM e PIM-SM	Conforme Edital	N/A	SIM	Anexo 20D - pág. 6, 7
Suporte a criptografia 3DES	Conforme Edital	N/A	SIM	Anexo 20 - pág. 6
Suporte a autenticação através dos protocolos RADIUS, TACACS+ e PAP/CHAP	Conforme Edital	N/A	SIM	Anexo 20 - pág. 6
Suportar inserção em redes com serviços de VOIP e VOFR Funcionalidades de Firewall, incluindo ACL e AAA, criptografia, VPN Tunnel Server integradas ao roteador	Conforme Edital	N/A	SIM	Anexo 20 - pág. 17
	Conforme Edital	N/A	SIM	Anexo 20D - pág. 1 Anexo 20 - pág 1, 4, 6, 7, 8
Suportar Digital Voice, e voz analógica na infra-estrutura telefônica existente	FXO, FXS, E&M	N/A	SIM	Anexo 21 - pág 2 Anexo 20 - pág 3
Possuir duas interfaces do tipo FXS para conexão de telefones analógicos e 02 interfaces do tipo FXO para conexão em interfaces de ramal de PABX	Foram colocadas interfaces do tipo VIC-2FXO e VIC-2FXS, fornecendo as portas requeridas	N/A	SIM	Anexo 23 e Anexo 24 Ver propostas Técnica e Comercial

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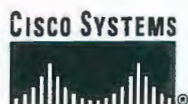
Entrada entre 90 e 240 Volts, com comutação automática e frequência de 60 Hz	Conforme Edital	N/A	SIM	Ver Carta do fabricante
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ANEXO 3



## Cisco 1751 Modular Access Router

Cisco 1751 Modular Access Router is ideally suited to help you evolve your organization into an e-Business. It supports e-Business features such as VPNs; secure Internet, intranet, and extranet access with optional firewall technology; broadband DSL and cable connectivity; and multiservice voice/video/data/fax integration. The Cisco 1751 Modular Access Router offers:

- Flexibility to adapt to changing requirements
- Modularity that allows you to individually configure the system to meet specific business needs
- Investment protection with features and performance to support new WAN services such as broadband DSL and cable access, multiservice voice/data integration, and VPNs
- Integration of multiple network functions, including an optional firewall VPN, and data service unit/channel service unit (DSU/CSU) to simplify deployment and management

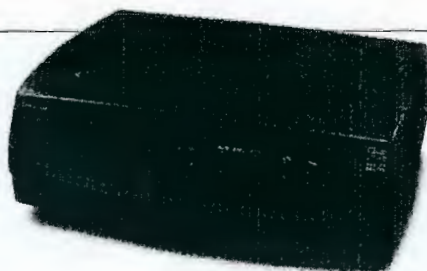
The Cisco 1751 Router delivers these capabilities with the power of Cisco IOS Software in a modular integrated access solution. The Cisco 1751 Router provides a cost-effective solution to support e-Business applications through a comprehensive feature set including support for:

- Multiservice voice/fax/data integration
- Secure Internet, intranet, and extranet access with VPN and firewall
- Integrated broadband DSL connectivity
- VLAN support (IEEE 802.1Q)

The Cisco 1751 Router, a member of the Cisco 1700 Family, features a modular architecture that enables cost-effective upgrades and additions of WAN and voice interfaces. Integrated network services and functions, such as optional firewall, DSU/CSU, and VPN features, reduce the complexity of deploying and managing e-Business solutions. The Cisco 1751 Router offers investment protection when your business needs it, with a RISC architecture and features to support new technologies and applications such as voice/video/data/fax integration and VPNs.

See Figure 2.

**Figure 1**  
The Cisco 1751 Router delivers a versatile e-Business WAN access solution.



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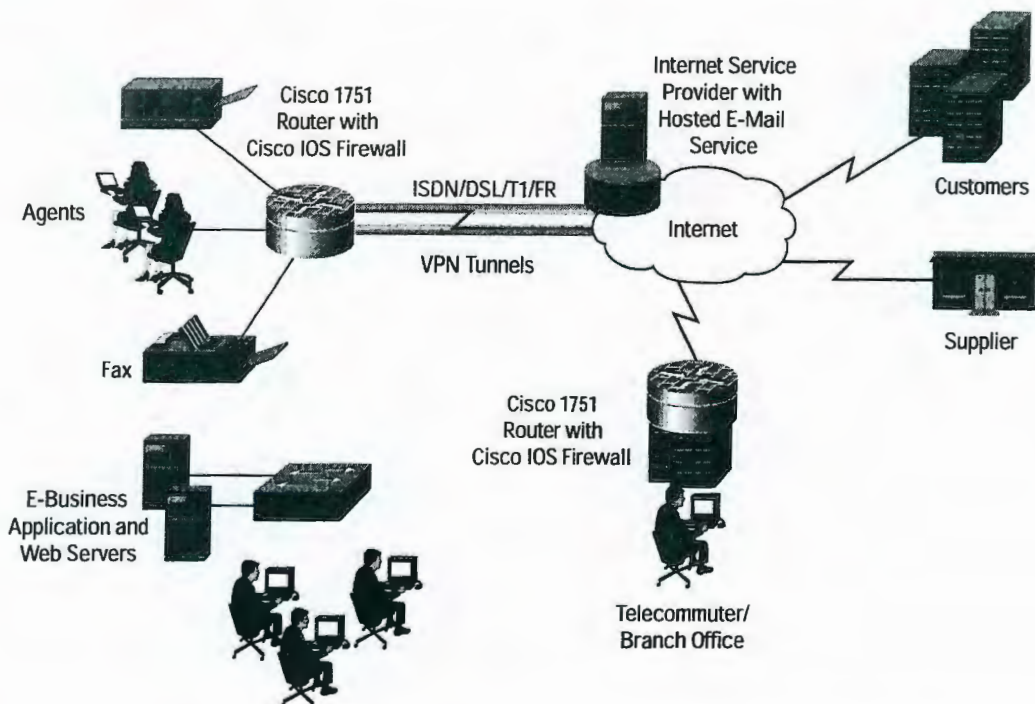
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**Figure 2**

Cisco 1751 Routers provide all necessary capabilities to connect to the Internet and communicate with vendors, customers, and other employees and offices.



The Cisco 1751 Router is available in two models that enable you to easily tailor an access solution to suit your e-Business requirements today and in the future. See Table 1.

**Table 1** The Cisco 1751 Modular Access Router

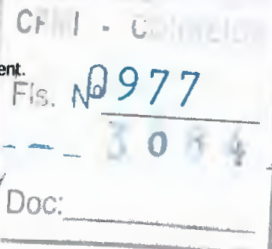
<b>Cisco 1751 Base Model</b>	Includes everything an office needs for data networking now (16 MB Flash, 32 MB DRAM, and Cisco IOS IP software feature set), with a simple upgrade path to full voice functionality. WAN interface cards are available separately.
<b>Cisco 1751-V Multiservice Model</b>	Includes all the features needed for immediate integration of data and voice services with support for up to two voice channels (32 MB Flash and 64 MB DRAM, one DSP (PVDM-256K-4), and Cisco IOS IP Plus Voice feature set). Voice and WAN interface cards are available separately.

All Cisco 1751 models offer three modular slots for voice and data interface cards, an autosensing 10/100BaseT Fast Ethernet LAN port supporting standards-based IEEE 802.1Q VLAN, a console port, and an auxiliary port. The Cisco 1751 Router supports the same WAN interface cards as the Cisco 1600, 1700, 2600, and 3600 Series routers, and the same voice interface cards and voice-over-IP (VoIP) technology as the Cisco 1700, 2600, and 3600 Series routers. This simplifies support requirements. The WAN interface cards support a wide range of services, including synchronous and asynchronous serial, Integrated Services Digital Network Basic Rate Interface (ISDN BRI), ADSL,

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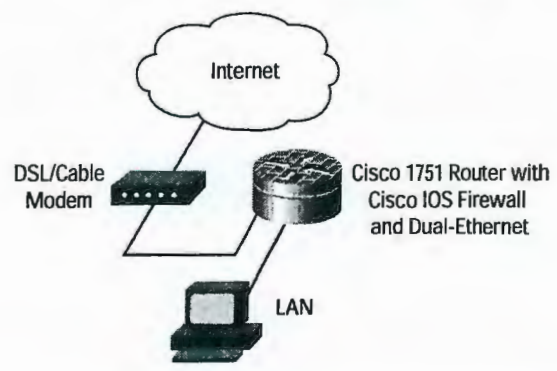
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and serial with DSU/CSU options for primary and backup WAN connectivity. The voice interface cards support Foreign Exchange Office (FXO), Foreign Exchange Station (FXS), Network and User Side Voice BRI (ISDN BRI NT/TE), Ear & Mouth (E&M), direct inward dial (DID), and T1/E1 Multiflex VWICs. Additionally, an Ethernet interface card provides the Cisco 1751 Router with dual-Ethernet capability to support the external broadband modem devices. See Figure 3.

**Figure 3**

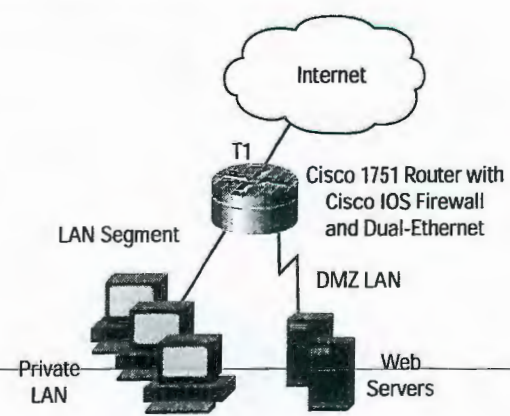
Cisco 1751 Router Incorporating Ethernet WAN Interface Card (WIC) Deployed with Broadband Modem



In addition, dual-Ethernet capability on the Cisco 1751 Router enables the creation of perimeter/DMZ (demilitarized zone) LANs to enhance security by physically separating private and public data. See Figure 4.

**Figure 4**

Cisco 1751 Router Incorporating Ethernet WIC to Deploy Perimeter/DMZ LAN



Combined, these interfaces support a comprehensive set of applications, including multiservice voice/video/data/fax integration, Frame Relay, ISDN BRI, SMDS, X.25, broadband DSL and cable services, and VPNs.

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### Key Benefits

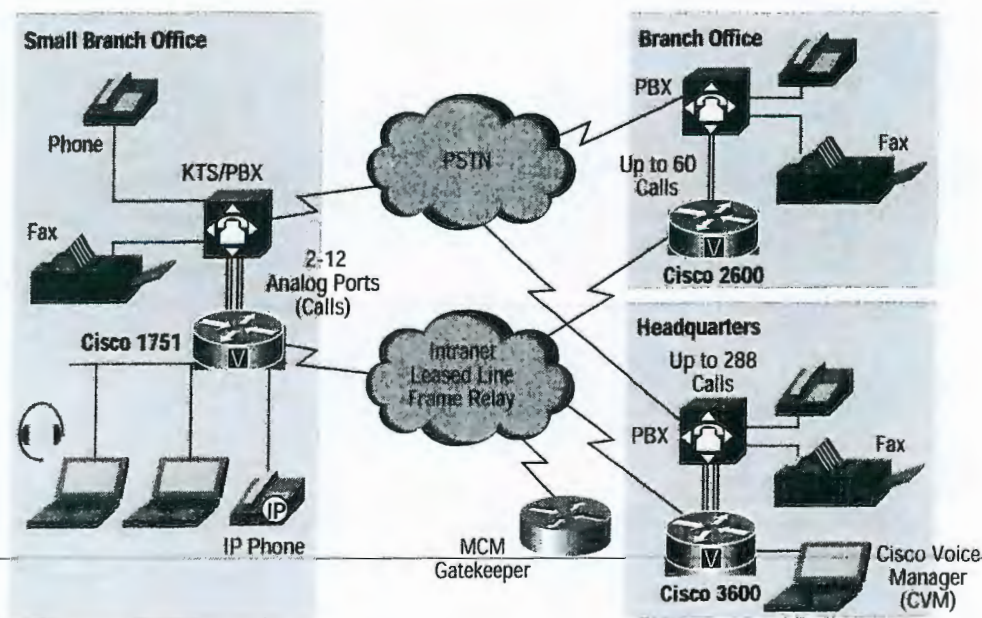
The Cisco 1700 Series routers support the value of end-to-end Cisco network solutions with the following benefits:

**Flexibility**—The modular Cisco 1751 Router adapts easily to fit the needs of growing businesses. Interchangeable WAN interface cards enable easy additions or changes in WAN technologies without requiring a forklift upgrade of the entire platform. Modular data and voice slots enable users to tailor data and voice services as needed. With the ability to use the same field-upgradable WAN and voice interface cards across multiple Cisco access router platforms, the Cisco 1751 Router reduces requirements for spare parts inventory and support training.

**Multiservice Access**—For businesses that want to become e-Businesses and incorporate applications that integrate multiservice voice/video/data/fax capabilities now or in the future, the Cisco 1751 Router offers a flexible, cost-effective answer. The Cisco 1751 Router enables network managers to save on long-distance interoffice billing costs. It also interoperates with next-generation voice-enabled applications such as integrated messaging and Web-based call centers. The Cisco 1751 Router works with the existing telephone infrastructure—phones, fax machines, key telephone systems (KTS) units, and PBX (including digital PBXs)—minimizing capital costs. See Figure 5.

**Figure 5**

Voice/video/data/fax integration. The Cisco 1751 Router integrates data and voice capabilities, significantly lowering toll charges for small- and medium-sized businesses and enterprise small branch offices.

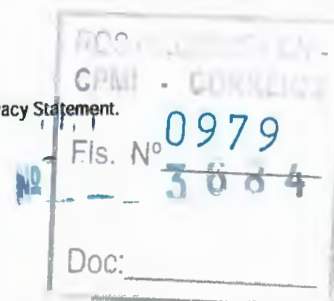


**Lower Cost of Ownership**—The Cisco 1751 Router provides a complete solution for integrated voice and data access in a single product, eliminating the need to install and maintain a large number of separate devices. You can combine optional functions—including a voice gateway, dynamic firewall, VPN tunnel server, DSU/CSU, ISDN network

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termination-1 (NT1) device, and more—to reduce deployment and management costs. This solution can be managed remotely using network management applications such as CiscoWorks2000 and CiscoView or any SNMP-based management tool.

**Investment Protection**—The Cisco 1751 Router RISC architecture, Cisco IOS Software, and modular slots provide solid investment protection. The Cisco 1751 incorporates services such as multiservice voice/video/data/fax integration, VPNs, and broadband DSL and cable communications to enable today's successful e-Business. An internal expansion slot on the mother-board offers the ability to support hardware-assisted IPsec data encryption at T1/E1 speeds.

For a complete list of Cisco 1751 Router features and benefits, see Table 2.

**Table 2** Key Features and Benefits

Features	Benefits
<b>Flexibility</b>	
Full Cisco IOS Software support, including multiprotocol routing (IP, IPX, Apple Talk, IBM/SNA) and bridging	<ul style="list-style-type: none"><li>• Provides the industry's most robust, scalable, and feature-rich internetworking software support using the de facto standard networking software for the Internet and private WANs</li><li>• Part of the Cisco end-to-end network solution</li></ul>
<b>Integrated Voice and Data Networking</b>	
Cisco 1751 router chassis accepts both WAN and voice interface cards	<ul style="list-style-type: none"><li>• Reduces long-distance toll charges by allowing the data network to carry interoffice voice and fax traffic</li><li>• Works with existing handsets, key units, and PBXs, eliminating the need for a costly phone-equipment upgrade</li></ul>
<b>Modular Architecture</b>	
Accepts an array of WAN and voice interface cards	<ul style="list-style-type: none"><li>• Adds flexibility and investment protection</li></ul>
WAN interface cards and voice interface cards are shared with Cisco 1600, 1700, 2600, and 3600 routers	<ul style="list-style-type: none"><li>• Reduce cost of maintaining inventory</li><li>• Lower training costs for support personnel</li><li>• Protect investments through re-use on various platforms</li></ul>
Autosensing 10/100 Fast Ethernet	<ul style="list-style-type: none"><li>• Simplifies migration to Fast Ethernet performance in the office</li></ul>
Expansion Slot on Motherboard	<ul style="list-style-type: none"><li>• Allows expandability to support hardware-assisted encryption at T1/E1 speeds</li><li>• Allows support for future technologies</li></ul>
<b>Dual DSP Slots</b>	<ul style="list-style-type: none"><li>• Allow expandability to support additional voice channels</li></ul>
<b>Security</b>	
The Cisco IOS Firewall Feature Set includes context-based access control for dynamic firewall filtering, denial-of-service detection and prevention, Java blocking, real-time alerts, Intrusion Detection System (IDS), and encryption	<ul style="list-style-type: none"><li>• Allows internal users to access the Internet with secure, per-application-based, dynamic access control, while preventing unauthorized Internet users from accessing the internal LAN</li></ul>

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**Table 2** Key Features and Benefits (Continued)

Features	Benefits
IPSec DES and 3DES	<ul style="list-style-type: none"><li>• Enable creation of VPNs by providing industry-standard data privacy, integrity, and authenticity as data traverses the Internet or a shared public network</li><li>• Supports up to 168-bit encryption</li></ul>
Hardware-Based Encryption Using Optional VPN Module	<ul style="list-style-type: none"><li>• Supports wire-speed encryption up to T1/E1 speeds</li></ul>
<b>Device Authentication and Key Management</b>	
IKE, X.509v3 digital certification, and support for certificate enrollment protocol (CEP) with certification authorities (CAs) such as Verisign and Entrust	<ul style="list-style-type: none"><li>• Ensure proper identity and authenticity of devices and data</li><li>• Enable scalability to very large IPSec networks through automated key management</li></ul>
<b>User Authentication</b>	
PAP/CHAP, RADIUS, TACACS+	<ul style="list-style-type: none"><li>• Support all leading user identity verification schemes</li></ul>
<b>VPN Tunneling</b>	
IPSec, GRE, L2TP, L2F	<ul style="list-style-type: none"><li>• Offer choice of standards-based tunneling methods to create VPNs for IP and non-IP traffic</li><li>• Allow standards-based IPSec or L2TP client to interoperate with Cisco IOS tunneling technologies</li><li>• Fully interoperable with public certificate authorities and IPSec standards-based products</li><li>• Part of the scalable Cisco end-to-end VPN solution portfolio</li></ul>
Cisco Easy VPN client	<ul style="list-style-type: none"><li>• Allows the router to act as remote VPN client and have VPN policies pushed down from the VPN concentrator</li></ul>
Cisco Unified VPN Access Server	<ul style="list-style-type: none"><li>• Allows the router to terminate remote access VPNs initiated by mobile and remote workers running Cisco VPN client software on PCs; and allows the router to terminate site-site VPNs initiated by IOS routers using the Cisco Easy VPN client feature</li></ul>
<b>Management</b>	
IEEE 802.1Q VLAN Support	<ul style="list-style-type: none"><li>• VLANs enable efficient traffic separation, provide better bandwidth utilization, and alleviate scaling issues by logically segmenting the physical LAN infrastructure into different subnets</li></ul>
Manageable via SNMP (CiscoView, CiscoWorks2000), Telnet, and console port	<ul style="list-style-type: none"><li>• Allow central monitoring, configuration, and diagnostics for all functions integrated in the Cisco 1751 router, reducing management time and costs</li></ul>
Cisco SDM	<ul style="list-style-type: none"><li>• Simplifies router and security configuration through smart wizards to enable customers to quickly and easily deploy, configure and monitor a Cisco access router without requiring knowledge of Cisco IOS Command Line Interface (CLI)</li></ul>

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**Table 2** Key Features and Benefits (Continued)

Features	Benefits
<b>Ease of Use and Installation</b>	
Cisco ConfigMaker, SETUP configuration utility, AutoInstall, color-coded ports/cables, and LED status indicators	<ul style="list-style-type: none"><li>• Simplifies and reduces deployment time and costs with graphical LAN/VPN policy configurator; command-line, context-sensitive configuration questions; and straightforward cabling</li><li>• LEDs allows quick diagnostics and troubleshooting</li></ul>
<b>Network Address Translation (NAT) and Easy IP</b>	<ul style="list-style-type: none"><li>• Simplifies deployment and reduces Internet access costs</li></ul>
<b>QoS</b>	
CAR, Policy Routing, WFQ, PQ/CBWFQ, GTS, RSVP, DSCP, cRTP, MLPPP and LFI	<ul style="list-style-type: none"><li>• Allocates WAN bandwidth to priority applications for improved performance</li></ul>
<b>Reliability and Scalability</b>	
Cisco IOS Software, dial-on-demand routing, dual-bank Flash memory, scalable routing protocols such as OSPF, EIGRP, and HSRP	<ul style="list-style-type: none"><li>• Improves network reliability and enables scalability to large networks</li></ul>
<b>Broadband Connectivity Options</b>	
ADSL and cable connectivity deliver business-class broadband access	<ul style="list-style-type: none"><li>• Leverage broadband access technologies like cable and DSL to increase WAN connectivity speeds and reduce WAN access costs</li><li>• The Cisco 1751 supports ADSL connectivity with ADSL WIC</li><li>• Cable connectivity with the Cisco 1751 and optional integrated Cisco uBR910 Series Cable DSU deliver business-class broadband access</li></ul>
<b>Device Integration</b>	
Integrated router, voice gateway, firewall, encryption, VPN tunnel server, DSU/CSU, and NT1 in a single device	<ul style="list-style-type: none"><li>• Reduce costs and simplifies management</li></ul>

## Cisco IOS Technology

### Internet and Intranet Access

Cisco IOS Software provides an extensive set of features that make the Cisco 1751 Router ideal for flexible, high-performance communications across both intranets and the Internet:

- Multiprotocol routing (IP, IPX, and AppleTalk), IBM/SNA, and transparent bridging over ISDN, asynchronous serial, and synchronous serial such as leased lines, Frame Relay, SMDS, Switched 56, X.25, and X.25 over ISDN D
- WAN optimization—including dial-on-demand routing (DDR), bandwidth-on-demand (BOD) and OSPF-on-demand circuit, Snapshot routing, compression, filtering, and spoofing to reduce WAN costs

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Cisco IOS Software supports an extensive set of basic and advanced network security features, including access control lists (ACLs); user authentication, authorization, and accounting (such as PAP/CHAP, TACACS+, and RADIUS); and data encryption. To increase security, the integrated Cisco IOS Firewall Feature Set protects internal LANs from attacks with context-based access control (CBAC) and Intrusion Detection (IDS), while IPSec tunneling with data encryption standard DES and 3DES encryption provide standards-based data privacy, integrity, and authenticity as data travels through a public network. Additionally, remote management applications, such as Cisco Security Device Manager (SDM), make it easier than ever to deploy and monitor security applications on your Cisco router.

The Cisco 1700 Series routers also support the Cisco Unified VPN Access Server feature that allows a Cisco 1700 router to act as a VPN head-end device. In site-to-site VPN environments, the Cisco 1700 router can terminate VPN tunnels initiated by the remote office routers using the Cisco Easy VPN client. Security policies can be pushed down to the remote office routers from the Cisco 1700 Series routers. In addition to terminating site-to-site VPNs, a Cisco 1700 Series router running the Unified VPN Access Server can terminate remote access VPNs initiated by mobile and remote workers running Cisco VPN client software on PCs. This flexibility makes it possible for mobile and remote workers, such as sales people on the road, to access company intranet where critical data and applications exist.

## Cisco IOS Software QoS Features

Because the Cisco 1751 Router provides robust voice compression, up to 8 voice calls can occupy a single 64K data channel simultaneously, without compromising data performance. Cisco IOS voice compression technology integrates data and voice traffic to enable efficient use of existing data networks.



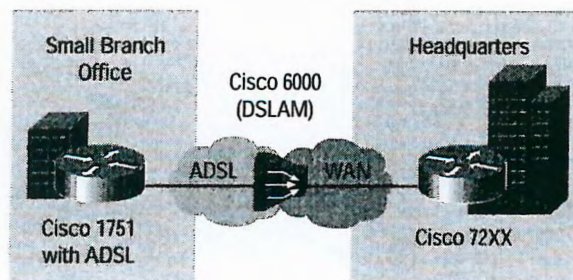


### High-Performance Architecture for VPNs and Broadband Service

A robust RISC architecture and Cisco IOS features enable the Cisco 1751 Router to support VPN applications with tunneling and security, as well as DSL, cable, and other broadband access technologies. An internal slot on the Cisco 1751 motherboard supports an optional VPN module that provides hardware-assisted IPsec DES and 3DES encryption at T1/E1 speeds. The Cisco 1751 Router equipped with the WIC-1ADSL supports VPN over ADSL service. See Figure 6. The Cisco 1751 Router with the uBR910 series cable DSU supports business-class broadband cable access. The Ethernet WIC (WIC-1ENET) provides an alternate method of deploying DSL/cable Internet access with the use of an external modem. In some cases, the ISP provides the broadband modem.

**Figure 6**

The Cisco 1751 Router, deployed in conjunction with the ADSL WIC, enables SMB and small branch customers to reap the benefits of ADSL.



### Network Management and Ease of Installation

The Cisco 1751 Router supports a range of network-management and ease-of-installation tools:

- The Cisco Security Device Manager (SDM) is an intuitive, web-based device management tool embedded within the Cisco IOS access routers. SDM simplifies router and security configuration through smart wizards to enable customers to quickly and easily deploy, configure and monitor a Cisco access router without requiring knowledge of Cisco IOS Command Line Interface (CLI). For more information visit [www.Cisco.com/go/sdm](http://www.Cisco.com/go/sdm).
- Cisco ConfigMaker is a Windows wizard-based tool designed to configure a small network of Cisco routers, switches, hubs, and other network devices from a single PC. This tool makes it easy to configure value-add security features such as the Cisco IOS Firewall Feature Set, IPsec encryption, and network address translation (NAT); establish VPN policies (including QoS and security); and configure the Dynamic Host Configuration Protocol (DHCP) server.
- CiscoWorks for Windows, a comprehensive network management solution for small to medium sized networks that provides Web-based network monitoring and device configuration management.
- CiscoWorks2000, the industry-leading Web-based network management suite from Cisco, simplifies tasks such as network inventory management and device change, rapid software image deployment, and troubleshooting.
- For service providers, Cisco Service Management (CSM) provides an extensive suite of service management solutions to enable planning, provisioning, monitoring, and billing.

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### Extending Cisco End-to-End Solutions

As part of the comprehensive Cisco end-to-end networking solution, the Cisco 1700 Series routers enable businesses to extend a cost-effective, seamless network infrastructure to the small branch office. The Cisco 1700 Family of access routers includes the Cisco 1751 Router and Cisco 1721 Router—a modular device optimized for data-only connections. WAN cards work with both devices, as well as with Cisco 1600, 2600, and 3600 Series routers. They are powered by Cisco IOS Software for robust WAN service between branches and central offices in organizations with multiple sites. Both feature RISC-based processors to provide performance for encryption and support for emerging broadband technologies.

The Cisco 1751 Router also shares VoIP technology and analog voice interface cards with Cisco 2600 and 3600 Series routers. This feature provides an end-to-end solution for multiservices communications between offices, simplifying inventory needs and leveraging IT expertise across more devices in an organization.

For a complete list of physical interfaces, see Tables 3, 4, 5, and 6.

**Table 3** Physical Interfaces/Architecture

<b>One 10/100 BaseT Fast Ethernet Port (RJ45)</b>	Automatic speed detection; automatic duplex negotiation; VLAN support
<b>One Voice Interface Card Slot</b>	Supports a single voice interface card with two ports per card
<b>Two WAN Interface Card/Voice Interface Card Slots</b>	Supports any combination of up to two WAN interface cards or voice interface cards
<b>Ethernet WAN Interface Cards</b>	Supports PPP and PPPoE; operates in full and half-duplex modes
<b>One Auxiliary (AUX) Port</b>	RJ-45 jack with RS232 interface (plug compatible with Cisco 2500 Series AUX port); asynchronous serial DTE with full modem controls (CD, DSR, RTS, CTS); asynchronous serial data rates up to 115.2 kbps
<b>One Console Port</b>	RJ-45 jack with RS232 interface (plug compatible with Cisco 1000/1600/2500 series console ports); asynchronous serial DTE; transmit/receive rates up to 115.2 kbps (default 9600 bps, not a network data port); no hardware handshaking such as RTS/CTS
<b>One Internal Expansion Slot</b>	Supports hardware-assisted services such as encryption (up to T1/E1)
<b>RISC Processor</b>	Motorola MPC860P PowerQUICC at 48MHz

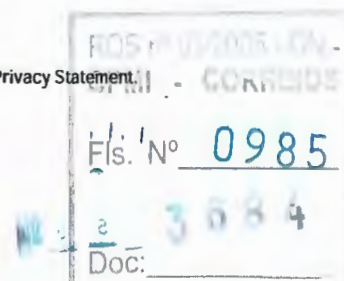
**Table 4** WAN Support

<b>Asynchronous Serial Interfaces on Serial WAN Interface Cards</b>	Interface speed: up to 115.2 Kbps; asynchronous serial protocols: Point-to-Point Protocol (PPP), Serial Line Internet Protocol (SLIP); asynchronous interface; EIA/TIA-232
<b>ISDN WAN Interface Cards</b>	ISDN dialup and ISDN leased line (IDSL) at 64 and 128 Kbps; encapsulation over ISDN leased line; Frame Relay and PPP
<b>ADSL WAN Interface Cards</b>	Supports ATP adaption Layer 5 (AAL5) services and applications; interoperates with Alcatel DSLAM with Alcatel chipset and Cisco 6130/6260 DSLAM with Globespan chipset; ANSI T1.413 issue 2 and ITU 992.1 (G.DMT) compliant

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**Table 5** WAN Interface Cards for the Cisco 1751 Router

Module	Description
WIC-1T	One serial, async, and sync (T1/E1)
WIC-2T	Two serial, async, and sync (T1/E1)
WIC-2A/S	Two low-speed serial (up to 128 kbps), async, and sync
WIC-1B-S/T	One ISDN BRI S/T
WIC-1B-U	One ISDN BRI U with integrated NT1
WIC-1DSU-56K4	One integrated 56/64-kbps, four-wire DSU/CSU
WIC-1DSU-T1	One integrated T1/fractional T1 DSU/CSU
WIC-1ADSL	One-port ADSL interface
WIC-1ENET	One-port 10BaseT Ethernet Interface
WIC-1SHDSL	One-port G.SHDSL interface
WIC-1AM	One-port V.90 analog modem WIC
WIC-2AM	Two-port V.90 analog modem WIC

**Table 6** Voice Interface Cards for the Cisco 1751

VIC-2FXS	Two-port FXS voice/fax interface card for voice/fax network module
VIC-2DID	Two-port DID (direct inward dial) voice/fax interface card
VIC-2FXO	Two-port FXO voice/fax interface card for voice/fax network module
VIC-2FXO-EU	Two-port FXO voice/fax interface card for Europe
VIC-2FXO-MI	Two-port FXO voice/fax interface card with battery reversal detection and Caller ID support (for US, Canada, and others) [enhanced version of the VIC-2FXO]
VIC-2FXO-M2	Two-port FXO voice/fax interface card with battery reversal detection and Caller ID support (for Europe) [enhanced version of the VIC-2FXO-EU]
VIC-2FXO-M3	Two-port FXO voice/fax interface card for Australia
VIC-2E/M	Two-port E&M voice/fax interface card for voice/fax network module
VIC-2BRI-NT/TE	Two-port network Side ISDN BRI interface
VIC-4FXS/DID <sup>1</sup>	Four-port FXS and DID voice/fax interface card
VWIC-1MFT-T1	One-port RJ-48 multiflex trunk - T1
VWIC-2MFT-T1	Two-port RJ-48 multiflex trunk - T1
VWIC-2MFT-T1-DI	Two-port RJ-48 multiflex trunk - T1 with drop and insert
VWIC-1MFT-E1	One-port RJ-48 multiflex trunk - E1
VWIC-2MFT-E1	Two-port RJ-48 multiflex trunk - E1

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**Table 6** Voice Interface Cards for the Cisco 1751

VWIC-2MFT-E1-DI	Two-port RJ-48 multiflex trunk - E1 with drop and insert
VWIC-1MFT-G703	One-port RJ-48 multiflex trunk - E1 G.703
VWIC-2MFT-G703	Two-port RJ-48 multiflex trunk - E1 G.703

1. The Cisco 1751 can support three VIC-4FXS/DID cards with a maximum of four ports in DID mode

### Voice Implementation Requirements

The Cisco 1751 Modular Access Router supports FXO, FXS, E&M, ISDN BRI VICs, and T1/E1 multiflex V/WICs. The FXO interface allows an analog connection to the central office of the Public Switched Telephone Network (PSTN). The FXS interface connects basic telephone service phones (home phones), fax machines, key sets, and PBXs through ring voltage and dial tone. The E&M interface allows connection for PBX trunk lines (tie lines). The ISDN-BRI NT/TE VIC is used to connect to the PSTN or a PBX/KTS, whereas the T1/E1 multiflex V/WIC (multiflex V/WIC) supports both data and voice services. The multiservice-ready Cisco 1751-V router version includes all the features needed for immediate integration of data and voice services:

- One DSP—(PVDM-256K-4)
- 32-MB Flash memory
- 64-MB DRAM
- Cisco IOS IP/VOX Plus feature set

VICs and WICs are available separately.

The Cisco 1751 and Cisco 1751-V routers have two DSP module slots on the motherboard and a maximum of eight DSPs are supported per router.

### DSP Requirements

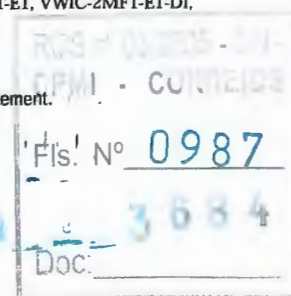
Cisco 1751 routers support 3 types of DSP images: high complexity (HC), medium complexity (MC) and Flexi-6. HC and MC are used for analog<sup>1</sup> and BRI (VIC-2BRI-NT/TE) VICs; Flexi-6 is used for T1/E1 VWICs<sup>2</sup> and BRI VIC. MC is introduced in Cisco 1751 starting from Cisco IOS 12.2(8)YN release, which will merge into 12.3(1)T. Therefore, please make sure to use Cisco 12.2(8) YN or later releases when using MC. In addition, starting from 12.2(8)YN release, the default DSP image for BRI VIC is changed from HC to Flexi-6. Table 7 lists the default images for each type of VICs; Table 8 lists IOS support for each DSP image. Table 9 lists the number of channels supported by one DSP (PVDM-256K-4) for each codec type.

Please use the following rules for calculating DSP requirements on the Cisco 1751:

1. For the Early Deployment (ED) releases: Cisco IOS 12.2(2)XK, 12.2(4)XW, 12.2(4)XL, 12.2(4)XM, 12.2(4)YA, 12.2(4)YB, 12.2(8)YL, 12.2(8)YM and 12.2(11)YT, or T train releases prior to 12.3(1)T:

1. Analog VICs include VIC-2FXS, VIC-2FXO, VIC-2FXO-M1, VIC-2FXO-M2, VIC-2FXO-M3, VIC-2FXO-EU, VIC-2E/M, VIC-2DID, VIC-4FXS/DID

2. T1/E1 VWICs include VWIC-1MFT-T1, VWIC-2MFT-T1, VWIC-2MFT-T1-DI, VWIC-1MFT-E1, VWIC-2MFT-E1, VWIC-2MFT-E1-DI, VWIC-1MFT-G703, VWIC-2MFT-G703







- a. Each 2-port analog VIC requires 1 DSP (PVDM-256K-4)
  - b. Each VIC-2BRI-NT/TE requires 2 DSPs (PVDM-256K-8)
  - c. For VWICs, refer to Table 9. For example, 12 G.711 digital T1/E1 voice calls require two DSPs; 12 G.729 calls require four DSPs
  - d. Total DSP requirement is the sum of a, b and c. The DSP resources can not be shared between analog VICs, BRI VIC and VWICs.
2. For the Early Deployment (ED) releases: Cisco IOS 12.2(8)YN or later (Note: not including 12.2(11)YT) or T train releases 12.3(1)T or later, please always refer to the DSP Calculator in the following link:

[http://www.cisco.com/cgi-bin/Support/DSP/cisco\\_prodsel.pl](http://www.cisco.com/cgi-bin/Support/DSP/cisco_prodsel.pl)

The DSP calculator optimizes the DSP resources for your configuration and suggests CLI configurations.

**Table 7** DSP Firmware for each type of VICs

VIC Type	Firmware Support
2-port Analog VICs	HC (default), MC (starting from 12.2(8)YN)
4-port Analog VIC	HC, MC (default, starting from 12.2(8)YN)
VIC-2BRI-NT/TE	HC (default for ED releases prior to 12.2(8)YN or T train releases prior to 12.3(1)T); MC; Flexi-6 (default for ED releases 12.2(8)YN or later or T train releases 12.3(1)T or later);
T1/E1 VWICs	Flexi-6 (default)

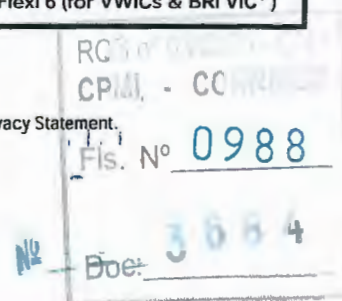
**Table 8** Cisco IOS support for DSP firmware

Firmware Support	IOS Release Support
HC	In all orderable IOS Releases
MC	ED Releases: Cisco IOS 12.2(8)YN or later <sup>1</sup> T Train Releases: Cisco IOS 12.3(1)T or later
Flexi-6	For T1/E1 VWICs: • ED Releases: Cisco IOS 12.2(4)YB or later <sup>2</sup> • T Train Releases: 6th releases of 12.2T or later For VIC-2BRI-NT/TE: • ED Releases: Cisco IOS 12.2(8)YN or later <sup>3</sup> • T Train Releases: Cisco IOS 12.3(1)T or later

1. It doesn't include Cisco 12.2(11)YT. 12.2(11)YT doesn't support MC.  
2. It doesn't include Cisco 12.2(11)YT. 12.2(11)YT doesn't support Flexi-6.  
3. It doesn't include Cisco 12.2(11)YT. 12.2(11)YT doesn't support Flexi-6.

**Table 9** The number of channels supported by one DSP (PVDM-256K-4) per codec type

Firmware		
Codec	HC (for analog & BRI VICs)	MC (for analog & BRI VICs) Flexi 6 (for VWICs & BRI VIC <sup>1</sup> )





**Table 9** The number of channels supported by one DSP (PVDM-256K-4) per codec type

Firmware			
G.711	2	4	6
G.729ab <sup>2</sup> /G.729a	2	4	3
G.726	2	4	3
G.723	2	-	2
G.728	2	-	2
Fax Relay	2	4	3

1. BRI VIC support in Flexi-6 starts from 12.2(8)YN or 12.3(1)T.  
2. G.729 and G.729b is not supported in MC or Flexi-6 images.

**Table 10** DSP Modules Available on Cisco 1751

Modules	DSPs
PVDM-256K-4	1 DSP Module
PVDM-256K-8	2 DSP Modules
PVDM-256K-12	3 DSP Modules
PVDM-256K-16HD	4 DSP Modules
PVDM-256K-20HD	5 DSP Modules

### Cisco IOS Software Feature Sets

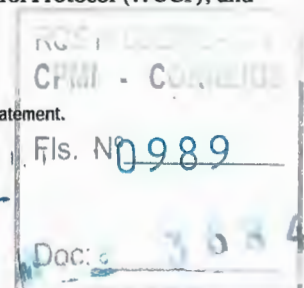
The Cisco 1751 Router supports a choice of Cisco IOS Software feature sets. Each feature set requires specific amounts of Flash and DRAM memory in the product. For default memory configurations, please see Table 11.

**Table 11** Cisco 1751 Router Memory Defaults and Maximums

Model Number	Default FLASH/Maximum FLASH	Default DRAM/Maximum DRAM
Cisco 1751	16 MB/16 MB	32 MB/96 MB
Cisco 1751-V Multiservice Model	32 MB/32 MB	64 MB/128 MB

The Cisco 1751 Router supports a choice of Cisco IOS Software feature sets with rich data features as well as data/voice features (Table 12). Each feature set requires specific amounts of RAM and Flash memory in the product.

- Cisco IOS IP base feature sets include: NAT, OSPF, RADIUS, and NHRP.
- Plus feature sets contain L2TP, L2F, the Border Gateway Protocol (BGP), IP Multicast, Frame Relay SVC, RSVP, the NetWare Link Services Protocol (NLSP), AppleTalk SMRP, the Web Cache Control Protocol (WCCP), and the Network Timing Protocol (NTP).







- Encryption is offered in special encryption feature sets (Plus IPsec 56, and Plus IPsec 3DES). The VPN encryption module requires an IOS IP Plus IPsec image.
- DSL support is only in the Plus feature sets.

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Table 12 Cisco IOS Features

Cisco 1751 Router Data Software Feature Sets for Cisco IOS Release 12.1(5)YB		
Feature Name	Product Code	CD Number
IP	S17C-12105YB	CD17-C-12.1.5=
IP ADSL	S17C7-12105YB	CD17-C-12.1.5=
IP Plus ADSL	S17C7P-12105YB	CD17-C7P-12.1.5=
IP Plus IPsec 56 (DES) ADSL	S17C7L-12105YB	CD17-C7L-12.1.5=
IP Plus IPsec 3DES ADSL	S17C7K2-12105YB	CD17-C7K2-12.1.5=
IP/FW/IDS	S17CH-12105YB	CD17-CH-12.1.5=
IP/FW/IDS Plus IPsec 56 (DES) ADSL	S17C7HL-12105YB	CD17-C7HL-12.1.5=
IP/IPX	S17B-12105YB	CD17-B-12.1.5=
IP/IPX/FW/IDS Plus ADSL	S17B7HP-12105YB	CD17-B7HP-12.1.5=
IP/FW/IDS Plus IPsec 3DES ADSL	S17C7HK2-12105YB	CD17-C7HK2-12.1.5=
IP/IPX/AT/IBM	S17Q-12105YB	CD17-Q-12.1.5=
IP/IPX/AT/IBM Plus ADSL	S17Q7P-12105YB	CD17-Q7P-12.1.5=
IP/IPX/AT/IBM/FW/IDS Plus IPsec 56 (DES) ADSL	S17Q7HL-12105YB	CD17-Q7HL-12.1.5=
IP/IPX/AT/IBM/FW/IDS Plus IPsec 3DES ADSL	S17Q7HK2-12105YB	CD17-Q7HK2-12.1.5=
Cisco 1751 Router Data/Voice Software Feature Packs for Cisco IOS Release 12.1(5)YB		
Feature Name	Product Code	CD Number
IP/Voice Plus	S17CVP-12105YB	CD17-C7VP-12.1.5=
IP/Voice Plus ADSL	S17C7VP-12105YB	CD17-C7VP-12.1.5=
IP/Voice Plus IPsec 56 (DES) ADSL	S17C7VL-12105YB	CD17-C7VL-12.1.5=
IP/Voice/FW/IDS Plus ADSL	S17C7HV-12105YB	CD17-C7HV-12.1.5=
IP/Voice/FW/IDS Plus IPsec 56 ADSL	S17C7HVL-12105YB	CD17-C7HVL-12.1.5=
IP/Voice Plus IPsec 3DES ADSL	S17C7VK2-12105YB	CD17-C7VK2-12.1.5=
IP/Voice/FW/IDS Plus IPsec 3DES ADSL	S17C7HVK2-12105YB	CD17-C7HVK2-12.1.5=
IP/IPX/Voice/FW/IDS Plus ADSL	S17B7HPV-12105YB	CD17-B7HPV-12.1.5=
IP/IPX/AT/IBM/FW/IDS Voice Plus IPsec 56 (DES) ADSL	S17Q7HVL-12105YB	CD17-Q7HVL-12.1.5=
IP/IPX/AT/IBM/FW/IDS/Voice Plus IPsec 3DES ADSL	S17Q7HVK2-12105YB	CD17-Q7HVK2-12.1.5=

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#### **Other IOS Features Include:**

##### **QoS Features**

- Frame Relay Fragmentation (FRF.12)
- IP Precedence
- Generic Traffic Shaping (GTS)
- Frame Relay Traffic Shaping (FRTS)
- Weighted Random Early Detection (WRED)
- DSCP Marking
- Compressed RTP
- Multiple Link PPP & Link Fragmentation and Interleaving
- Resource Reservation Protocol (RSVP)
- Queuing Techniques: Weighted Fair Queuing (WFQ), Priority Queuing (PQ), Low Latency Queuing (LLQ) and Custom Queuing (CQ)
- Preclassification for IPsec Tunneling

##### **Voice Support**

- VoIP
- VoFR
- VoATM
- Fax Pass Through
- Fax Relay
- Modem Pass Through

##### **VoIP Protocol Support**

- H.323 V2
- Media Gateway Control Protocol 1.0
- Session Initiation Protocol 2.0

##### **Codec Support**

- G.711
- G.729
- G.729a
- G.723.1
- G.726
- G.728

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## Technical Specifications

### Dimensions

- Width: 11.2 in. (28.4 cm)
- Height: 4.0 in. (10.0 cm)
- Depth: 8.7 in. (22.1 cm)
- Weight (minimum): 3.0 lb (1.36 kg)
- Weight (maximum): 3.5 lb (1.59 kg)

### Power

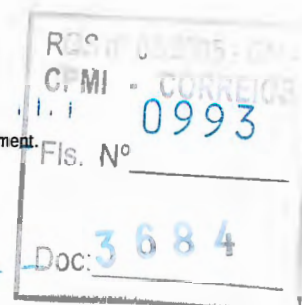
- Locking connector on power socket
- External Power Brick
- AC Input Voltage: 100 to 240 VAC
- Frequency: 50 - 60 Hz
- AC Input Current: rated 1 A, measured 0.5 A
- Power Dissipation: 20W (maximum)

### Environmental

- Operating Temperature: 32 to 104 F (0 to 40 C)
- Nonoperating Temperature: -4 to 149 F (-20 to 65 C)
- Relative Humidity: 10 to 85% noncondensing operating; 5 to 95% noncondensing, nonoperating

### Safety

- Regulatory Approvals
  - UL 1950, 3rd Edition
  - CSA 22.2 No 950-95, 3rd Edition
  - EN60950 with A1 through A4 and A11
  - EN41003
  - TCA TS001-1997
  - AS/NZS 3260 with A1 through A4
- IEC 60950 with A1 through A4 and all country deviations
- NOM-019-SCFI
- GB4943
  - ETSI 300-047
  - BS 6301 (power supply) EMI
  - AS/NRZ 3548 Class B
- CNS-13438
  - FCC Part 15 Class B
  - EN60555-2 Class B







- EN55022 Class B
- VCCI Class II
- CISPR-22 Class B
- EN55024 comprised of:
  - IEC 1000-4-2 (EN61000-4-2)
  - IEC 1000-4-3 (ENV50140)
  - IEC 1000-4-4 (EN61000-4-4)
  - IEC 1000-4-5 (EN61000-4-5)
  - IEC 1000-4-6 (ENV50141)
  - IEC 1000-4-11
  - IEC 1000-3-2 Network Homologation
- 
- Europe: CTR2, CTR3, TBR21
- Canada: CS-03
- United States: FCC Part 68
- Japan: Jate NTT
- Australia/New Zealand: TS013/TS-031, TS002, TS003
- Hong Kong: CR22

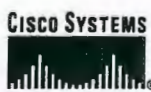
**Service and Support**

Leading-edge technology deserves leading-edge support. Service and support for the Cisco 1751 is available on a one-time or an annual contract basis. Support options range from help desk assistance to proactive, onsite consultation. All support contracts include:

- Major Cisco IOS Software updates in protocol, security, bandwidth, and feature improvements
- Full access to Cisco.com for technical assistance, electronic commerce, and product information
- 24-hour-a-day access to the industry's largest dedicated technical support staff

A support contract maximizes the value of your technology investment throughout its lifecycle, ensuring optimum performance and availability. Augment your internal staff's capabilities by taking full advantage of Cisco expertise.

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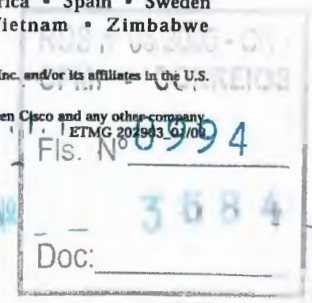
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## Configuring SNMP Support

This chapter describes the Simple Network Management Protocol (SNMP), SNMP MIBs, and how to configure SNMP on Cisco devices.

For a complete description of the router monitoring commands mentioned in this chapter, see the “SNMP Commands” chapter in the Release 12.2 *Cisco IOS Configuration Fundamentals Command Reference*. To locate documentation of other commands that appear in this chapter, use the *Cisco IOS Command Reference Master Index* or search online. For further information about using SNMP, see the SNMP Technical Tips area on Cisco.com at <http://www.cisco.com/warp/public/477/SNMP/snmp-indx.html>.

To identify hardware or software image support for a specific feature, use Feature Navigator on Cisco.com to search for information about the feature or refer to the software release notes for a specific release. For more information, see the “Identifying Platform Support for Cisco IOS Software Features” section in the “About Cisco IOS Software Documentation” chapter.

This chapter contains the following sections:

- Understanding SNMP
- SNMP Configuration Task List
- SNMP Configuration Examples
- New MIB Features in Cisco IOS Release 12.2

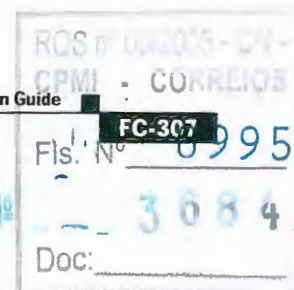
## Understanding SNMP

SNMP is an application-layer protocol that provides a message format for communication between SNMP managers and agents. SNMP provides a standardized framework and a common language used for the monitoring and management of devices in a network.

The SNMP framework has three parts:

- An SNMP manager
- An SNMP agent
- A MIB

The **SNMP manager** is the system used to control and monitor the activities of network hosts using SNMP. The most common managing system is called a Network Management System (NMS). The term NMS can be applied to either a dedicated device used for network management, or the applications used on such a device. A variety of network management applications are available for use with SNMP. These features range from simple command-line applications to feature-rich graphical user interfaces (such as the CiscoWorks2000 line of products).





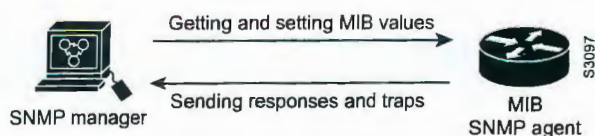
The SNMP agent is the software component within the managed device that maintains the data for the device and reports these data, as needed, to managing systems. The agent and MIB reside on the routing device (router, access server, or switch). To enable the SNMP agent on a Cisco routing device, you must define the relationship between the manager and the agent.

The Management Information Base (MIB) is a virtual information storage area for network management information, which consists of collections of managed objects. Within the MIB there are collections of related objects, defined in MIB modules. MIB modules are written in the SNMP MIB module language, as defined in STD 58, RFC 2578, RFC 2579, and RFC 2580 (see the "MIBs and RFCs" section for an explanation of RFC and STD documents). Note that individual MIB modules are also referred to as MIBs; for example, the Interfaces Group MIB (IF-MIB) is a MIB module within *the* MIB on your system.

The SNMP agent contains MIB variables whose values the SNMP manager can request or change through Get or Set operations. A manager can get a value from an agent or store a value into that agent. The agent gathers data from the MIB, the repository for information about device parameters and network data. The agent can also respond to manager requests to Get or Set data.

Figure 14 illustrates the communications relationship between the SNMP manager and agent. A manager can send the agent requests to get and set MIB values. The agent can respond to these requests. Independent of this interaction, the agent can send unsolicited notifications (traps or informs) to the manager to notify the manager of network conditions.

**Figure 14** Communication Between an SNMP Agent and Manager



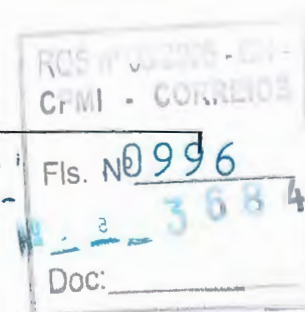
**Note**

This chapter discusses how to enable the SNMP agent on your Cisco device, and how to control the sending of SNMP notifications from the agent. For information on using SNMP management systems, see the appropriate documentation for your NMS application.

## SNMP Notifications

A key feature of SNMP is the ability to generate notifications from an SNMP agent. These notifications do not require that requests be sent from the SNMP manager. Unsolicited (asynchronous) notifications can be generated as *traps* or *inform requests*. Traps are messages alerting the SNMP manager to a condition on the network. Inform requests (informs) are traps that include a request for confirmation of receipt from the SNMP manager. Notifications can indicate improper user authentication, restarts, the closing of a connection, loss of connection to a neighbor router, or other significant events.

Traps are less reliable than informs because the receiver does not send any acknowledgment when it receives a trap. The sender cannot determine if the trap was received. An SNMP manager that receives an inform request acknowledges the message with an SNMP response protocol data unit (PDU). If the manager does not receive an inform request, it does not send a response. If the sender never receives a response, the inform request can be sent again. Thus, informs are more likely to reach their intended destination.

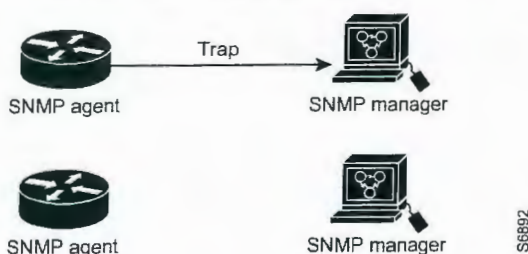


However, traps are often preferred because informs consume more resources in the router and in the network. Unlike a trap, which is discarded as soon as it is sent, an inform request must be held in memory until a response is received or the request times out. Also, traps are sent only once, while an inform may be retried several times. The retries increase traffic and contribute to a higher overhead on the network. Thus, traps and inform requests provide a trade-off between reliability and resources. If it is important that the SNMP manager receives every notification, use inform requests. However, if you are concerned about traffic on your network or memory in the router and you need not receive every notification, use traps.

Figure 15 through Figure 18 illustrate the differences between traps and inform requests.

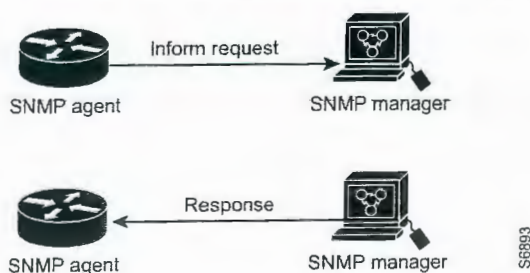
In Figure 15, the agent router successfully sends a trap to the SNMP manager. Although the manager receives the trap, it does not send any acknowledgment to the agent. The agent has no way of knowing that the trap reached its destination.

**Figure 15 Trap Successfully Sent to SNMP Manager**



In Figure 16, the agent router successfully sends an inform request to the manager. When the manager receives the inform request, it sends a response to the agent. Thus, the agent knows that the inform request reached its destination. Notice that, in this example, twice as much traffic is generated as in Figure 15; however, the agent knows that the manager received the notification.

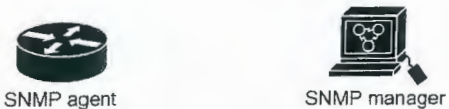
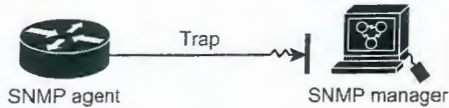
**Figure 16 Inform Request Successfully Sent to SNMP Manager**



In Figure 17, the agent sends a trap to the manager, but the trap does not reach the manager. Because the agent has no way of knowing that the trap did not reach its destination, the trap is not sent again. The manager never receives the trap.



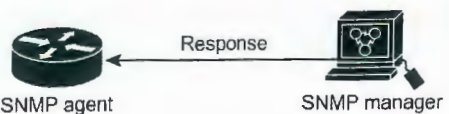
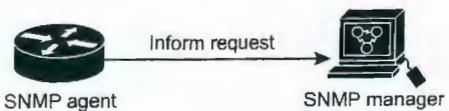
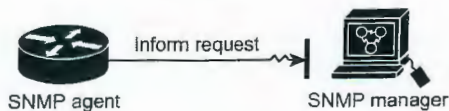
**Figure 17** *Trap Unsuccessfully Sent to SNMP Manager*



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In Figure 18, the agent sends an inform request to the manager, but the inform request does not reach the manager. Because the manager did not receive the inform request, it does not send a response. After a period of time, the agent will resend the inform request. The second time, the manager receives the inform request and replies with a response. In this example, there is more traffic than in Figure 17; however, the notification reaches the SNMP manager.

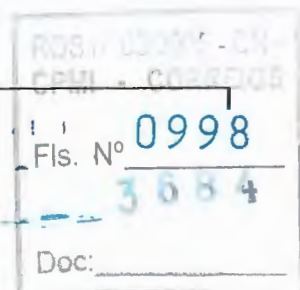
**Figure 18** *Inform Request Unsuccessfully Sent to SNMP Manager*



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## MIBs and RFCs

MIB modules typically are defined in RFC documents submitted to the Internet Engineering Task Force (IETF), an international standards body. RFCs are written by individuals or groups for consideration by the Internet Society and the Internet community as a whole, usually with the intention of establishing a recommended Internet standard. Before being given RFC status, recommendations are published as Internet Draft (I-D) documents. RFCs that have become recommended standards are also labeled as standards (STD) documents. You can learn about the standards process and the activities of the IETF at the Internet Society website at <http://www.isoc.org>. You can read the full text of all RFCs, I-Ds, and STDs referenced in Cisco documentation at the IETF website at <http://www.ietf.org>.





The Cisco implementation of SNMP uses the definitions of MIB II variables described in RFC 1213 and definitions of SNMP traps described in RFC 1215.

Cisco provides its own private MIB extensions with every system. Cisco enterprise MIBs comply with the guidelines described in the relevant RFCs unless otherwise noted in the documentation. You can find the MIB module definition files and list of which MIBs are supported on each Cisco platform on the Cisco MIB website on Cisco.com.

For a list of new MIB-related functionality, see the “New MIB Features in Cisco IOS Release 12.2” section.

## SNMP Versions

Cisco IOS software supports the following versions of SNMP:

- **SNMPv1**—The Simple Network Management Protocol: A Full Internet Standard, defined in RFC 1157. (RFC 1157 replaces the earlier versions that were published as RFC 1067 and RFC 1098.) Security is based on community strings.
- **SNMPv2c**—The community-string based Administrative Framework for SNMPv2. SNMPv2c (the “c” stands for “community”) is an Experimental Internet Protocol defined in RFC 1901, RFC 1905, and RFC 1906. SNMPv2c is an update of the protocol operations and data types of SNMPv2p (SNMPv2 Classic), and uses the community-based security model of SNMPv1.
- **SNMPv3**—Version 3 of SNMP. SNMPv3 is an interoperable standards-based protocol defined in RFCs 2273 to 2275. SNMPv3 provides secure access to devices by a combination of authenticating and encrypting packets over the network.

The security features provided in SNMPv3 are as follows:

- **Message integrity**—Ensuring that a packet has not been tampered with in transit.
- **Authentication**—Determining that the message is from a valid source.
- **Encryption**—Scrambling the contents of a packet prevent it from being learned by an unauthorized source.

Both SNMPv1 and SNMPv2c use a community-based form of security. The community of managers able to access the agent MIB is defined by an IP address Access Control List and password.

SNMPv2c support includes a bulk retrieval mechanism and more detailed error message reporting to management stations. The bulk retrieval mechanism supports the retrieval of tables and large quantities of information, minimizing the number of round-trips required. The SNMPv2c improved error handling support includes expanded error codes that distinguish different kinds of error conditions; these conditions are reported through a single error code in SNMPv1. Error return codes now report the error type. Three kinds of exceptions are also reported: no such object exceptions, no such instance exceptions, and end of MIB view exceptions.

SNMPv3 is a security model. A security model is an authentication strategy that is set up for a user and the group in which the user resides. A security level is the permitted level of security within a security model. A combination of a security model and a security level will determine which security mechanism is employed when handling an SNMP packet. See Table 18 for a list of security levels available in SNMPv3.

Three security models are available: SNMPv1, SNMPv2c, and SNMPv3. Table 18 identifies what the combinations of security models and levels mean.

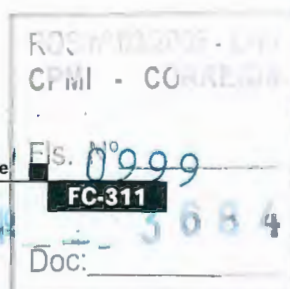






Table 18 SNMP Security Models and Levels

Model	Level	Authentication	Encryption	What Happens
v1	noAuthNoPriv	Community String	No	Uses a community string match for authentication.
v2c	noAuthNoPriv	Community String	No	Uses a community string match for authentication.
v3	noAuthNoPriv	Username	No	Uses a username match for authentication.
v3	authNoPriv	MD5 or SHA	No	Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms.
v3	authPriv	MD5 or SHA	DES	Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms. Provides DES 56-bit encryption in addition to authentication based on the CBC-DES (DES-56) standard.

**Note**

SNMPv2p (SNMPv2 Classic) is not supported in any Cisco IOS releases after 11.2. SNMPv2c replaces the Party-based Administrative and Security Framework of SNMPv2p with a Community-based Administrative Framework. SNMPv2c retained the bulk retrieval and error handling capabilities of SNMPv2p.

You must configure the SNMP agent to use the version of SNMP supported by the management station. An agent can communicate with multiple managers; for this reason, you can configure the Cisco IOS software to support communications with one management station using the SNMPv1 protocol, one using the SNMPv2c protocol, and another using SNMPv3.

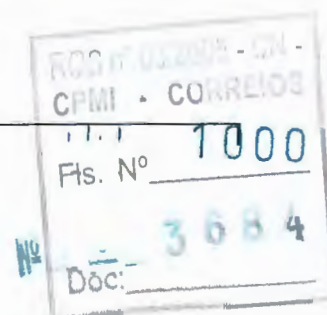
The SNMPv3 feature supports RFCs 1901 to 1908, 2104, 2206, 2213, 2214, and 2271 to 2275. For additional information on SNMPv3, refer to RFC 2570, *Introduction to Version 3 of the Internet-standard Network Management Framework* (note that this is not a standards document).

## SNMP Configuration Task List

There is no specific command that you use to enable SNMP. The first **snmp-server** command that you enter enables the supported versions of SNMP.

To configure SNMP support, perform the tasks described in the following sections. Each task is labeled as required or optional.

- Creating or Modifying an SNMP View Record (Optional)
- Creating or Modifying Access Control for an SNMP Community (Required)
- Specifying an SNMP-Server Engine Name (ID) (Optional)





- Specifying SNMP-Server Group Names (Optional)
- Configuring SNMP-Server Hosts (Required)
- Configuring SNMP-Server Users (Optional)
- Enabling the SNMP Agent Shutdown Mechanism (Optional)
- Setting the Contact, Location, and Serial Number of the SNMP Agent (Optional)
- Defining the Maximum SNMP Agent Packet Size (Optional)
- Limiting the Number of TFTP Servers Used via SNMP (Optional)
- Monitoring and Troubleshooting SNMP Status (Optional)
- Disabling the SNMP Agent (Optional)
- Configuring SNMP Notifications (Required)
- Configuring the Router as an SNMP Manager (Optional)

## Creating or Modifying an SNMP View Record

You can assign views to community strings to limit which MIB objects an SNMP manager can access. You can use a predefined view, or create your own view. If you are using a predefined view or no view at all, skip this task.

To create or modify an SNMP view record, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server view</b> view-name oid-tree {included   excluded}	Creates or modifies a view record.

To remove a view record, use the **no snmp-server view** command.

You can enter this command multiple times for the same view record. Later lines take precedence when an object identifier is included in two or more lines.

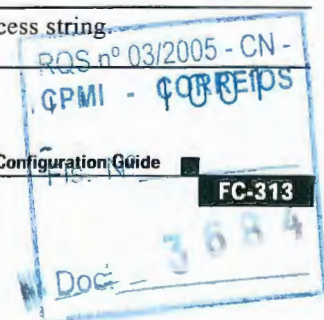
## Creating or Modifying Access Control for an SNMP Community

Use an SNMP community string to define the relationship between the SNMP manager and the agent. The community string acts like a password to regulate access to the agent on the router. Optionally, you can specify one or more of the following characteristics associated with the string:

- An access list of IP addresses of the SNMP managers that are permitted to use the community string to gain access to the agent.
- A MIB view, which defines the subset of all MIB objects accessible to the given community.
- Read and write or read-only permission for the MIB objects accessible to the community.

To configure a community string, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server community</b> string [view view-name] [ro   rw] [number]	Defines the community access string.





You can configure one or more community strings. To remove a specific community string, use the **no snmp-server community** command.

For an example of configuring a community string, see the “SNMP Configuration Examples” section.

## Specifying an SNMP-Server Engine Name (ID)

To specify an identification name (ID) for a local SNMP engine, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server engineID local</b> <i>engineid-string</i>	Specifies the name of the local SNMP engine (or copy of SNMP).

To specify an ID for a remote SNMP engine, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server engineID remote</b> <i>ip-address</i> [ <i>udp-port port-number</i> ] <i>engineid-string</i>	Specifies the name of the remote SNMP engine (or copy of SNMP).

## Specifying SNMP-Server Group Names

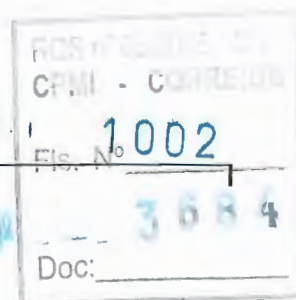
To specify a new SNMP group, or a table that maps SNMP users to SNMP views, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server group</b> [ <i>groupname</i> { <i>v1</i>   <i>v2c</i>   <i>v3</i> [ <i>auth</i>   <i>noauth</i>   <i>priv</i> ]}] [ <i>read readview</i> ] [ <i>write writeview</i> ] [ <i>notify notifyview</i> ] [ <i>access access-list</i> ]	Configures a new SNMP group, or a table that maps SNMP users to SNMP views.

## Configuring SNMP-Server Hosts

To configure the recipient of an SNMP trap operation, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server host</b> <i>host-id</i> [ <i>traps</i>   <i>informs</i> ] [ <i>version</i> { <i>1</i>   <i>2c</i>   <i>3</i> [ <i>auth</i>   <i>noauth</i>   <i>priv</i> ]}] <i>community-string</i> [ <i>udp-port port-number</i> ] [ <i>notification-type</i> ]	Specifies whether you want the SNMP notifications sent as traps or informs, the version of SNMP to use, the security level of the notifications (for SNMPv3), and the recipient (host) of the notifications.





## Configuring SNMP-Server Users

To configure a new user to an SNMP group, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server user</b> username groupname [remote ip-address [udp-port port]] {v1   v2c   v3} [encrypted] [auth {md5   sha} auth-password ] [access access-list]	Configures a new user to an SNMP group.

## Enabling the SNMP Agent Shutdown Mechanism

Using SNMP packets, a network management tool can send messages to users on virtual terminals and the console. This facility operates in a similar fashion to the **send EXEC** command; however, the SNMP request that causes the message to be issued to the users also specifies the action to be taken after the message is delivered. One possible action is a shutdown request. After a system is shut down, typically it is reloaded. Because the ability to cause a reload from the network is a powerful feature, it is protected by the **snmp-server system-shutdown** global configuration command. If you do not issue this command, the shutdown mechanism is not enabled. To enable the SNMP agent shutdown mechanism, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server system-shutdown</b>	Enables system shutdown using the SNMP message reload feature.

## Setting the Contact, Location, and Serial Number of the SNMP Agent

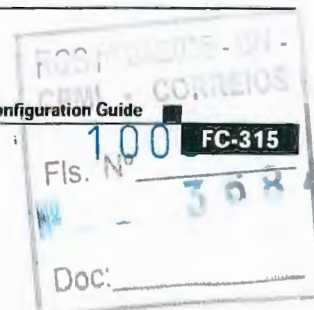
You can set the system contact, location, and serial number of the SNMP agent so that these descriptions can be accessed through the configuration file. To do so, use the following commands in global configuration mode, as needed:

Command	Purpose
Router(config)# <b>snmp-server contact</b> text	Sets the system contact string.
Router(config)# <b>snmp-server location</b> text	Sets the system location string.
Router(config)# <b>snmp-server chassis-id</b> number	Sets the system serial number.

## Defining the Maximum SNMP Agent Packet Size

You can define the maximum packet size permitted when the SNMP agent is receiving a request or generating a reply. To do so, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server packetsize</b> byte-count	Establishes the maximum packet size.







## Limiting the Number of TFTP Servers Used via SNMP

You can limit the number of TFTP servers used for saving and loading configuration files via SNMP to the servers specified in an access list. To do so, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server tftp-server-list</b> number	Limits the number of TFTP servers used for configuration file copies via SNMP to the servers in an access list.

## Monitoring and Troubleshooting SNMP Status

To monitor and troubleshoot SNMP status and information, use the following commands in EXEC mode, as needed:

Command	Purpose
Router> <b>show snmp</b>	Monitors SNMP status.
Router> <b>show snmp engineID</b> [local   remote]	Displays information about the local SNMP engine and all remote engines that have been configured on the device.
Router> <b>show snmp groups</b>	Displays information about each SNMP group on the network.
Router> <b>show snmp user</b>	Displays information about each SNMP username in the SNMP users table.

To monitor SNMP trap activity in real time for the purposes of troubleshooting, use the SNMP **debug** commands, including the **debug snmp packet** EXEC command. For documentation of SNMP **debug** commands, see the *Cisco IOS Debug Command Reference*.

## Disabling the SNMP Agent

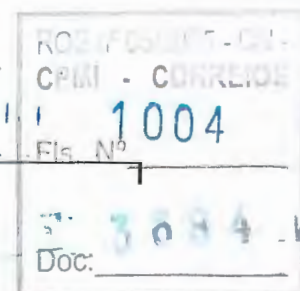
To disable any version of the SNMP agent, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>no snmp-server</b>	Disables SNMP agent operation.

## Configuring SNMP Notifications

To configure the router to send SNMP traps or informs, perform the tasks described in the following sections:

- Configuring the Router to Send SNMP Notifications (Required)
- Changing Notification Operation Values (Optional)
- Controlling Individual RFC 1157 SNMP Traps (Optional)



**Note**

Most Cisco IOS commands use the word “traps” in their command syntax. Unless there is an option within the command to specify either traps or informs, the keyword **traps** should be taken to mean either traps or informs, or both. Use the **snmp-server host** command to specify whether you want SNMP notifications to be sent as traps or informs.

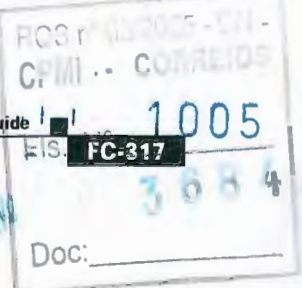
The SNMP Proxy manager must be available and enabled on the device for informs to be used. The SNMP Proxy manager is shipped with PLUS software images only.

## Configuring the Router to Send SNMP Notifications

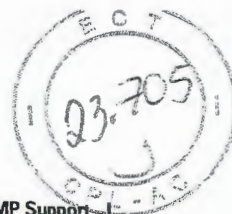
To configure the router to send traps or informs to a host, use the following commands in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>snmp-server engineID remote</b> <i>remote-ip-addr remote-engineID</i>	Specifies the engine ID for the remote host.
Step 2	Router(config)# <b>snmp-server user</b> <i>username groupname</i> [ <i>remote host [udp-port port] {v1   v2c   v3</i> [ <i>encrypted</i> ] [ <i>auth {md5   sha} auth-password</i> ]] [ <i>access</i> <i>access-list</i> ]	Configures an SNMP user to be associated with the host created in Step 1.  <b>Note</b> You cannot configure a remote user for an address without first configuring the engine ID for that remote host. This is a restriction imposed in the design of these commands; if you try to configure the user before the host, you will receive a warning message and the command will not be executed.
Step 3	Router(config)# <b>snmp group</b> <i>groupname {v1   v2   v3 {auth   noauth   priv}}</i> [ <i>read readview</i> ] [ <i>write writeview</i> ] [ <i>notify notifyview</i> ] [ <i>access access-list</i> ]	Configures an SNMP group.
Step 4	Router(config)# <b>snmp-server host</b> <i>host [traps   informs]</i> [ <i>version {1   2c   3 {auth   noauth   priv}}</i> ] <i>community-string [notification-type]</i>	Specifies whether you want the SNMP notifications sent as traps or informs, the version of SNMP to use, the security level of the notifications (for SNMPv3), and the recipient (host) of the notifications.
Step 5	Router(config)# <b>snmp-server enable traps</b> [ <i>notification-type [notification-options]</i> ]	Enables sending of traps or informs, and specifies the type of notifications to be sent. If a <i>notification-type</i> is not specified, all supported notification will be enabled on the router. To discover which notifications are available on your router, enter the <b>snmp-server enable traps ?</b> command.

The **snmp-server host** command specifies which hosts will receive SNMP notifications, and whether you want the notifications sent as traps or inform requests. The **snmp-server enable traps** command globally enables the production mechanism for the specified notification types (such as Border Gateway Protocol [BGP] traps, config traps, entity traps, Hot Standby Router Protocol [HSRP] traps, and so on).







## Changing Notification Operation Values

You can specify a value other than the default for the source interface, message (packet) queue length for each host, or retransmission interval.

To change notification operation values, use the following commands in global configuration mode, as needed:

Command	Purpose
Router(config)# <b>snmp-server trap-source</b> interface	Specifies a source interface for trap or inform notifications.
Router(config)# <b>snmp-server queue-length</b> length	Establishes the message queue length for each notification.
Router(config)# <b>snmp-server trap-timeout</b> seconds	Defines how often to resend notifications on the retransmission queue.

For inform requests, you can configure inform-specific operation values in addition to the operation values mentioned. To change inform operation values, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server informs</b> [retries retries] [timeout seconds] [pending pending]	Sets the maximum number of times to resend an inform request, the number of seconds to wait for an acknowledgment before resending, and the maximum number of informs waiting for acknowledgments at any one time.

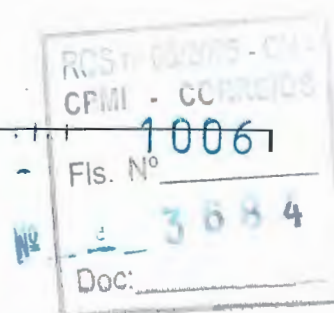
## Controlling Individual RFC 1157 SNMP Traps

Starting with Cisco IOS Release 12.1(3)T, you can globally enable or disable authenticationFailure, linkUp, linkDown, warmStart, and coldStart notifications (traps or informs) individually. (These traps constitute the “generic traps” defined in RFC 1157.) To enable any of these notification types, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>snmp-server enable traps snmp</b> [authentication] [linkup] [linkdown] [warmstart] [coldstart]	Enables RFC 1157 generic traps. When used without any of the optional keywords, enables authenticationFailure, linkUp, linkDown, warmStart, and coldStart traps. When used with keywords, enables only the trap types specified.

For example, to globally enable only linkUp and linkDown SNMP traps or informs for all interfaces, use the **snmp-server enable traps snmp linkup linkdown** form of this command.

Note that linkUp and linkDown notifications are enabled by default on specific interfaces, but will not be sent unless they are enabled globally. To control (disable or reenable) the sending of linkUp/linkDown notifications for specific interfaces, use the **no snmp trap link-status** command in interface configuration mode.





## Configuring the Router as an SNMP Manager

The SNMP manager feature allows a router to act as a network management station. In other words, configuring a router as an SNMP manager allows it to act as an SNMP client. As an SNMP manager, the router can send SNMP requests to agents and receive SNMP responses and notifications from agents. When the SNMP manager process is enabled, the router can query other SNMP agents and process incoming SNMP traps.

### Security Considerations

Most network security policies assume that routers will accept SNMP requests, send SNMP responses, and send SNMP notifications.

With the SNMP manager functionality enabled, the router may also send SNMP requests, receive SNMP responses, and receive SNMP notifications. Your security policy implementation may need to be updated prior to enabling this feature.

SNMP requests typically are sent to User Datagram Protocol (UDP) port 161. SNMP responses are typically sent from UDP port 161. SNMP notifications are typically sent to UDP port 162.

### SNMP Sessions

Sessions are created when the SNMP manager in the router sends SNMP requests, such as inform requests, to a host, or receives SNMP notifications from a host. One session is created for each destination host. If there is no further communication between the router and host within the session timeout period, the session will be deleted.

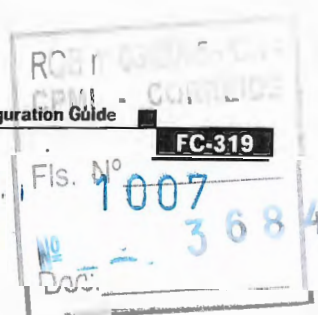
The router tracks statistics, such as the average round-trip time required to reach the host, for each session. Using the statistics for a session, the SNMP manager in the router can set reasonable timeout periods for future requests, such as informs, for that host. If the session is deleted, all statistics are lost. If another session with the same host is later created, the request timeout value for replies will return to the default value.

Sessions consume memory. A reasonable session timeout value should be large enough that regularly used sessions are not prematurely deleted, yet small enough such that irregularly used, or one-time sessions, are purged expeditiously.

### Enabling the SNMP Manager

To enable the SNMP manager process and set the session timeout value, use the following commands in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>snmp-server manager</b>	Enables the SNMP manager.
Step 2	Router(config)# <b>snmp-server manager session-timeout seconds</b>	(Optional) Changes the session timeout value.





## Monitoring the SNMP Manager

To monitor the SNMP manager process, use the following commands in EXEC mode, as needed:

Command	Purpose
Router> <code>show snmp</code>	Displays global SNMP information.
Router> <code>show snmp sessions [brief]</code>	Displays information about current sessions.
Router> <code>show snmp pending</code>	Displays information about current pending requests.

## SNMP Configuration Examples

The following example enables SNMPv1, SNMPv2c, and SNMPv3. The configuration permits any SNMP manager to access all objects with read-only permissions using the community string named public. This configuration does not cause the router to send any traps.

```
snmp-server community public
```

The following example permits any SNMP to access all objects with read-only permission using the community string named public. The router also will send ISDN traps to the hosts 172.16.1.111 and 172.16.1.33 using SNMPv1 and to the host 172.16.1.27 using SNMPv2c. The community string named public is sent with the traps.

```
snmp-server community public
snmp-server enable traps isdn
snmp-server host 172.16.1.27 version 2c public
snmp-server host 172.16.1.111 version 1 public
snmp-server host 172.16.1.33 public
```

The following example allows read-only access for all objects to members of access list 4 that specify the comaccess community string. No other SNMP managers have access to any objects. SNMP Authentication Failure traps are sent by SNMPv2c to the host cisco.com using the community string named public.

```
snmp-server community comaccess ro 4
snmp-server enable traps snmp authentication
snmp-server host cisco.com version 2c public
```

The following example sends Entity MIB inform notifications to the host cisco.com. The community string is restricted. The first line enables the router to send Entity MIB notifications in addition to any traps or informs previously enabled. The second line specifies that the notifications should be sent as inform requests, specifies the destination of these informs, and overwrites any previous `snmp-server host` commands for the host cisco.com.

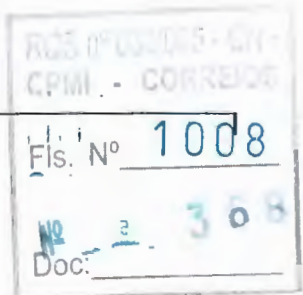
```
snmp-server enable traps entity
snmp-server host informs cisco.com restricted entity
```

The following example sends the SNMP and Cisco environmental monitor enterprise-specific traps to address 172.30.2.160:

```
snmp-server enable traps
snmp-server host 172.30.2.160 public snmp envmon
```

The following example enables the router to send all traps to the host myhost.cisco.com using the community string public:

```
snmp-server enable traps
```





```
snmp-server host myhost.cisco.com public
```

The following example will not send traps to any host. The BGP traps are enabled for all hosts, but only the ISDN traps are enabled to be sent to a host.

```
snmp-server enable traps bgp
snmp-server host bob public isdn
```

The following example enables the router to send all inform requests to the host myhost.cisco.com using the community string named public:

```
snmp-server enable traps
snmp-server host myhost.cisco.com informs version 2c public
```

In the following example, the SNMP manager is enabled and the session timeout is set to a larger value than the default:

```
snmp-server manager
snmp-server manager session-timeout 1000
```

## New MIB Features in Cisco IOS Release 12.2

This section outlines the new MIBs and MIB enhancements for the current Cisco IOS software release.

### Circuit Interface Identification MIB

The Circuit Interface Identification MIB (also known as the Circuit Interface MIB) is a Cisco enterprise MIB used to assist in SNMP monitoring of circuit-based interfaces. The Circuit Interface MIB (CISCO-CIRCUIT-INTERFACE-MIB) provides a MIB object that can be used to identify individual circuit-based interfaces (for example, interfaces using ATM or Frame Relay). This user-specified identification will then be returned when linkup and linkdown SNMP traps are generated for the interface.

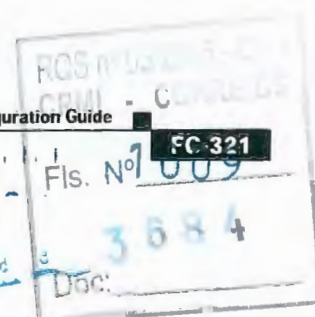
No Cisco IOS software configuration commands are associated with this MIB.

For more information, refer to the CISCO-CIRCUIT-INTERFACE-MIB.my file, available from the Cisco.com MIB website.

### Ethernet-like Interfaces MIB

The Ethernet-like Interfaces MIB (ETHERLIKE-MIB) was introduced in Cisco IOS Release 12.1(2)T. The Cisco implementation of the Ethernet-like Interfaces MIB (defined in the ETHERLIKE-MIB.my and CISCO-ETHERLIKE-CAPABILITY.my files on the Cisco MIB website) complies with RFC 2665 (*Definitions of Managed Objects for the Ethernet-like Interface Types*), and Data Over Cable Service Interface Specification (DOCSIS) 1.0 requirements for Cable Modem Termination Systems (CMTSS) and cable modems (CMs). Support for RFC 2665 in the ETHERLIKE-MIB was achieved through the addition of two new objects in the *dot3StatsTable*: *dot3StatsSymbolErrors* and *dot3StatsDuplexStatus*.

No Cisco IOS software configuration commands are associated with this MIB.







## Event MIB

The Event MIB was introduced in Cisco IOS Release 12.0(11)S and 12.1(3)T. No Cisco IOS software configuration commands are associated with this MIB. Instead, Event MIB configuration is done with applications external to Cisco IOS software. The Event MIB allows specialized monitoring capabilities that can be configured through a network management system (NMS) application using SNMP Get and Set operations. The Event MIB provides an asynchronous notification mechanism supported by SNMP that can be set to monitor any SNMP MIB object on a Cisco device and perform notification (trap or inform) operations or Set operations when specific conditions occur. Conditions are defined in event values. Event values that have been configured on your system can be displayed using the **show management event** command in privileged EXEC mode. By allowing SNMP notifications to take place only when a specified condition is met, Event MIB support reduces the load on affected devices, substantially improving the scalability of network management solutions.

For further information, see the Event MIB Support feature module document at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121t/121t3/dtevent.htm>

## Expression MIB Support for Delta, Wildcarding, and Aggregation

Expression MIB adds support of the Delta, Wildcarding, Delta Wildcarding, and Aggregation features in the Distributed Management Expression MIB (EXPRESSION-MIB) to Cisco IOS software for use by SNMP. No Cisco IOS software configuration commands are associated with this MIB. The functionality provided by this MIB is especially useful when used with the Event MIB (described previously).

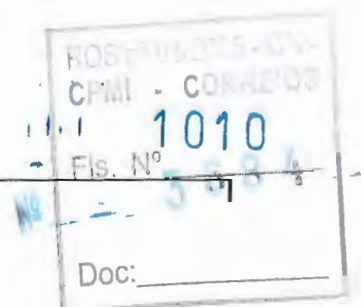
The Delta function enables the Expression MIB to use Delta values of an object instead of absolute values when evaluating an expression. Delta is obtained by taking the difference in the current value of an object with its previous value. Wildcarding empowers the Expression MIB to evaluate multiple instances of an object. This feature is useful in cases when the expression must be applied to all instances of an object. The user need not individually specify all instances of an object in the Expression but only needs to set the `expWildcardedObject` in `expObjectTable` to TRUE for the respective object. Aggregation is done by using the `sum()` function in the Expression MIB. The operand to the `sum` function must be a wildcarded object. The result of the `sum()` function is the sum of values of all instances of the wildcarded object.

For more information, see the *EXPRESSION-MIB.my* document available from the Cisco.com MIB website.

## Interfaces Group MIB Enhancements

The Cisco implementation of the Interfaces Group MIB (IF-MIB) has been enhanced to allow you to enable linkUp and linkDown SNMP traps that are compliant with RFC 2233. The default implementation of linkUp and linkDown traps is defined in *CISCO-IF-CAPABILITY.my* and *OLD-CISCO-INTERFACES-MIB.my*. To enable linkUp and linkDown traps that will function for both interfaces and subinterfaces, use the **snmp-server trap link ietf** command in global configuration mode.

The IF-MIB implementation also has been enhanced to allow the consistent identification of interfaces using the Interface Index (`ifIndex`) value of the IF-MIB.





## Interfaces Group MIB Support for ATM Subinterfaces

Introduced in Cisco IOS Release 12.1, the Interfaces Group MIB support for ATM subinterfaces feature provides the implementation of RFC 2233 (MIB-II) for ATM subinterfaces. ATM subinterfaces are visible in the ifTable and accessible to NMS applications. There are two entities in the ifTable corresponding to each subinterface—an atmSubif entity and an aal5 entity. The atmSubif entity corresponds to the ATM layer and the aal5 entity corresponds to the AAL5 layer. The MIB variables are defined in RFC 1695.

## MIB Enhancements for Universal Gateways and Access Servers

The following MIB enhancements were designed to monitor modem and line status for network access servers (NASs).

### CISCO-AAA-SERVER-MIB

The CISCO-AAA-SERVER-MIB provides statistics reflecting the state of authentication, authorization, and accounting (AAA) server operation within a device and AAA communications with external servers for the Cisco AS5300 and AS5800 series platforms. The Cisco AAA Server MIB provides the following information:

- A table for configuring AAA servers
- Identities of external AAA servers
- Statistics for each AAA function (**show radius statistics** command)
- Status of servers providing AAA functions

ServerStateChange notifications are controlled (enabled or disabled) through use of the **snmp-server enable traps aaa\_server** command in global configuration mode. ServerStateChange notifications, when enabled, will be sent when the server moves from an “up” to “dead” state or when a server moves from a “dead” to “up” state.

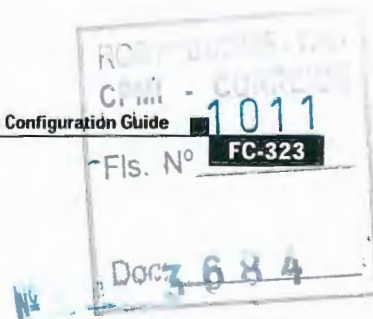
Statistics for AAA functions can be displayed through use of the **show radius statistics** command in EXEC mode.

The implementation of this MIB is defined in the CISCO-AAA-SERVER-MIB.my and CISCO-AAA-SERVER-CAPABILITY.my files available from the Cisco.com MIB website.

### CISCO-AAA-SESSION-MIB

The CISCO-AAA-SESSION-MIB provides the ability to both monitor and terminate authenticated client connections using SNMP for the Cisco AS5300 and AS5800 series platforms. Real-time information can be provided on data such as idle time, allowing configurations that can terminate calls when there are periods of inactivity on a line. Data provided by this MIB is directly related to the accounting information reported by AAA to RADIUS or TACACS servers. You can verify SNMP queried values through use of the **show accounting** and **show caller timeouts** commands in EXEC mode.

To enable the ability to terminate connections, you must configure the device through use of the **aaa session-mib {disconnect}** command in global configuration mode. When this command is found in a system configuration, SNMP managers have the ability to disconnect all lines that have AAA accounting







records associated to them using the Disconnect object. (AAA must already be configured with accounting enabled for this feature to function.) For more information, see the Release 12.2 *Cisco IOS Security Configuration Guide*.

## CISCO-CALL-TRACKER-MIB, CISCO-CALL-TRACKER-MODEM-MIB, and CISCO-CALL-TRACKER-TCP-MIB

The CISCO-CALL-TRACKER-MIB, the CISCO-CALL-TRACKER-MODEM-MIB, and the CISCO-CALL-TRACKER-TCP-MIB provide the ability to capture detailed data on the progress and status of calls, from the time the NAS receives a setup request or allocates a channel, to the time a call is rejected or terminated. This data is maintained within the Call Tracker database tables, which are accessible through SNMP, command-line interface (CLI), or SYSLOG.

Call Tracker SNMP notifications are controlled through use of the **snmp-server enable traps snmp calltracker** command in global configuration mode. CallSetup notifications are generated at the start of each call, when an entry is created in the active table (cctActiveTable), and CallTerminate notifications are generated at the end of each call, when an entry is created in the history table (cctHistoryTable).

The Call Tracker feature is supported on the Cisco AS5300 and the Cisco AS5800 series platforms. For more information on this feature, see the *Call Tracker plus ISDN and AAA Enhancements for the Cisco AS5300 and Cisco AS5800* document available from Cisco.com.

## CISCO-ISDN-MIB

The CISCO-ISDN-MIB supplies ISDN PRI channel-not-available traps that can be generated when a requested DS 0 channel is not available, or when no modem is available to take the incoming call. ISDN PRI channel-not-available notifications are controlled (enabled or disabled) through use of the **no snmp-server enable traps isdn [chan-not-avail]** command in global configuration mode. These notifications are disabled by default and are available only for ISDN PRI interfaces on the Cisco AS5300, Cisco AS5400, and Cisco AS5800 universal access servers.

## CISCO-MODEM-MGMT-MIB

The CISCO-MODEM-MGMT-MIB supplies modem health traps that can be generated when a modem port is bad, disabled, reflashed, or shut down, or when there is a request to busyout the modem. Modem health notifications are controlled (enabled or disabled) through use of the **no snmp-server enable traps modem-health** command in global configuration mode. Modem health traps are disabled by default and are supported on the Cisco AS5300, Cisco AS5400, and Cisco AS5800 universal access servers.

## CISCO-POP-MGMT-MIB

The CISCO-POP-MGMT-MIB supplies the DS 0 busyout notification. DS 0 busyout traps or informs can be generated when there is a request to busyout a DS 0, when there is a request to take a DS 0 out of busyout mode, or when busyout completes and the DS 0 is out of service. DS 0 busyout traps are controlled (enabled or disabled) through use of the **no snmp-server enable traps pop** command in global configuration mode. Busyout is enabled on a device using the **isdn snmp busyout b-channel** command. DS 0 busyout notifications are disabled by default and are supported on Cisco AS5300, Cisco AS5400, and Cisco AS5800 universal access servers.





DS 1 loopback traps can be generated when a DS 1 line goes into loopback mode. DS 1 loopback traps are controlled (enabled or disabled) through use of the **no snmp-server enable traps ds1-loopback** command in global configuration mode. DS 1 loopback traps are disabled by default and are supported only on the Cisco AS5300 and Cisco AS5400 universal access servers.

## RFC1406-MIB

The RCF1406-MIB supplies dsx1LineStatus and dsx1LineIndex objects.

## MSDP MIB

The Multicast Source Discovery Protocol (MSDP) MIB feature adds support in Cisco IOS software for the MSDP MIB. This MIB describes objects used for managing MSDP operations using SNMP. MSDP MIB notifications are controlled (enabled or disabled) through use of the **no snmp-server enable traps msdp** command in global configuration mode. There are two MSDP MIB notification-types: msdpEstablished (1) and msdpBackwardTransition (2). The msdpEstablish notifications are sent when the MSDP finite state machine (FSM) enters the ESTABLISHED state. The msdpBackwardTransition notifications are sent generated when the MSDP FSM moves from a higher numbered state to a lower numbered state. For more information on the Cisco implementation of the MSDP MIB, refer to the *MSDP-MIB.my* document available from Cisco.com. The Cisco implementation of the MSDP MIB has the following restrictions in Cisco IOS Release 12.2:

- All MSDP MIB objects are implemented as read-only.
- The Requests table is not supported in the Cisco implementation of the MSDP MIB.
- The msdpEstablished notification is not supported in the Cisco implementation of the MSDP MIB.

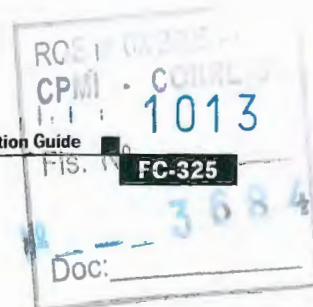
## NTP MIB

The Network Time Protocol (NTP) is used to synchronize timekeeping among a set of distributed time servers and clients. The Cisco NTP MIB enables users to remotely monitor an NTP server using SNMP, provided the MIB itself is implemented on that server. Use of the NTP MIB to monitor the NTP status of routing devices is accomplished using software on an NMS. No new or modified Cisco IOS software commands are associated with this feature.

The Cisco implementation of the NTP MIB is based on NTP version 3 (RFC-1305). The MIB objects are all read-only. SNMP requests are processed by reading the corresponding variables from the NTP subsystem and returning them in the response. The NTP MIB defines a set of NTP server system objects, including an NTP server peers table and an NTP server filter register table. For more information on the Cisco implementation of the NTP MIB, refer to the MIB document itself (*CISCO-NTP-MIB.my*, available from Cisco.com).

## Response Time Monitor MIB

The CISCO-RTTMON-MIB is used for network monitoring and management using the Cisco Service Assurance Agent (SA Agent). For information about the enhancements to this MIB, see the "Network Monitoring Using Cisco Service Assurance Agent" chapter in this document.

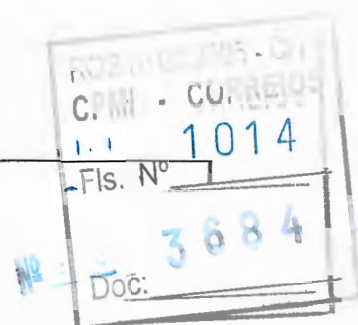


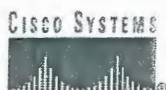




Configuring SNMP Support

New MIB Features in Cisco IOS Release 12.2





## Cisco 1700, 2600, 3600, and 3700 Integrated V.90 Modem WAN Interface Cards

One- and two-port analog modem WAN Interface Cards (Part numbers WIC-1AM and WIC-2AM) are now available for the award-winning Cisco 1700, 2600, 3600, and 3700 Series modular router platforms. The addition expands the already extensive range of WAN Interface Cards currently available for these routers (Figure 1). The interface cards provide cost-effective basic telephone service connectivity to allow remote router management, asynchronous Dial-on-Demand Routing (DDR) and dial backup, dial- and fax-out modem access, and low-density remote access server (RAS) services. Combined with the differentiated services delivered through Cisco IOS® Software, the Cisco 1700, 2600, 3600, and 3700 Series routers offer customers best-of-breed scalability, flexibility, and investment protection, all in cost-effective, multifunctional platforms.

**Figure 1** One- and Two-Port Analog Modem WAN Interface Cards for Cisco 1700, 2600, 3600, and 3700 Series Platforms



Both cards feature dual RJ-11 connectors, which are used for basic telephone service connection. The WIC-1AM uses one port for connection to a standard telephone line, and the other port can be connected to a basic analog telephone for use when the modem is idle.

### Key Benefits

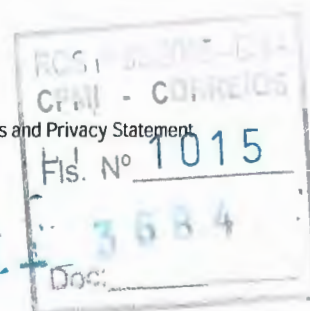
Combined with the Cisco 1700, 2600, 3600, and 3700, the WIC-1AM and WIC-2AM cards provide:

- An integrated solution for ease of deployment and management
- Enhanced remote management capabilities
- A cost-effective alternative to leased lines or ISDN
- On-demand dial backup for critical WAN links

### Key Features

The Cisco 1700, 2600, 3600, and 3700, equipped with the new integrated analog modem WAN interface cards, offer the most flexible, scalable, and manageable Plain Old Telephone Service (POTS) dial access solution available on the market today.

- Internal analog modem dialup capability—Internal modems allow simple setup of a remote router. There is no separate external power, no cables, and everything is in one chassis.
- Support for speeds up to 56K (V.90 specification)—When dialing out to a digital endpoint, this feature allows users to achieve maximum data transfer rates, equating to faster file transfers, speedier Web access, and faster e-mail downloads.





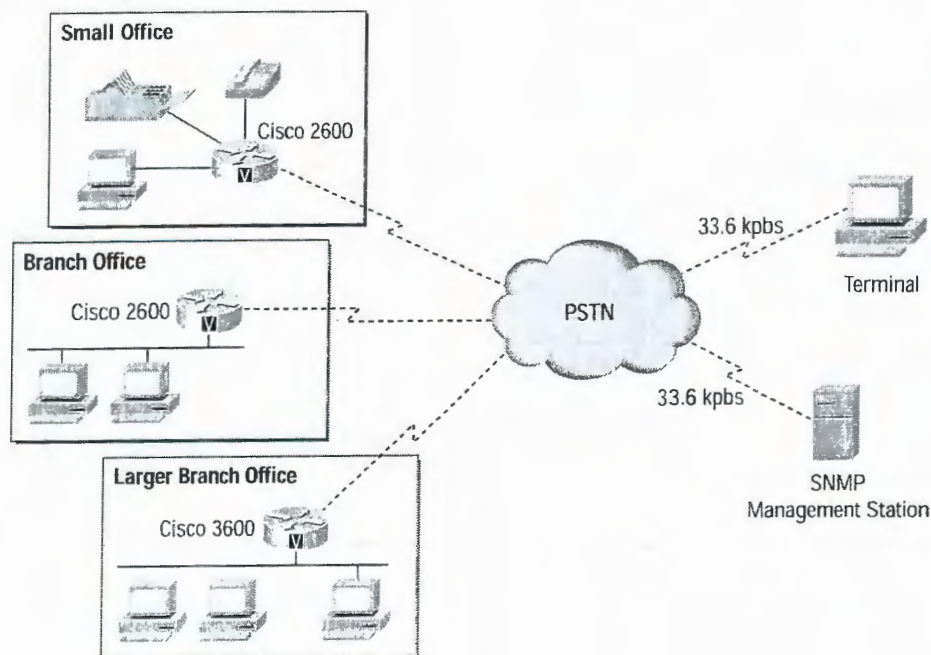


- Cisco IOS Dial Access Software—Cisco IOS Software provides a broad range of features for remote router management and dial backup, including:
  - Reverse Telnet support for LAN-based dial-out and fax-out
  - Point-to-Point Protocol (PPP), Multilink PPP (MLPPP), and Serial Line Internet Protocol (SLIP)
  - TACACS+, Radius, and PPP password security
  - Auto-sensing Internetwork Packet Exchange (IPX), Transmission Control Protocol/IP (TCP/IP), AppleTalk Remote Access (ARA), and AppleTalk Control Protocol (ATCP)

## Applications

### Remote Router Management

**Figure 2** Remote Router Management



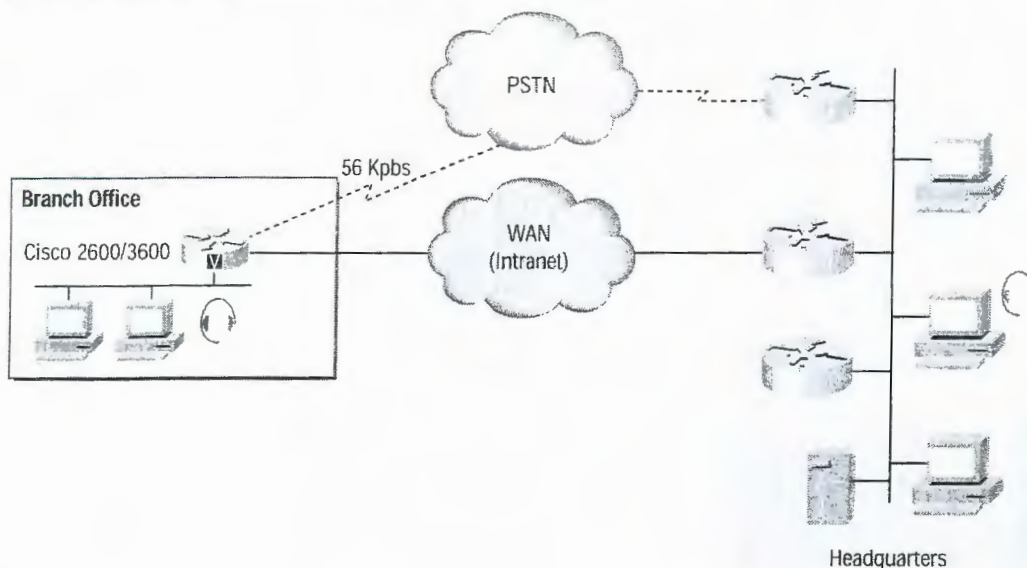
The WIC-1AM and WIC-2AM cards are ideal for dialup access for remote router configuration and management (Figure 2). Similar to connecting a modem to the router's auxiliary port, the modem WAN Interface Cards allow out-of-band management through an internal device. Both WAN Interface Cards can receive calls at speeds as fast as 33.6K, depending upon line conditions.





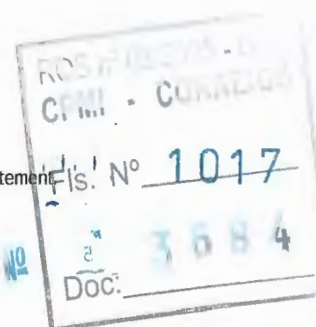
### Dial Backup and Asynchronous DDR

**Figure 3** Dial Backup and Asynchronous DDR



Constant WAN access is often a requirement for branch offices connecting to a corporate site or the Internet. While DSL, Frame Relay, ISDN, and leased line are common choices for a primary WAN link, an alternate data path is sometimes needed. The WIC-1AM and WIC-2AM cards combined with the Cisco 1700, 2600, 3600, and 3700 offer the ability to automatically dial a backup connection when the primary WAN link is unavailable. In addition, the modem WAN Interface Cards can also be used to provide supplemental bandwidth when the primary WAN link is overutilized. Multiple modem calls can be aggregated using MLPPP when one 56K connection is insufficient.

For some customers, dialup telephone service connectivity may be the only available choice for WAN access to the Internet or to a corporate home office. For those situations and for those installations that only require a dialup connection, the Cisco Series Routers with integrated modem WAN Interface Card offer WAN connectivity through Asynchronous DDR. As in the case of dial-backup, MLPPP can be used to aggregate multiple dialup connections into one data stream, providing higher throughput.

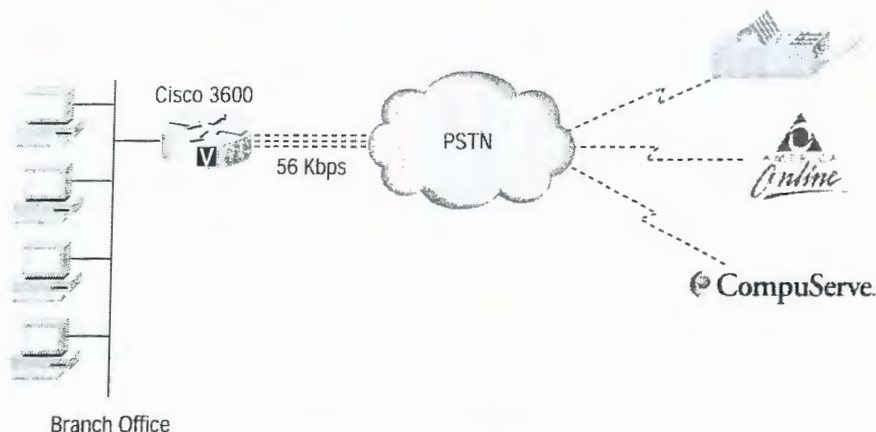






## Dial-Out and Fax-Out Modem Access

**Figure 4** Dial- and Fax-Out Modem Access



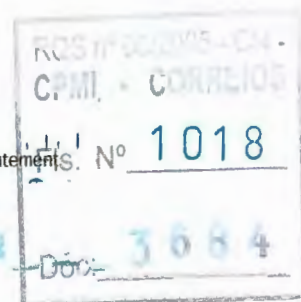
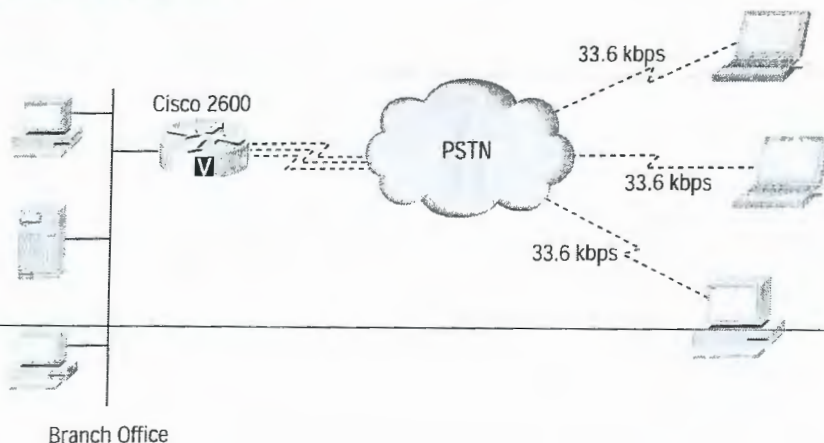
The WIC-1AM and WIC-2AM cards comply with RFC-2217 and provide dial-out and fax-out modem functionality to LAN-connected devices (Figure 4). Using the recommended "Advanced COM Port Redirection" software (available from <http://www.tacticalsoftware.com>), customers can take advantage of the modem WAN Interface Cards as if they were connected directly to their PC's communications port. This allows convenient access to services such as America Online, CompuServe, and remote fax machines without requiring dedicated phone lines and modems at each PC. For more details on using "Advanced COM Port Redirection" software, visit the following URL:

<http://www.cisco.com/warp/public/cc/pd/iosw/ioft/dlout/index.shtml>

**Note:** The WIC-1AM and WIC-2AM cards do not have the ability to receive faxes—only fax-out is supported.

## Low-Density Analog RAS Access

**Figure 5** Low-Density Analog RAS Access





Dial-in users can take advantage of the router's ability to function as a small remote access server (RAS), thus allowing dialup access to the LAN (Figure 5). Typically, a two-port modem WAN Interface Card would be used here for maximum port density, but the WIC-1AM is also acceptable. Scalability to multiple modem WAN Interface

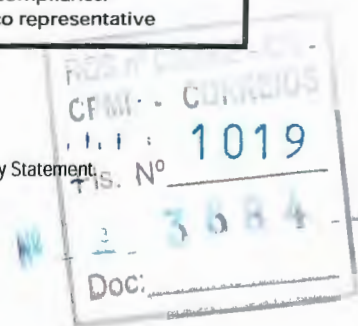
Cards per chassis (up to 12 in a Cisco 3660 Multiservice Platform) is also possible. Dial-in speeds of up to 33.6K (V.34bis) are possible. MLPPP is available to bond two or more calls together, therefore allowing higher speed RAS support.

### Feature Summary

A summary of the features and benefits of the integrated modem WAN interface cards is provided in Table 1.

**Table 1** Integrated V.90 Modem WAN Interface Cards Feature and Benefit Summary

Feature	Benefit
<b>Auxiliary port compatibility</b>	<ul style="list-style-type: none"><li>• Eases deployment and saves space due to its integrated solution</li><li>• Provides convenience by replicating all functions of an external modem connected to auxiliary port</li></ul>
<b>V.90 (up to 56K) modem specification support when dialing out to a digital endpoint</b>	<ul style="list-style-type: none"><li>• Achieves maximum data transfer rates equating to faster file transfers, speedier Web access, and faster e-mail downloads</li></ul>
<b>Fax-out capability at speeds up to 14.4K</b>	<ul style="list-style-type: none"><li>• Allows customers to access fax machines and servers from their LAN-connected PCs</li></ul>
<b>Multilink PPP</b>	<ul style="list-style-type: none"><li>• Increases connection speeds across modems in the same WAN Interface Card and across other modem WAN Interface Cards in the same chassis</li></ul>
<b>Full platform support</b>	<ul style="list-style-type: none"><li>• Modem WAN Interface Card supported on Cisco 1700, 2600, 2600XM, 2691, 3600, and 3700 routers</li></ul>
<b>Retrofits into existing chassis</b>	<ul style="list-style-type: none"><li>• Fits into a WAN Interface Card slot on a Cisco 1700, 2600, 3600 chassis or any compatible network module on a Cisco 2600, 3600, or 3700 router (See Table 3 for details)</li></ul>
<b>Cisco IOS Software support</b>	<ul style="list-style-type: none"><li>• Does not require additional memory to support the modem WAN Interface Cards</li></ul>
<b>Up to 24 modems per chassis</b>	<ul style="list-style-type: none"><li>• No restriction on number of modems available (other than slot availability)(See Table 2 for details)</li></ul>
<b>Major modem vendor compatibility</b>	<ul style="list-style-type: none"><li>• Works with AT&amp;T, Hayes, Motorola, Microcom, Multitech, and USR modems (compatibility with other modem vendors is expected, but not confirmed)</li></ul>
<b>Fax vendor compatibility</b>	<ul style="list-style-type: none"><li>• Works with Panasonic fax machines (compatibility with other fax vendors is expected, but not confirmed)</li></ul>
<b>Current analog and digital modem network module compatibility</b>	<ul style="list-style-type: none"><li>• Integrates seamlessly with current NM-8AM and NM-16AM analog and NM-xDM digital modems</li></ul>
<b>Worldwide support for country-specific standards</b>	<ul style="list-style-type: none"><li>• Supports various regulatory requirements. For the latest per-country approval information for the WIC-1AM and WIC-2AM, please visit the following URL: <a href="http://www.cisco.com/cgi-bin/compliance/approvals_search.pl">http://www.cisco.com/cgi-bin/compliance/approvals_search.pl</a> or contact your local Cisco representative</li></ul>







**Table 1** Integrated V.90 Modem WAN Interface Cards Feature and Benefit Summary (Continued)

Feature	Benefit
Leased-line mode	• Does not support leased-line mode
Modem firmware upgrade capability	• Does not support modem firmware upgrades

### Network Management Support

One- and two-port analog modem WAN Interface Cards work with the following configuration and network management methods:

- CiscoWorks
- Telnet and console port command-line interface (CLI) configuration

### Memory and Software Requirements

Minimum IOS Support	1700	2600	2600XM	3600	3700
WIC-1AM,	12.2(4)	12.2(2)	12.2(8)T1	12.2(2)	12.2(8)
WIC-2AM	YB	XB, 12.2(8) T		XB, 12.2(8) T	T

- No additional memory required to support the modem WAN Interface Cards (see the IOS Software release notes for platform memory requirements per feature set)

### Maximum Modem WAN Interface Cards Per Chassis

**Table 2** Maximum Modem WAN Interface Cards Per Chassis

Platform	Maximum modem WAN Interface Cards per chassis
Cisco 1700	2
Cisco 2600, Cisco 2600XM	4
Cisco 2691	5
Cisco 3620	4

**Table 2** Maximum Modem WAN Interface Cards Per Chassis

Platform	Maximum modem WAN Interface Cards per chassis
Cisco 3640	8
Cisco 3660	12
Cisco 3725	7
Cisco 3745	11

**Note:** Please refer to the platform documents for more details on other hardware restrictions. The Cisco 2600, 3600, and 3700 also support higher density modem solutions in a network module form factor. Visit the following URLs for additional information on the NM-8AM, NM-16AM, and NM-xDM:

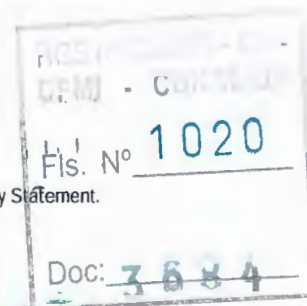
For NM-8AM and NM-16AM (Cisco 2600, 3600, and 3700 Analog Modem Network Modules)  
[http://www.cisco.com/warp/public/cc/pd/rt/3600/prodlit/2636\\_ds.htm](http://www.cisco.com/warp/public/cc/pd/rt/3600/prodlit/2636_ds.htm)

For NM-xDM (Cisco 3600 and 3700 Series Digital Modem Network Modules)  
[http://www.cisco.com/warp/public/cc/pd/rt/3600/prodlit/d3600\\_ds.htm](http://www.cisco.com/warp/public/cc/pd/rt/3600/prodlit/d3600_ds.htm)

### Modem Specifications

#### Carrier protocols:

- International Telecommunications Union (ITU) V.90
- K56Flex
- ITU V.23
- Bell 103
- ITU V.21
- ITU V.22





- Bell 212A
- ITU V.22bis
- ITU V.32
- ITU V.32bis
- V.32 turbo
- V.34
- V.34 bis

#### Error-correcting link access protocols:

- V.42 Link Access Procedure for Modems (LAPM), MNP 2-4

#### Compression protocols:

- V.42bis (includes MNP-5)

#### Fax protocols:

- ITU-T V.27ter
- ITU-T V.29
- ITU-T V.17
- Point of Sale (PoS) Configuration support
- FAX Class 2
- TIA/EIA-592 Class 2.0 and TIA/EIA-592 draft SP-2388 Class 2 Group III fax transmission, at ITU-T V.33, V.17, V.29, V.27ter, and V.21 modulations

#### Hardware Specifications

Hardware specifications of the integrated modem WAN Interface Cards are described in Table 3.

**Table 3** Specifications for the WIC-1AM and WIC-2AM

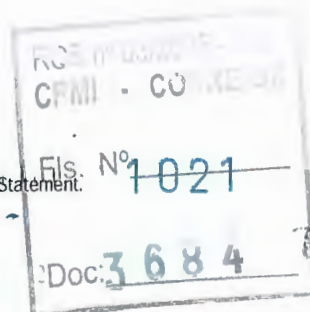
Specification	Data
<b>Hardware/Platform Compatibility</b>	Cisco 1700, 2600, 3600, and 3700 models
<b>Dimensions</b>	Width 3.08 in. (6.93 cm) Height .75 in. (1.91 cm) Depth 4.38 in. (9.86 cm)
<b>Weight</b>	2.4 oz (68 gram)

**Table 3** Specifications for the WIC-1AM and WIC-2AM

Specification	Data
<b>Network module support</b>	Cisco 2600—Built-in WAN Interface Card slots plus the NM-2W Cisco 3600—Through combo modules (NM-2W, NM-1E2W, NM-2E2W, and NM-1E1R2W, NM-1FE2W, NM-2FE2W, NM-1FE1R2W) Cisco 3700—Through combo modules (NM-2W, NM-1FE2W, NM-2FE2W, NM-1FE1R2W)
<b>Throughput</b>	Up to 56K downstream and up to 33.6K upstream, subject to line conditions.
<b>Ports</b>	Two RJ-11 ports (second port on WIC-1AM can be used to connect an analog telephone for use when the modem is idle)
<b>Cabling</b>	One or two RJ-11 connectors
<b>LEDs (per modem)</b>	SP (high-speed connectivity for V.90 or K56flex), CN (carrier detect), and OH (off-hook) status indicators
<b>NEBS compliance</b>	Level 3, Types II and IV

Refer to the Cisco 1700, 2600, 3600, and 3700 data sheets for additional information on mechanical, environmental, and agency certifications. Please visit the following URLs for Cisco 1700, 2600, 3600, and 3700 data sheets:

- Cisco 1700:  
<http://www.cisco.com/warp/public/cc/pd/rt/1700/prodlit/index.shtml>
- Cisco 2600:  
[http://www.cisco.com/warp/public/cc/pd/rt/2600/prodlit/2600\\_ds.htm](http://www.cisco.com/warp/public/cc/pd/rt/2600/prodlit/2600_ds.htm)
- Cisco 3600:  
[http://www.cisco.com/warp/public/cc/pd/rt/3600/prodlit/36kmp\\_ds.htm](http://www.cisco.com/warp/public/cc/pd/rt/3600/prodlit/36kmp_ds.htm)
- Cisco 3700:  
<http://www.cisco.com/warp/public/cc/pd/rt/ps282/prodlit/index.shtml>







## Country Availability

For the latest information regarding per country approval for the WIC-1AM and WIC-2AM, please visit the following URL or contact your local Cisco representative:

[http://www.cisco.com/cgi-bin/compliance/approvals\\_search.pl](http://www.cisco.com/cgi-bin/compliance/approvals_search.pl)

## Ordering Information

**Table 4** Part Numbers

Part Number	Description
<b>WIC-1AM</b>	One-port Analog Modem WAN Interface Card
<b>WIC-1AM=</b>	One-port Analog Modem WAN Interface Card
<b>WIC-2AM</b>	Two-port Analog Modem WAN Interface Card
<b>WIC-2AM=</b>	Two-port Analog Modem WAN Interface Card

- Non-operating temperature: -4 to 149° F (-20 to 65° C)
- Relative humidity: 10 to 85 percent non-condensing operating; 5 to 95 percent non-condensing, non-operating safety

## Cisco 1700, 2600, 3600, and 3700 Power

- AC input voltage: 100 to 240 VAC
- DC voltages (2600, 3600, and 3700)
- Frequency: 47 to 64 Hz

## Environmental Operating Ranges

- Operating temperature: 32 to 104° F (0 to 40° C)



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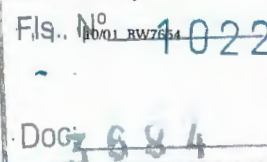
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A  
ANEXO 200



## Cisco – Understanding 2-Port Serial WAN Interface Card (WIC)

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Doc: 3684





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# Understanding 2-Port Serial WAN Interface Card (WIC-2T)

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## Introduction

### Before You Begin

Conventions

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Components Used

### Product Numbers

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### Known Problems

Hardware Failures

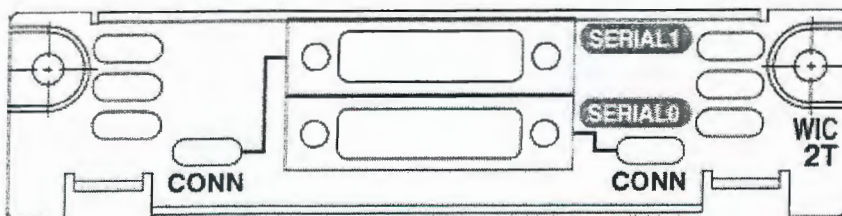
### Sample Configuration

### Related Information

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## Introduction

The dual-serial port WAN interface cards (WICs) for the Cisco 2600 and 1700 series feature Cisco's new, compact, high-density Smart Serial connector to support a wide variety of electrical interfaces when used with the appropriate transition cable. Two cables are required to support the two ports on the WIC. Each port on a WIC is a different physical interface and can support different protocols such as Point-to-Point protocol (PPP) or Frame Relay and Data Terminal Equipment/Data Communications Equipment (DTE/DCE).



## Before You Begin

### Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

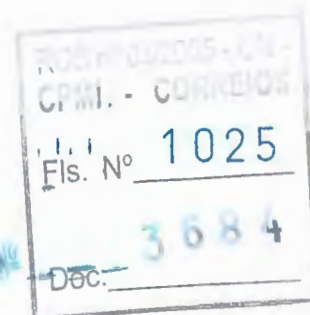
### Prerequisites

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There are no specific prerequisites for this document.

### Components Used

This document is not restricted to specific software and hardware versions.







## Product Numbers

WIC-2T	2 Port Serial WAN Interface Card
--------	----------------------------------

## Features

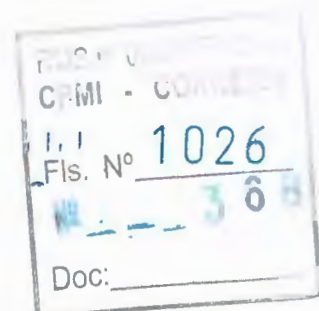
The WIC-2T provides two serial ports using the Smart Serial connector.

- Asynchronous support with a maximum speed (per port) of 115.2 Kbps, minimum 600 bps. If you need to run at speeds lower than 600 bps, use the AUX port instead.
- Synchronous support with a maximum speed of 2.048 Mbps per port.
  - ◆ Supports one port at 8 Mbps when used in NM-1FE1R2W, NM-1FE2W, NM-2FE2W, or NM-2W, or Cisco 2600 chassis WIC slots. All other WIC ports on that network module or Cisco 2600 chassis must not be used.
  - ◆ Supports two ports at 4 Mbps each when used in NM-1FE1R2W, NM-1FE2W, NM-2FE2W, or NM-2W, or Cisco 2600 chassis WIC slots. All other WIC ports on that network module or Cisco 2600 chassis must not be used.
  - ◆ Supports 8 Mbps on all ports simultaneously on 2691, 3725, and 3745. No restrictions. Maximum six ports at 8 Mbps each.

## Cables

The WIC-2T serial ports require Smart Serial cables. The following table lists the part number for the cables that can be used with the WIC-2T card.

Cable Type	Product Number	Length	Male/Female
V.35 DTE	CAB-SS-V35MT(=)	10 feet / 3 meters	Male
V.35 DCE	CAB-SS-V35FC(=)	10 feet / 3 meters	Female
RS-232 DTE	CAB-SS-232MT(=)	10 feet / 3 meters	Male
RS-232 DCE	CAB-SS-232FC(=)	10 feet / 3 meters	Female
RS-449 DTE	CAB-SS-449MT(=)	10 feet / 3 meters	Male
RS-449 DCE	CAB-SS-449FC(=)	10 feet / 3 meters	Female
X.21 DTE	CAB-SS-X21MT(=)	10 feet / 3 meters	Male
X.21 DCE	CAB-SS-X21FC(=)	10 feet / 3 meters	Female
EIA-530 DTE	CAB-SS-530MT(=)	10 feet / 3 meters	Male





EIA-530A DTE	CAB-SS-530AMT(=)	10 feet / 3 meters	Male
-----------------	------------------	-----------------------	------

## Platform Support

Platform	Cisco 1600	Cisco 1700	Cisco 2600		Cisco 2600XM		Cisco 3620, 3640, 3660	
Carrier Module	Not Required	Not Required	on-board	NM-2W	on-board	NM-2W	NM-1E2W, NM-1E1R2W, NM-2E2W	NM-1FE2W, NM-1FE1R2W, NM-2FE2W, NM-2W
Cisco IOS® Support	Not supported	All Cisco IOS versions	All Cisco IOS versions	Cisco IOS versions 12.0(7)XK, 12.1(1)T, 12.2, 12.2T	All Cisco IOS versions	Cisco IOS versions 12.2(8)T1	Not supported	Cisco IOS versions 12.0(7)XK, 12.1(1)T, 12.2, 12.2T

The Cisco 1600 Series is not capable of supporting the WIC-2T due to lack of Serial Communications Controllers.

The NM-1E2W, NM-1E1R2W, and NM-2E2W Network Modules do not have enough performance power to support the WIC-2T due to hardware limitations.

## Known Problems

The **show version** command shows WIC-2T as "low-speed". This is a display only (cosmetic) problem.

## Hardware Failures

The WIC-2T and WIC-2A/S can be damaged by excessive electrostatic discharge. You can minimize this electrostatic discharge in several ways.

- Use shielded cable end-to-end.
- Use a data surge protector that protects against surges over +/- 18v.
- Use an optical isolator (best protection).

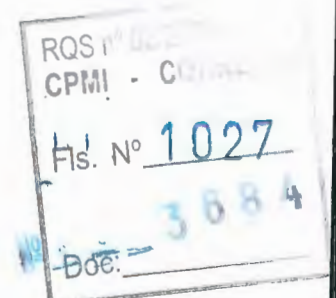
## Sample Configuration

The following is a sample configuration for the WIC-2T interface card.

**Note:** There are no **framing**, **clocking** or **linecode** parameters or commands being used here. This is because this card does not have an integrated channel service unit/data service unit (CSU/DSU). You need to use an external CSU/DSU.

Configuration
maui-soho-02(config)#interface Serial 2/0 maui-soho-02(config-if)#ip add 10.0.0.1 255.255.255.0

Cisco - Understanding 2-Port Serial WAN Interface Card (WIC-2T)







```
maui-soho-02(config-if)#encapsulation ppp  
maui-soho-02(config-if)#no shutdown
```

For more information on configuring the WIC-2T card refer to Configuring Serial Interfaces.

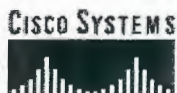
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## Related Information

- 1- and 2-Port Serial WAN Interface Cards
  - Overview of Cisco Network Modules
  - Technical Support – Cisco Systems
- 

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## Cisco Feature Navigator II

[Search by Feature](#)[Search by Release](#)[Compare Images](#)**Objective:** Define a specific software image in order to view its supported features.

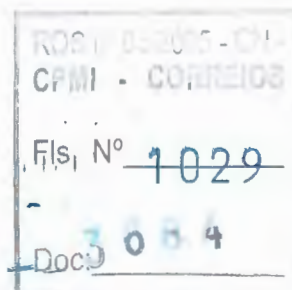
Select from the pull down menus to find releases which support particular platform and feature set combinations. View your results in the table below and repeat as necessary to define a specific software image.

**Your Selections:**Platform **1751-V**Major Release **12.2T**Release **12.2(8)T10**Feature Set **IP/ADSL/VOICE/FW/IDS PLUS IPSEC 3DES**

Software Image

[New Search](#)[Search Results](#)[Image Info](#)**Image Name (Dram/Flash) :**

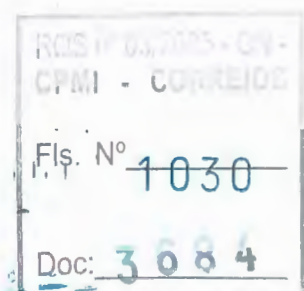
c1700-k9o3sv3y7-mz.12.2-8.T10 (48/16)

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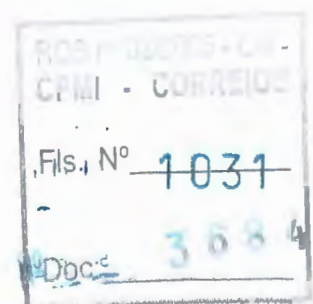


[AutoInstall Using DHCP for LAN Interfaces](#)  
[Automatic modem configuration](#)  
[Bandwidth Allocation Control Protocol \(BACP\)](#)  
[BGP](#)  
[BGP 4](#)  
[BGP 4 Multipath Support](#)  
[BGP 4 Prefix Filter and In-bound Route Maps](#)  
[BGP 4 Soft Config](#)  
[BGP Conditional Route Injection](#)  
[BGP Link Bandwidth](#)  
[BGP Multipath Load Sharing for Both eBGP and iBGP in an MPLS-VPN](#)  
[BGP Prefix-Based Outbound Route Filtering](#)  
[BGP Soft Reset](#)  
[Bidirectional PIM](#)  
[Call Admission Control for H.323 VoIP Gateways](#)  
[Caller ID](#)  
[CEF Support for IP Routing between IEEE 802.1Q VLANs](#)  
[CEF Switching for Routed Bridge Encapsulation](#)  
[CEF/dCEF - Cisco Express Forwarding](#)  
[Certification Authority Interoperability \(CA\)](#)  
[CGMP - Cisco Group Management Protocol](#)  
[Challenge Handshake Authentication Protocol \(CHAP\)](#)  
[Circuit Interface Identification Persistence for SNMP](#)  
[Cisco Discovery Protocol \(CDP\)](#)  
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[Class-Based Frame-Relay DE-Bit Matching and Marking](#)  
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[Committed Access Rate \(CAR\)](#)  
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[Configurable per ATM-VC Hold Queue size](#)  
[Configurable Timers in H.225](#)  
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[Control Plane DSCP Support for RSVP](#)  
[COPS for RSVP](#)  
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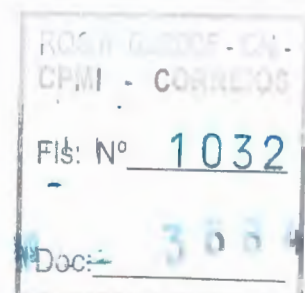
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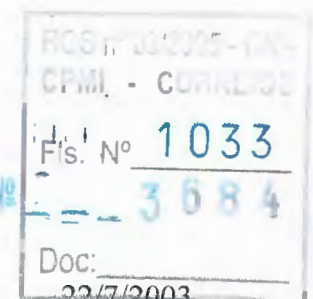
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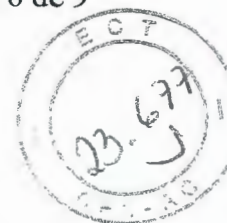
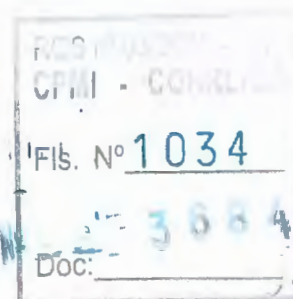
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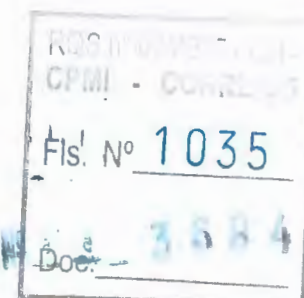
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NBAR - Network-based Application RecognitionNetflowNetFlow AggregationNetflow Multiple Export DestinationsNetFlow Policy Routing (NPR)NetFlow ToS-Based Router AggregationNetwork Side ISDN PRI Signaling, Trunking, and SwitchingNetwork Time Protocol (NTP)Next Hop Resolution Protocol (NHRP)Offload Server Accounting EnhancementOn Demand Routing (ODR)Optimized PPP NegotiationOSPFOSPF ABR type 3 LSA FilteringOSPF Flooding ReductionOSPF Not-So-Stubby Areas (NSSA)OSPF On Demand Circuit (RFC 1793)OSPF Packet PacingOSPF Stub Router AdvertisementOSPF Update Packet-Pacing Configurable TimersPAD SubaddressingParse BookmarksParser CachePassword Authentication Protocol (PAP)Per-User ConfigurationPGM HostPGM Router AssistPIM Dense Mode State RefreshPIM MIB Extension for IP MulticastPIM Version 1PIM Version 2Policy-Based Routing (PBR)Port to Application Mapping (PAM)PPPPPP over ATMPPP over ATM (IETF-Compliant)PPP over ATM SVCsPPP Over Fast Ethernet 802.1QPPP over Frame RelayPPPoA/PPPoE autosense for ATM PVCsPPPoE ClientPPPoE on ATMPPPoE on EthernetPPPoE over Gigabit Ethernet interfacePPPoE Radius Port IdentificationPPPoE Session limitPPTP with MPPEPreambulation with ISDN PRI and Channel-Associated Signalling EnhancementsPriority Queueing (PQ)QoS Device Manager (QDM)



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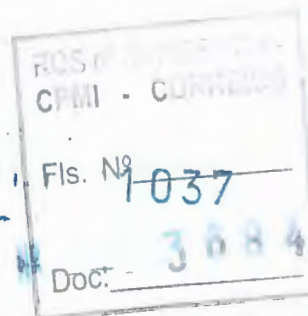
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Some features are dependent on product model, interface modules (i.e. Line Cards & Port Adapters), and/or require a software feature license. [Click here for more information.](#)

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# Cisco Products Quick Reference Guide

February 2002

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## Cisco 1700 Series

The Cisco 1700 series of modular access routers are designed and priced to provide a cost-effective integrated e-business platform for small and medium-sized businesses and enterprise small branch offices. These Cisco IOS-based routers deliver high-speed network access, comprehensive security features, and multiservice data/voice/video/fax integration to meet the most demanding e-business requirements. Within the Cisco 1700 series, Cisco 1710 security access routers work with existing broadband modems to provide advanced routing and security functionality, Cisco 1720 modular access routers provide flexible, high-performance data access, and Cisco 1751 modular access routers are optimized for both voice and data traffic, providing a simple and cost-effective path to multi-service networking—today or in the future.

## When to Sell

## Sell This Product

## Cisco 1710

## Cisco 1720

## Cisco 1751

## When a Customer Needs These Features

- Advanced routing and security functionality when connecting to the Internet using a broadband modem
- Hardware-assisted 3DES VPN encryption at full T1/E1 speeds
- Secure data-only access solution that adapts to customers' evolving network requirements
- Support for data applications including VPNs and broadband access services
- A broad array of WAN services supported, including Frame Relay, leased line, ADSL, ISDN BRI, X.25, SMDS and more
- 3DES VPN encryption at full T1/E1 speeds
- All the above, plus:
- Digital Voice Support
- IEEE 802.1Q VLAN Support
- Ample default memory to support feature rich Cisco IOS software images

## Key Features

- Support for up to 4 serial interfaces or 2 ISDN BRI; 1 autosensing 10/100 Mbps Fast Ethernet LAN connection; 1 auxiliary (AUX) port for dial-up management or low-speed asynchronous connections (up to 112.5 kbps)
- Flexibility—1700 Series supports a diverse set of WAN and Voice Interface Cards that are shared with the 1600 (WAN only), 2600, and 3600 series routers enabling field upgradeability to evolve with the needs of growing businesses
- Integrated Device—Cisco 1700 series combines WAN routing, VPN and multiservice access in a single device
- Expansion Slot—Supports optional hardware VPN module for wire-speed IPsec 3DES encryption and can enable future technologies (VPN Module standard on Cisco 1710)
- Integrated Security—The 1700 series supports context-based access control for dynamic firewall filtering, denial-of-service detection and prevention, Java blocking, real-time alerts, Intrusion Detection System (IDS), and encryption.
- IEEE 802.1Q VLAN Support (Cisco 1710 and 1751 only)

## Competitive Products

- 3Com: OfficeConnect NETBuilder
- Ascend: Pipeline 130
- Nortel/Bay: AN

- Motorola: Vanguard 6425 (only competes with Cisco 1751)
- Nortel/Micron: V/IP Gateway (only competes with Cisco 1751)

Cisco 1700 Series

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## Specifications

Feature	Cisco 1710	Cisco 1720	Cisco 1751
<b>Fixed LAN Ports (connections)</b>	1-port autosensing 10/100 Mbps Ethernet (10/100BASE-T) 1-port 10BASE-T Ethernet	1-port autosensing 10/100 Mbps Ethernet (10/100BASE-T)	1-port autosensing 10/100 Mbps Ethernet (10/100BASE-T)
<b>Fixed WAN Ports</b>	None	None	None
<b>Performance</b>	9 Mbps	8,500 pps	12,500 pps
<b>Modular Slots</b>	None	2 WAN slots	3 slots (2 WAN or Voice slots and 1 Voice slot)
<b>WAN Interface Card (WIC) Modules</b>	None	See Part Numbers and Ordering Information	Same as Cisco 1720
<b>Voice Interface Cards (VIC) Modules</b>	None	None	See Part Numbers and Ordering Information
<b>Flash Memory</b>	16 MB Flash (default/max)	8 MB (default); 16 MB (max)	1751 base model: 16 MB (default); 16 MB (max) 1751-V multiservice ready configuration: 32 MB (default); 32 MB (max)
<b>DRAM Memory</b>	32 MB (default); 48 MB (max)	32 MB (default); 48 MB (max)	1751 base model: 32 MB (default); 96 MB (max) 1751-V multiservice-ready configuration: 64 MB (default); 128 MB (max)
<b>Dimensions (HxWxD)</b>	3.1 x 11.2 x 8.7 in.	3.1 x 11.2 x 8.7 in.	4.0 x 11.2 x 8.7 in.

Cisco IOS Software and Memory Requirements<sup>1</sup>

Distribution Part Number	Feature Pack Description	IOS Image Release	Flash Memory Required	DRAM Memory Required
CD17-C-12.x	IP only IP/ADSL	12.1 Mainline	4 MB 8 MB	16 MB 20 MB
CD17-CH-12.x	IP/FW	12.1 Mainline	4 MB	20 MB
CD17-CP-12.x	IP Plus	12.1 Mainline	4 MB	20 MB
CD17-CHK2-12.x	IP/FW Plus IPSEC 3DES	12.1 Mainline	8 MB	32 MB
CD17-CVP-12.x	IP/Voice Plus	12.1 Mainline	8 MB	24 MB
CD17-CHV-12.x	IP/FW/Voice Plus	12.1 Mainline	8 MB	24 MB
CD17-CHVK2-12.x	IP/FW/Voice Plus IPSEC 3DES	12.1 Mainline	8 MB	24 MB
CD17-C-12.x	IP only	12.1T	4 MB	16 MB
CD17-CH-12.x	IP/FW	12.1T	4 MB	20 MB
CD17-CP-12.x	IP Plus	12.1T	8 MB	24 MB
CD17-CK2-12.x	IP Plus IPSEC 3DES	12.1T	8 MB	32 MB
CD17-CHK2-12.x	IP/FW Plus IPSEC 3DES	12.1T	8 MB	32 MB
CD17-CVP-12.x	IP/Voice Plus	12.1T	8 MB	32 MB
CD17-CHV-12.x	IP/FW/Voice Plus	12.1T	8 MB	32 MB
CD17-CVK2-12.x	IP/Voice Plus IPSEC 3DES	12.1T	8 MB	32 MB
CD17-CHVK2-12.x	IP/FW/Voice Plus IPSEC 3DES	12.1T	8 MB	32 MB

1. For the complete list of IOS Feature Sets, refer to the parts list, via the URL listed under "For More Information". For users with CCO access, search by IOS feature or release via the *Feature Navigator* at <http://www.cisco.com/go/fn>

Selected Part Numbers and Ordering Information<sup>1</sup>

## Cisco 1700 Series Modular Access Routers

CISCO1710-VPN-M/K9	Dual-Ethernet Security Access Router, VPN Module, IP/3DES/FW
CISCO1720	10/100BASE-T Modular Router w/ 2 WAN slots, Cisco IOS IP SW
CISCO1751	10/100 Modular Router w/ 3 slots, IOS IP
CISCO1751-V	10/100 Modular Router w/Voice, IOS IP/VOICE Plus
CISCO1720-ADSL	10/100BASE-T Modular ADSL Router

## Cisco 1700 Series Bundles

SEC17-VPN=	Cisco 1700 Bundle: Firewall IPsec 3DES, Memory
SEC17-VPN-M=	Cisco 1700 Bundle: VPN Module, Firewall IPsec 3DES, Memory

Cisco 1700 Series

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## Cisco 1751 Router Overview

This chapter introduces the Cisco 1751 router, also referred to in this guide as *the router*, and covers the following topics:

- Key Features
- Rear-Panel Ports and LEDs
- Front-Panel LEDs
- Router Memory
- Unpacking the Router
- Additional Required Equipment

Figure 1-1 shows the Cisco 1751 router.

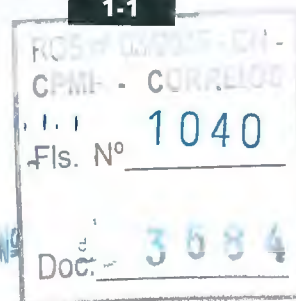
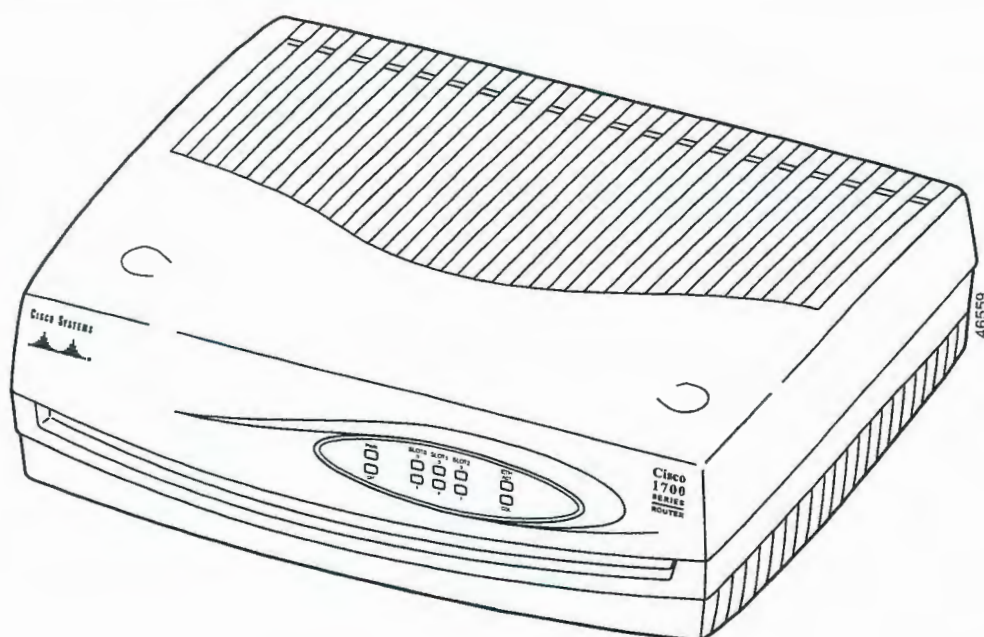




Figure 1-1 Cisco 1751 Router



## Key Features

The Cisco 1751 router is a voice-and-data capable router that provides Voice-over-IP functionality (VoIP) and can carry voice traffic (for example, telephone calls and faxes) over an IP network. Using one to four WAN connections, the router links small-to-medium-size remote Ethernet and FastEthernet LANs to central offices. Table 1-1 lists the router key features.

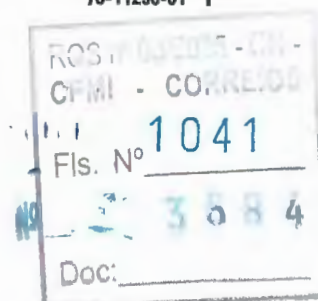






Table 1-1 Key Features

Feature	Description
One FastEthernet (10/100BaseTX) port	<ul style="list-style-type: none"><li>Operates in full- or half-duplex mode (with software override support).</li><li>Supports autosensing for 10- or 100-Mbps operation (with software override support).</li></ul>
Cisco interface cards	<ul style="list-style-type: none"><li>Supports two slots for either WAN interface cards (WICs) or voice interface cards (VICs).</li><li>Supports one VIC-only slot.</li><li>Supports the following WICs: ISDN BRI (U and S/T), 56- or 64-kbps DSU/CSU, FT1/T1 DSU/CSU, WIC-1ADSL, WIC-1ENET (Ethernet), highspeed serial, dual-serial, and 2Async/Sync.</li><li>Supports the following VICs: 2FXS, 2FXO, 2E&amp;M, F2XO-EU, 2FXO-M3, and 2-port ISDN Voice-BRI.</li><li>Changes in WAN interface configuration can be made as your network requirements change.</li></ul>
Console port	Supports router configuration and management from a connected terminal or PC. Supports up to 115.2 kbps.
Auxiliary port	Supports modem connection to the router, which can be configured and managed from a remote location. Supports up to 115.2 kbps.
Security slot	Supports Kensington or similar lockdown equipment.
SNMP support	Supports Simple Network Management Protocol (SNMP) to manage the router over a network.
VoIP, VoFR, and VoATM support	Supports Voice over IP, Voice over Frame Relay, and Voice over ATM connections.
AutoInstall support	Supports AutoInstall to download configuration files to the router over a WAN connection.

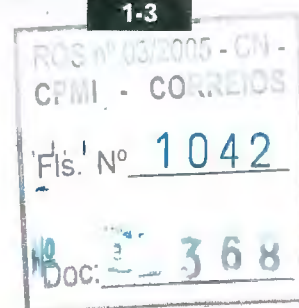




Table 1-1 Key Features (continued)

Feature	Description
Cisco ConfigMaker support	Supports Cisco ConfigMaker application, a wizard-based software tool, to configure a network that includes the Cisco 1751 router.
Cisco Voice Manager support	Supports Cisco Voice Manager to help you install and operate voice and fax services over the IP network.
Compatible with Cisco Networked Office stack	Stackable with other Cisco Networked Office stack products.

## Rear-Panel Ports and LEDs

This section describes the router rear-panel ports and LEDs, which are shown in Figure 1-2 and described in Table 1-2 and Table 1-3.

Figure 1-2 Rear-Panel Components and LEDs

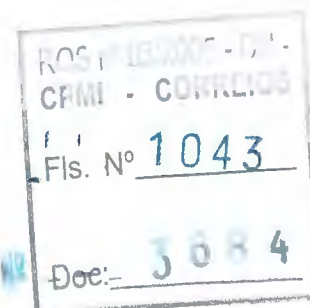
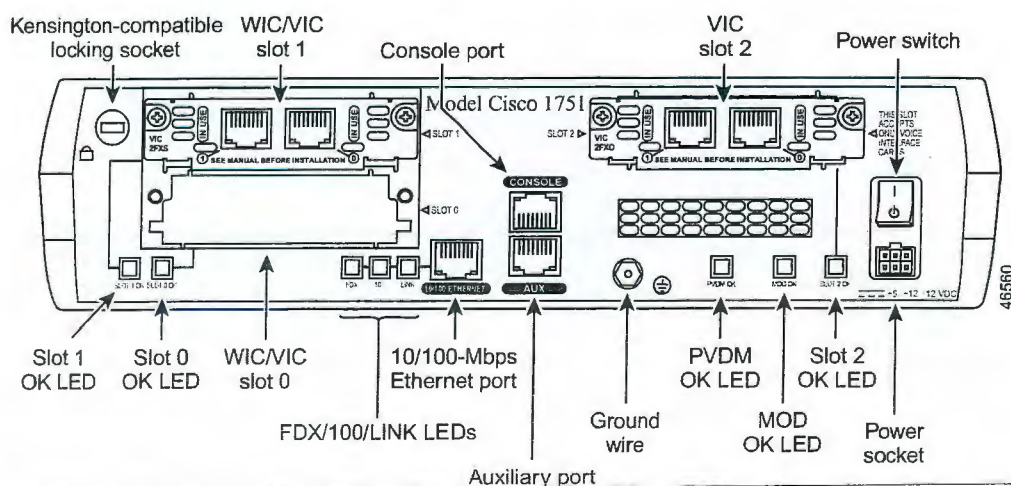






Table 1-2 Rear-Panel Connectors

Connector/Slot	Label/Color	Description
Ethernet port	10/100-Mbps ETHERNET (yellow)	Router connection to the local Ethernet network. This port autosenses the speed (10 or 100 Mbps) and duplex mode (full or half) of the device to which it is connected and then operates at the same speed and in the same duplex mode.
Auxiliary port	AUX (black)	Modem connection for remote configuration using Cisco IOS software.
Console port	CONSOLE (light blue)	Terminal or PC connection for local configuration using Cisco IOS software.
WIC/VIC slot	SLOT 0	Supports either a Cisco WIC or VIC. For detailed information, refer to the <i>Cisco WAN Interface Cards Hardware Installation Guide</i> that comes with every card.
WIC/VIC slot	SLOT 1	Supports either a Cisco WIC or VIC. For detailed information, refer to the <i>Cisco WAN Interface Cards Hardware Installation Guide</i> that comes with every card.
VIC slot	SLOT 2	Supports one Cisco VIC. For detailed information, refer to the <i>Cisco WAN Interface Cards Hardware Installation Guide</i> that comes with every card.
Power socket	+5, +12, -12 VDC	Router connection to the external power supply.
Protective earth	Ground wire	Router connection to earth ground by using a green and yellow 14 AWG ground wire.

Use the rear-panel LEDs (see Table 1-3) during router installation to confirm that you have correctly connected all cables to the router.

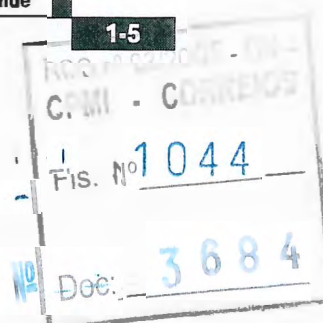




Table 1-3 Rear Panel LEDs

LED Label	Color	Description
FDX	Green	On—Ethernet port is operating in full-duplex mode. Off—Ethernet port is operating in half-duplex mode.
100	Green	On—Ethernet port is operating at 100 Mbps. Off—Ethernet port is operating at 10 Mbps.
LINK	Green	On when the Ethernet link is up.
SLOT 0 OK	Green	On when either a WIC or VIC is correctly inserted in the card slot.
SLOT 1 OK	Green	On when either a WIC or VIC is correctly inserted in the card slot.
SLOT 2 OK	Green	On when a VIC is correctly inserted in the card slot.
PVDM OK	Green	On when a packet voice data module (PVDM) is correctly inserted in the card slot.
MOD OK	Green	On when a VPN module is present.

## Front-Panel LEDs

Use the router front-panel LEDs to determine network activity and status on the Ethernet port and on the WIC and VIC ports. The front-panel LEDs are illustrated in Figure 1-3 and described in Table 1-4.

Figure 1-3 Front-Panel LEDs

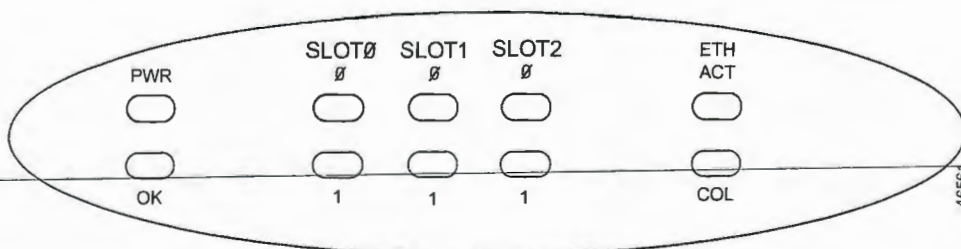






Table 1-4 Front-Panel LEDs

LED	Color	Cards Supported	LED Meaning
PWR	Green	–	On when DC power is being supplied to the router.
OK	Green	–	On when the router has successfully booted up and the software is functional. This LED blinks during the power-on self-test (POST).  Refer to Table 3-1 in the “Troubleshooting” chapter for information on how to use this LED for router diagnostics.
ETH			
ACT	Green	–	Blinks when there is network activity on the Ethernet port.
COL	Yellow	–	Blinks when there are packet collisions on the local Ethernet network.
SLOTØ			
Ø	Green	ISDN	On when the first ISDN B channel is connected.
		Serial and CSU/DSU	Blinks when data is being sent to or received from the port. For the VIC-2BRI-ST-NT/TE, blinks when data is being sent to or received from any of the B channels.
		2-port serial	
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-ST-NT/TE	
WIC1-ADSL			

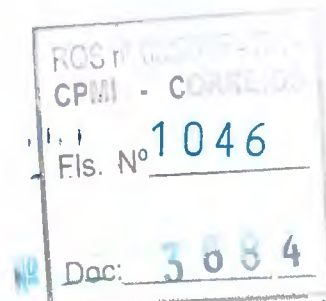




Table 1-4 Front-Panel LEDs (continued)

LED	Color	Cards Supported	LED Meaning
1	–	Serial and CSU/DSU	Off.
	Green	ISDN	On when the first ISDN B channel is connected.
		2-port serial	Blinks when data is being sent to or received from the port.
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
SLOT1			
Ø	Green	ISDN	On when the first ISDN B channel is connected.
		Serial and CSU/DSU	Blinks when data is being sent to or received from the port.
		2-port serial	
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		WIC1-ADSL	
1	–	Serial and CSU/DSU	Off.
	Green	ISDN	On when the first ISDN B channel is connected.
		2-port serial	Blinks when data is being sent to or received from the port.
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	

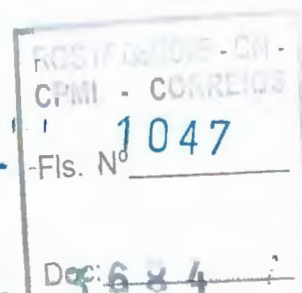






Table 1-4 Front-Panel LEDs (continued)

LED	Color	Cards Supported	LED Meaning
SLOT2			
Ø	Green	VIC-2E&M	Blinks when data is being sent to or received from the port.
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
1	Green	VIC-2E&M	Blinks when data is being sent to or received from the port.
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	

## Router Memory

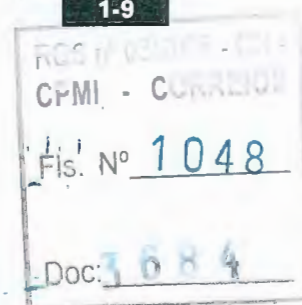
This section describes the types of memory stored in the router and how to find out how much of each the router has.

For instructions on how to upgrade memory in the router, refer to the “Installing and Upgrading Memory and Packet Voice Data Modules” appendix in this guide.

## Types of Memory

The router has the following types of memory:

- **Dynamic RAM (DRAM)**—This is the main storage memory for the router. DRAM is also called working storage and contains the dynamic configuration information. The router stores a working copy of Cisco IOS software, dynamic configuration information, and routing table information in DRAM. The Cisco 1751 router ships with 32 MB of DRAM.
- **Nonvolatile RAM (NVRAM)**—This type of memory contains the startup configuration.





- Flash memory—This special kind of erasable, programmable memory contains a copy of the Cisco IOS software. The Flash memory structure can store multiple copies of the Cisco IOS software. You can load a new level of the operating system in every router in your network and then, when convenient, upgrade the whole network to the new level. The Cisco 1751 router ships with 32 MB of Flash memory and is not upgradeable.

## Amounts of Memory

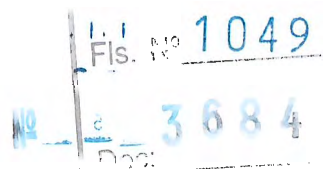
Use the **show version** command to view the amount of DRAM, NVRAM, and Flash memory stored in your router. The following example shows the output of the **show version** command. The bold text displays the amount of memory stored in this router.

```
Router> show version
Cisco Internetwork Operating System Software
IOS (tm) C1700 Software (C1700-SV8Y7-M), Version 12.2(8)YN, EARLY
DEPLOYMENT RELEASE SOFTWARE (fc1)
Synched to technology version 12.2(11.2u)T
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Wed 30-Oct-02 11:07 by ealyon
Image text-base:0x80008120, data-base:0x81329648

ROM: System Bootstrap, Version 12.2(1r)XE1, RELEASE SOFTWARE (fc1)
ROM: C1700 Software (C1700-SV8Y7-M), Version 12.2(8)YN, EARLY
DEPLOYMENT RELEASE SOFTWARE (fc1)

Router uptime is 0 minutes
System returned to ROM by reload
System image file is "flash:c1700-sv8y7-mz.122-8.YN"

cisco 1751 (MPC860P) processor (revision 0x200) with 55706K/9830K
bytes of memory.
Processor board ID JAD060409KG (290786369), with hardware revision
0000
MPC860P processor: part number 5, mask 2
Bridging software.
X.25 software, Version 3.0.0.
1 FastEthernet/IEEE 802.3 interface(s)
2 ATM network interface(s)
2 Voice FXS interface(s)
32K bytes of non-volatile configuration memory.
32768K bytes of processor board System flash (Read/Write)
Configuration register is 0x0
```



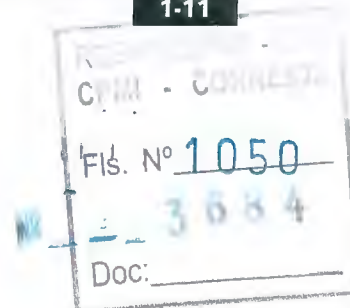
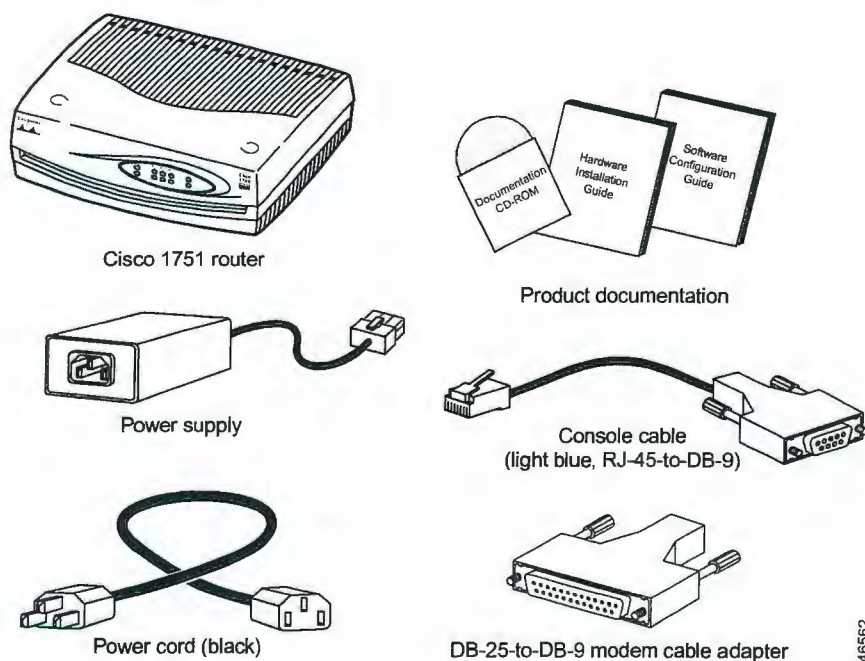




## Unpacking the Router

Figure 1-4 shows the items that come with your router. All of these are in the accessory kit that is inside the box that your router came in.

**Figure 1-4 Router Box Contents**





## Additional Required Equipment

Depending on your local network and which Cisco WICs and VICs you install in your router, you might need other items listed in Table 1-5 to complete your router installation.

**Table 1-5** Additional Required Equipment

Equipment	When You Use It
Ethernet hub	A hub connects pieces of network equipment (including the router) to create a network. You can use a 10-, 100-, or 10/100-Mbps hub with the router.
Ethernet switch	A switch connects pieces of network equipment (including the router) to create a network. You can use a 10-, 100-, or 10/100-Mbps switch with the router.
Phillips screwdriver	Although the WICs and VICs use thumbscrews, you might need a Phillips screwdriver to loosen the WIC and VIC cover.
Cisco WIC	To make a WAN connection, the router must have a supported WIC installed. The router supports up to two cards. You can either order the cards when ordering the router, and they will be installed for you, or you can order the cards separately, after receiving the router, and install them yourself.
Cisco VIC	To make a voice connection, the router must have a supported VIC installed. The router supports up to three cards. You can either order the cards when ordering the router, and they will be installed for you, or you can order the cards separately, after receiving the router, and install them yourself. You must install digital signal processors (DSPs) to use VICs in the router.
Straight-through RJ-45-to-RJ-45 cable	This cable connects the router to the Ethernet LAN and the WICs to various WAN services, including ISDN, T1/FT1, and 56-kbps services. You will need one cable for each of these connections.
Standard RJ-11 telephone cable	This cable connects the VIC to a telephone, fax machine, or a telephone wall-jack. You will need one cable for each of these connections.
Standard RJ-48 telephone cable	This cable connects the VIC to a PBX trunk line. You will need one cable for each of these connections.

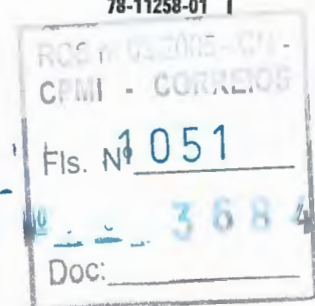
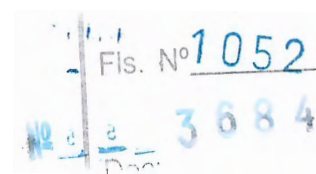


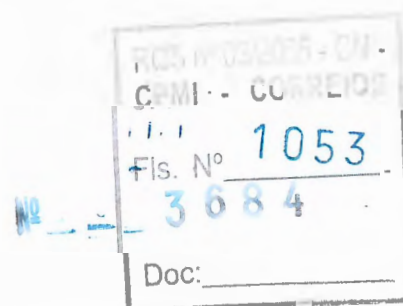




Table 1-5 Additional Required Equipment (continued)

Equipment	When You Use It
Serial cable	This cable connects a serial card to serial services. You must order this cable from Cisco. For detailed information about serial cable types, refer to the <i>Cisco WAN Interface Cards Hardware Installation Guide</i> that comes with every card.
NT1	Some ISDN service providers require a Network Termination 1 device to connect an ISDN S/T port to the ISDN line.
Asynchronous modem	To configure the router from a remote location, connect a modem to the AUX port on the router.





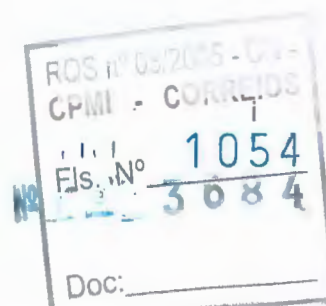




# Cisco – Understanding Foreign Exchange Office (FXO) Voice Interface Cards

## Table of Contents

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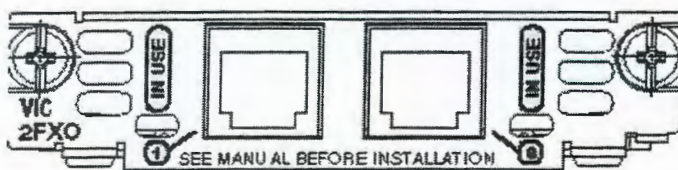
# Understanding Foreign Exchange Office (FXO) Voice Interface Cards

- Introduction
- Before You Begin
  - Conventions
  - Prerequisites
  - Components Used
- Product Numbers
- Features
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## Introduction

Cisco's Foreign Exchange Office (FXO) interface is an RJ-11 connector that allows an analog connection to be directed at the PSTN's central office or to a station interface on a private branch exchange (PBX). The FXO sits on the switch end of the connection. It plugs directly into the line side of the switch so the switch thinks the FXO interface is a telephone.

**Note:** The FXO voice interface card is not a Foreign Exchange Station (FXS) card and therefore will not provide dial tone. Do not plug a telephone set to the FXO voice interface card.



## Before You Begin

### Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

### Prerequisites

There are no specific prerequisites for this document.

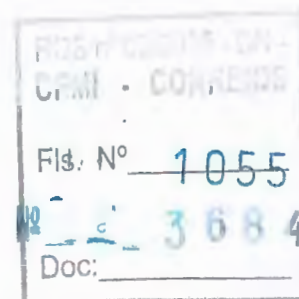
## Components Used

This document is not restricted to specific software and hardware versions.

## Product Numbers

Product Number	Description
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Cisco – Understanding Foreign Exchange Office (FXO) Voice Interface Cards







VIC-2FXO	Two-port FXO Voice Interface Card
VIC-2FXO-EU	Two-port FXO for Europe
VIC-2FXO-M1	Two-port FXO for U.S. with battery reversal
VIC-2FXO-M2	Two-port FXO for Europe with battery reversal
VIC-2FXO-M3	Two-port FXO for Australia

## Features

Product Number	Description
Voice Ports	Two FXO ports
Connections	Connects to a telco line or to a PBX or key set that emulates a telco line. Uses RJ-11 connectors.
IOS Feature Set	Requires a Plus feature set.
Caller ID	Requires VIC-2FXO-M1 or VIC-2FXO-M2
Battery Reversal	Requires VIC-2FXO-M1 or VIC-2FXO-M2
Ground Start	Requires VIC-2FXO, VIC-2FXO-M1, or VIC-2FXO-M3
Loop Start	Supported on all cards

## Configuration

For configuration of voice features in Cisco IOS, see Voice over IP for the Cisco 3600 Series.

**Note:** In Cisco IOS, use the global configuration command **voice-port <slot>/<VIC slot>/<unit>** to configure the voice port parameters.

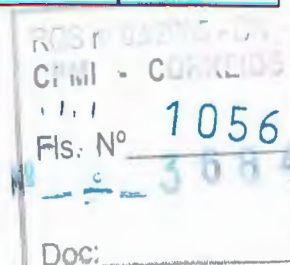
The commands to configure VoIP on Cisco routers are very similar on all of the router platforms shown below.


For configuration of voice features in CatOS on a Catalyst 4000, see Configuring the Voice Interfaces.

## Platform Support

The following table shows which routers support the VIC-2FXO voice interface cards including Cisco IOS® software release support selection.

IOS Support <sup>1</sup>	1750, 1751 <sup>2</sup>	1760	VG200	2600	3620, 3640 <sup>3</sup>	3660 <sup>3</sup>	2691, 3725, 3745	Catalyst 4000
Carrier Module	Not Required	Not Required	NM-1V NM-2V	NM-1V NM-2V	NM-1V NM-2V	NM-1V NM-2V	NM-1V NM-2V	WS-X4604 AGM
VIC-2FXO	all versions	all versions	12.1(3)T	all versions	11.3(1)T, all 12.x	all versions	all versions	12.1(3a)XI





VIC-2FXO-EU	all versions	all versions	12.1(3)T	11.3(6)T 12.0(2) 12.0(2)T 12.0XK 12.1 12.1T 12.2 12.2T	11.3(6)T 12.0(2) 12.0(2)T 12.0XK 12.1	all versions	all versions	12.1(3a)XI
VIC-2FXO-M1	12.2(2)XJ	all versions	12.1(3)T	12.0(7)XK 12.1(2)T 12.2, 12.2T	12.1T 12.2 12.0(7)XK 12.1(2)T 12.2	12.0(7)XK 12.1(2)T 12.2	all versions	not supported
VIC-2FXO-M2	12.2(2)XJ	all versions	12.1(3)T	12.0(7)XK 12.1(2)T 12.2 12.2T	12.2T 12.0(7)XK 12.1(2)T 12.2	12.2T 12.0(7)XK 12.1(2)T 12.2	all versions	not supported
VIC-2FXO-M3	12.1(5)T, 12.2, 12.2T	all versions	12.1(3)T	11.3(6)T 12.0(2) 12.0(2)T 12.0XK 12.1 12.1T 12.2 12.2T	12.2T 11.3(6)T 12.0(2) 12.0(2)T 12.0XK 12.1 12.1T	12.2T all versions	all versions	not supported

<sup>1</sup> Voice requires an IOS Voice feature set on 1700 series and Plus feature set on 2600/3600 series.

<sup>2</sup> On the Cisco 1750, a PVDM (Packet Voice DSP Module) is needed to support the VIC-2FXO. The PVDMs hold DSPs that make the card fully functional. The 1750 requires a PVDM-4 for one VIC-2FXO and a PVDM-8 for two VIC-2FXOs. These PVDMs are installed on the motherboard within the 1750. On the Cisco VG200, 2600, and 3600, the NM-1V and 2Vs come with the DSPs installed on the module.

<sup>3</sup> Voice is not supported on 3631.

Certain FXO voice interface cards include two jumper headers, W3 and W4, to set loop-start or ground-start mode (see the Features table). One jumper configures each FXO port. The default setting, which should be satisfactory in most installations, is loop start. In this setting, jumpers are placed over positions 2 and 3 of headers W3 and W4. Most modern central office equipment, such as DMS-100 and 5ESS switches, provides calling party control (CPC) and Ring on Seize on loop-start lines. CPC allows quicker disconnection, and Ring on Seize minimizes glare (collision of inbound and outbound calls on the same interface). If your central office does not provide these features on loop start, you may want to configure the FXO card for ground-start operation instead by moving the jumpers to positions 1 and 2. For proper operation, both jumpers must be configured identically. In most cases, jumper setting should have little or no effect on operation.

The FXO interface configured for GroundStart is polarity sensitive. If you see from the debug **voip ccapi inout** a 0x22 disconnect cause code, you may have the telco ground connected to the FXO ground on the router. This can be caused by an incorrect RJ-11 cable between the FXO port and the telco jack. If you are using a straight through cable try using a crossover, or if you are using a crossover try using a straight through.





The Cisco IOS versions provided are typically the minimum version required to support the platform, module or feature in question. To find out a complete list of Cisco IOS software versions a feature, module, interface card, or chassis is supported in, use the Software Advisor tool. This tool is linked below in the Tools Information section of this document.

---

## Related Information

- **Voice – Understanding FXO Disconnect Problem**
  - **Voice Hardware Compatibility Matrix for Cisco 1750, 2600, 3600 and VG200 Routers and Catalyst 4000, 5000 and 6000 Switches**
  - **Technical Support – Cisco Systems**
- 

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# Cisco – Understanding Foreign Exchange Station (FXS) Voice Interface Cards

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# Understanding Foreign Exchange Station (FXS) Voice Interface Cards

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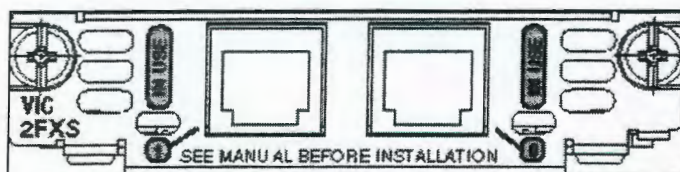
- Introduction**
- Before You Begin**
  - Conventions
  - Prerequisites
  - Components Used
- Product Numbers**
- Features**
- Configuration**
- Platform Support**
- Pinout Information**
- Related Information**

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## Introduction

A Foreign Exchange Station (FXS) interface connects directly to a standard telephone, fax machine, or similar device and supplies ring, voltage, and dial tone. Cisco's FXS interface is an RJ-11 connector that allows connections to basic telephone service equipment, keysets, and private branch exchanges (PBXes).

For more information and troubleshooting, refer to the TAC Case Collection tool.



## Before You Begin

### Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

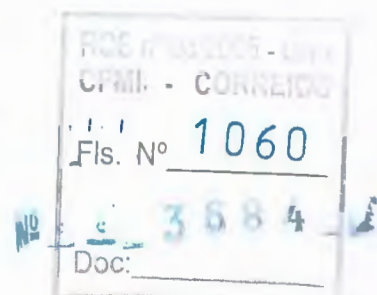
### Prerequisites

There are no specific prerequisites for this document.

## Components Used

This document is not restricted to specific software and hardware versions.

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.





## Product Numbers

VIC-2FXS Two port FXS Voice Interface Card

## Features

Feature	
Voice Ports	Two FXS ports
Connections	Connects to a telephone or fax, or to a PBX or key set that emulates a telephone. Uses RJ-11 connectors.
IOS Feature Set	Requires a "Plus" feature set.

**Note:** Caller ID is not supported.

## Configuration

For configuration of Voice features in Cisco IOS® see Voice over IP for the Cisco 3600 Series.

**Note:** In Cisco IOS, use the global configuration command **voice-port** <slot>/<VIC slot>/<unit> to configure the voice port parameters.

The commands to configure Voice over IP (VoIP) on Cisco routers are very similar on all of the router platforms shown below.

For configuration of Voice features in CatOS on a Catalyst 4000 see Configuring the Voice Interfaces.

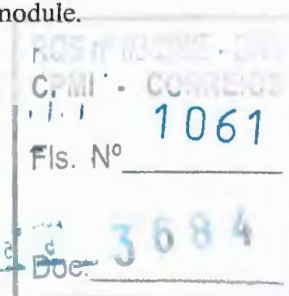
## Platform Support

IOS Support <sup>1</sup>	1750, 1751, 1760	VG200	2600	3620, 3640 <sup>2</sup>	3660 <sup>2</sup>	2691, 3700	Catalyst 4000
Carrier Module	Not	NM-1V NM-2V	NM-1V	NM-1V /	NM-1V	NM-1V	WS-X4604
VIC-2FXS	Required all versions	12.1(3)T12.1(3)T	NM-2V all versions	NM-2Vv 11.3(1)T, all 12.x	NM-2Vv all versions	NM-2Vv all versions	AGM 12.1(3a)XI

<sup>1</sup> Voice requires an IOS "Voice" feature set on 1700 Series and an IOS "Plus" feature set on 2600/3600/3700 series.

<sup>2</sup> Voice is not supported on 3631.

**Note:** On the Cisco 1750, a PVDm (Packet Voice DSP Module) is needed to support the VIC-2FXS. The PVDms hold DSPs that make the card fully functional. The 1750 requires a PVDm-4 for one VIC-2FXS and a PVDm-8 for two VIC-2FXSs. These PVDms are installed on the motherboard within the 1750. On the Cisco VG200, 2600, and 3600, the NM-1V and 2Vs come with the DSPs installed on the module.







## Pinout Information

Port 0 on a VIC-2FXS is designed to accommodate a US style 2-line phone, instead of the usual European style 1-line phone.

This means that in addition to pins 3 and 4 being used, pins 2 and 5 are also monitored. With some phone handsets it is possible that pins 2 and 5 are wired up to allow last number re-call or call-forwarding. If this is the case, Port 0 on the VIC will assume you have a 2-line phone, and shutdown port 1.

To check this, use only two wires in the cable from the VIC to the Phone and verify that Port 1 becomes active again.

- Pin 1 No Connection
- Pin 2 line-2 tip
- Pin 3 line-1 ring
- Pin 4 line-1 tip
- Pin 5 line-2 ring
- Pin 6 Non Connection

**Note:** The Cisco IOS versions provided are typically the minimum version required to support the platform, module or feature in question. To find out a complete list of Cisco IOS software versions a feature, module, interface card, or chassis is supported in, use the Software Advisor tool. This tool is linked below in the Tools Information section of this document.

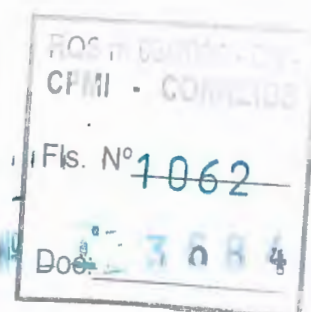
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## Related Information

- **Voice Hardware Compatibility Matrix for Cisco 1750, 2600, 3600 and VG200 Routers and Catalyst 4000, 5000 and 6000 Switches**
- **Voice, Telephony and Messaging Technologies**
- **Voice, Telephony and Messaging Devices**
- **Voice, Telephony and Messaging Software**
- **Voice, Telephony and Messaging TAC eLearning Solutions**
- **Recommended Reading: Troubleshooting Cisco IP Telephony , Cisco Press, ISBN 1587050757**
- **Technical Support – Cisco Systems**

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Q & A

## Cisco 1751 Modular Access Router

### **Product Features and Positioning**

**Q.** What is the ideal environment for the Cisco 1751 router?

**A.** The Cisco 1751 modular access router is an ideal access solution for small- and medium-sized businesses and small branch offices. The Cisco 1751 is a modular access platform that offers customers secure Internet and intranet access, as well as the capability to implement a variety of applications in the same platform, including voice over IP, virtual-private-network (VPN) access, and business-class Digital Subscriber Line (DSL) access when needed.

In addition to the various functions available on the 1720, the Cisco 1751 provides multiservice integrated voice/data support. By implementing the Cisco 1751 into existing data networks, customers can save on long-distance interoffice phone/fax toll charges while enabling next-generation voice-enabled applications such as integrated messaging and Web-based call centers.

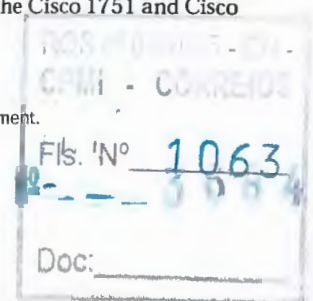
The Cisco 1751 router is particularly suitable for environments that require:

- Modularity, flexibility, and investment protection to upgrade to new services and technologies such as multiservice, VPN, and broadband access now or later

- VPN deployment either now or in the future, with requirements for encryption speeds up to T1/E1 (the Cisco 1751 can encrypt at 512 Kbps using software-based encryption, and at T1/E1 using the VPN hardware-based encryption card inserted on the motherboard)
- Multiservice data/voice/fax integration
- Digital voice support (ISDN NT/TE VIC support, VIC-BRI-NT/TE)
- 10/100 Ethernet LAN
- Dual Ethernet capability (with 10BaseT Ethernet WIC)
- VLAN support (802.1Q)
- The flexibility of one voice and two WAN/voice interface card slots
- Higher number of serial interfaces (up to five, including AUX port)
- Dual ISDN Basic Rate Interface (BRI) connections
- Compression at speeds greater than 128 Kbps
- Support for ADSL and G.SHDSL interface card

**Q.** What are the key differences between the Cisco 1751 and the Cisco 1751-V?

**A.** The Cisco 1751 and 1751-V support the same data and voice functionality. The main difference between these two models is that the Cisco 1751-V is voice ready, i.e. it comes with higher default memory, 1 DSP module and the IOS IP/Voice PLUS image. Table 1 compares the Cisco 1751 and Cisco 1751-V.







**Table 1** Feature Comparison of the Cisco 1751 and the Cisco 1751-V

<b>Cisco 1751</b>	<b>Cisco 1751-V</b>
Base version	Multiservice-ready version
Includes everything for data networking	Includes all the features needed for <i>immediate</i> integration of voice and data
16-MB Flash memory (Non-upgradeable)	32-MB Flash memory (Non-Upgradeable)
32-MB DRAM (on board)	64-MB DRAM (32 MB on board, 32 MB in DRAM DIMM <sup>1</sup> socket)
Cisco IOS IP Software Feature Set	Cisco IOS IP/Voice Plus feature set
Two DSP <sup>2</sup> module slots available DSPs available separately	Two DSP module slots available Comes with one DSP (PVDM-256K-4) inserted in one DSP module slot DSPs available separately for further upgrades
VICs available separately	VICs available separately
Flash memory and DRAM upgrades available separately	Flash memory and DRAM upgrades available separately
WICs available separately	WICs available separately

1. Double in-line memory module  
2. Digital signal processor

**Table 2** Feature Comparison of the Cisco 1751 and Cisco 1750

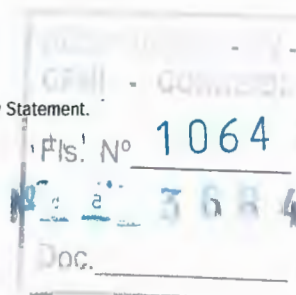
<b>Feature</b>	<b>Cisco 1751</b>	<b>Cisco 1750</b>
Digital voice support (ISDN BRI VIC and T1/E1 VWICs)	Yes	No
VLAN (IEEE 802.1Q)	Yes	No
Routing performance (64-byte packets)—fast-switching	12,000 pps	8,500 pps
Base models: flash/ DRAM (default)	Cisco 1751: 16/32 Cisco 1751-V: 32/64	Cisco 1750: 4/16 Cisco 1750-2V: 8/32 Cisco 1750-4V: 8/32
No. of PVDM slots	2	1

**Q.** Is the Cisco 1751 a replacement for the Cisco 1750?

**A.** The Cisco 1751 is a superior solution when compared to the Cisco 1750 in terms of performance, value and functionality (see Table 2).

**Q.** Will the Cisco 1750 be discontinued (i.e. EOS)?

**A.** Yes. Cisco 1750 Router will be end of sale on May 31st 2002. Please refer to the following product bulletin for details: [http://www.cisco.com/warp/public/cc/pd/rt/1700/prodlit/1660\\_pp.htm](http://www.cisco.com/warp/public/cc/pd/rt/1700/prodlit/1660_pp.htm)





We urge the customers to migrate to the Cisco 1751 due to the clear advantages that it offers at the same price point. The Cisco 1751 Router provides all of the features of the 1750 plus support for; digital voice, VLAN, and greater performance. In addition, the Cisco 1751 Router comes with more memory than the 1750 (both flash and DRAM), which reduces the overall solution cost when deploying voice and/or security features.

**Q.** What are the differences between the Cisco 1600-R series and the Cisco 1700 series router?

**A.** Compared with the Cisco 1600-R series, the Cisco 1700 series offers increased performance, added flexibility with fully modular chassis, and investment protection with support for new services such as DSL, Voice over IP (VoIP), and VPNs at similar price points to the Cisco 1600-R. Wherever possible, Cisco encourages customers to move to the new Cisco 1700 platform to be best positioned for future growth and services. Some services (DSL, VoIP) are and will not be supported on the Cisco 1600-R series because of performance and architecture limitations. Table 3 clarifies the features of the Cisco 1600-R and 1700 series families. The Cisco 1600-R series will continue to be available, but Cisco is actively marketing the 1700 series as the next-generation access platform ideal for small- and medium-sized businesses and small branch offices. Most Cisco 1600-R models have a list price of \$1495 (US), and an equivalent configuration of the Cisco 1720 is \$1595 (US list). For \$100, customers get the added benefits of increased performance and the ability to benefit from a broad array of services including VPNs, VoIP, and DSL when needed.

- Secure Internet/intranet access with firewall- and software-based DES and 3DES encryption
- VPN (with optional hardware-based encryption card)
- Multiservice voice with VoIP and Voice over Frame Relay (VoFR)
- ADSL and G.SHDSL
- High-speed LAN (10/100 Ethernet)
- More modularity

**Table 3** Key Enhanced Capabilities of Cisco 1751 Series Compared to Cisco 1600-R Series

Feature	Cisco 1600-R Series Modular Access Routers	Cisco 1751 Series Modular Access Routers
WAN slots	1601-R-1604-R: One fixed WAN port plus one modular WAN interface card (WIC) slot 1605-R: One modular WAN interface card (WIC) slot and two 10 Mbps Ethernet ports	Two WAN interface card slots
WAN Interface Cards Supported	Single serial (sync, async): WIC-1T Single ISDN BRI S/T: WIC-1B-S/T Single ISDN BRI U: WIC-1B-U Single serial with integrated 56/64 K DSU: WIC-1DSU-56K4 Single serial with integrated T1/FT1 DSU: WIC-1DSU-T1	All Cisco 1600-R series WAN interface cards plus: Dual serial (sync): WIC-2T Dual serial (async/sync): WIC-2A/S Ethernet WIC: WIC-1ENET ADSL WIC: WIC-1ADSL G.SHDSL WIC: WIC-1SHDSL Modem WIC: WIC-1AM and WIC-2AM
Maximum WAN Interfaces Supported	Two serial (synchronous/asynchronous)	Five serial (sync/async, including the auxiliary port)
	One ISDN BRI (maximum)	Two ISDN BRI
LAN	1601-R-1604-R: One 10BaseT Ethernet port 1605-R: Two 10BaseT Ethernet ports	One autosensing 10/100 Fast Ethernet

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**Table 3** Key Enhanced Capabilities of Cisco 1751 Series Compared to Cisco 1600-R Series

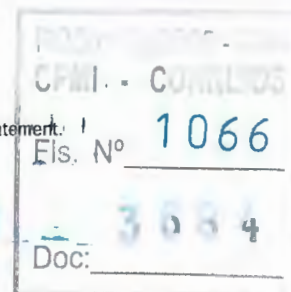
Feature	Cisco 1600-R Series Modular Access Routers	Cisco 1751 Series Modular Access Routers
Dual Ethernet support	1605-R: Two 10BaseT Ethernet ports	One autosensing 10/100 Fast Ethernet on-board interface + 10BaseT Ethernet WIC
VLAN support (802.1Q)	No	Yes
Support for Voice Interface Cards (VICs)	No	Yes: 2-port ear and mouth (E&M) voice interface card (VIC) 2-port Direct Inward Dial (DID) 2-port Foreign Exchange Office (FXO) VIC, and 2-port Foreign Exchange Station (FXS) VIC 2-port Network/Userside BRI (VIC-2BRI-NT/TE) 1 or 2-port T1/E1 Multiflex VWICs
Maximum Voice Channels Supported	None	Analog: 6 total (2 slots support voice or WAN interface cards; all voice cards provide 2 voice ports) Digital: 24 total (T1/E1 Multiflex VWICs)
AUX Port (async up to 115.2 kbps)	No	Yes
Support for Dual ISDN BRI	No	Yes
Encryption Support	DES	DES, triple DES
IPSec DES Encryption Speed	Software performance (DES, 256-byte packets) 128 Kbps (ISDN)	Software performance (3DES, 256-byte packets) 256 Kbps (2xISDN) Performance with VPN module (3DES, 256-byte packets) 1700 Kbps (T1/E1)
Expansion Slot for High-Speed Hardware-Based Encryption Card	No	Yes
Maximum Flash Memory	16 MB	Cisco1751: 16MB Cisco1751-V: 32MB
Maximum DRAM Memory	24 MB	Cisco1751: 96 MB Cisco1751-V: 128MB

**Q.** Will the Cisco 1600-R support DSL or VPN or multiservice voice or 10/100 Ethernet or 3DES encryption in the future?

**A.** No. The Cisco 1600-R series was not designed to support the above technologies.

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**Q.** Should we position Cisco 1700 series to the customer instead of 1600-R?

**A.** Yes. Always. Please educate the value proposition of the Cisco 1700 series and the applications and services that it can support either now or later. We strongly suggest the sales team to help educate the customer to invest in Cisco 1700 series and avoid the cost of upgrading later.

**Q.** What is the proper positioning of the Cisco 1700 series, and 2600 series routers?

**A.** The Cisco 1700 series routers are positioned for small- and medium-sized businesses and small branch offices. Because of its modularity, increased performance, and investment protection capabilities, the Cisco 1700 is a strategic platform for small- and medium-sized businesses and small branch offices. The Cisco 2600 series routers are positioned as enterprise-class solutions for enterprise large branch offices, offering rack-mount for wiring-closet environments, internal power supply, and optional redundant power supply. The Cisco 2600 series offers a flexible, modular solution with higher performance; more WAN density such as dual ISDN Primary Rate Interface (PRI), 10 ISDN BRIs, four T1/E1s, 36 async serial interfaces; and support for dial and digital voice with densities ranging from two to 60 calls.

These four router families are positioned as two winning pairs:

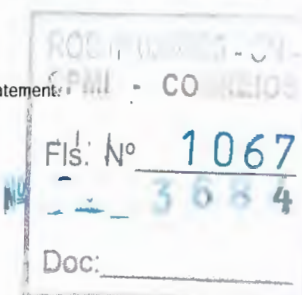
- Cisco 1700 series for small and medium-sized businesses and enterprise small branch offices
- Cisco 2600 series for enterprise branch offices

**Q.** When would a customer want a Cisco 2600 series router rather than a Cisco 1751 router?

**A.** The Cisco 2600 series is better suited for larger enterprise branch offices that require multiple WAN ports and, typically, a 19-inch rack-mount enclosure. It provides two WAN interface card slots, plus an additional network module slot, which provides higher port densities as well as support for voice services. The key differences are highlighted in Table 4.

**Table 4** Key Differences between Cisco 1751 Router and Cisco 2600 Series Routers

Feature	Cisco 1751	Cisco 2600 Series
Performance (fast-switch 64-byte packets)	12,000 pps	12,000 to 37,000 pps
Performance (IPSec DES-encrypted 256-byte Packets)	512 Kbps	512 Kbps
"Class of Product"	Small/medium business and small enterprise branch office	"Enterprise class"
	Desktop	19-in. rack-mount, ideal for wiring closets
	External power supply	Internal power supply
	No redundant power supply option	Redundant power supply option
	Optional Plus feature sets for enterprise-class software features (IP multicast, RSVP, BGP, and so on)	Enterprise-class software features standard in Base IP, for example, IP multicast, RSVP, BGP
	No enterprise or APPN feature sets	Enterprise and APPN feature sets







**Table 4** Key Differences between Cisco 1751 Router and Cisco 2600 Series Routers (Continued)

Feature	Cisco 1751	Cisco 2600 Series
	Not NEBS compliant	NEBS compliant
	No Token Ring LAN	Token Ring LAN option
Support for Voice Interface Cards	Yes: supports dual port E&M, FXO, FXS, DID and ISDN BRI NT/TE, T1/E1 Multiflex VWICs	Yes: supports dual-port E&M, FXO, FXS, ISDN BRI-N/T-TE and BRI-ST/TE, digital T1/E-1 packet voice trunk network module, T1/E-1 multiflex WAN/voice interface card (multiflex WAN/voice interface card)
Maximum Voice Interfaces Supported	Analog: 4 ports with 1 WAN slot (up to dual T1/E1 WIC) or 6 ports without WAN access Digital: 24 calls with one channelized T1 or E1 or 12 ports without WAN access	2 to 60 voice calls
Maximum WAN Densities	4 serial, 2 BRI, 4 A/S	10 BRI, 12 A/S, 36 A, 2 PRI, 1 ATM
Maximum LAN Density	2 (one on-board 10/100 and an optional Ethernet WIC)	6 Ethernet
Slots	2 WAN/voice interface cards + 1 voice interface card	2 WAN interface cards + 1 network module
	1 internal expansion slot for VPN hardware encryption card	1 AIM slot for encryption, compression, voice processing, ATM SAR
Voice	Voice-over-IP (VoIP), VoFR	Voice/fax-over-IP capable, VoFR capable
Integrated Dial Capability	Not supported	16 modem or 32 async serial

**Q.** Which Cisco IOS® release is available with the Cisco 1751 at first customer ship (FCS)?

**A.** At FCS, the Cisco 1751 router shipped with Cisco IOS Release 12.1(5)YB, which is a special release. The Cisco 1751 router will be available on the 12.2T Release train in 12.2(4)T.

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### Software Feature Sets

**Q.** What software feature sets are available for the Cisco 1751 router?

**A.** Twenty-four feature sets are available (see Table 5). This includes 14 data images and 10 data and voice images.

**Table 5** Minimum Memory Requirements and Software Feature Sets for Cisco IOS Releases 12.1(5)YB

Cisco IOS Feature Set	Memory Requirement	
	FLASH	DRAM
IP	4MB	24MB
IP/ADSL	8MB	24MB
IP/ADSL Plus	8MB	32MB
IP/ADSL Plus IPSec 56	8MB	32MB
IP/FW/IDS	4MB	24MB
IP/ADSL/FW/IDS Plus IPSec 56	8MB	32MB
IP/IPX	4MB	24MB
IP/ADSL/IPX/FW/IDS Plus	8MB	32MB
IP/ADSL Plus IPSec 3DES	8MB	32MB
IP/ADSL/FW/IDS Plus IPSec 3DES	8MB	32MB
IP/IPX/AT/IBM	8MB	24MB
IP/ADSL/IPX/AT/IBM Plus	16MB	48MB
IP/ADSL/IPX/AT/IBM/FW/IDS Plus IPSec 56	16MB	48MB
IP/ADSL/IPX/AT/IBM/FW/IDS Plus IPSec 3DES	16MB	48MB
IP/ADSL/VoicePlus	8MB	32MB
IP/Voice Plus	8MB	32MB
IP/ADSL/Voice Plus IPSec 56	16MB	48MB
IP/ADSL/FW/IDS/VoicePlus	16MB	48MB
IP/ADSL/FW/IDS/Voice Plus IPSec 56	16MB	48MB
IP/IPX/FW/IDS/Voice Plus	16MB	48MB
IP/ADSL Voice Plus IPSec 3DES	16MB	48MB
IP/ADSL/FW/IDS/Voice Plus IPSec 3DES	8MB	32MB
IP/ADSL/IPX/AT/IBM/FW/IDS/VoicePlus IPSec 56	16MB	48MB
IP/ADSL/IPX/AT/IBM/FW/IDS/Voice Plus IPSec 3DES	16MB	48MB

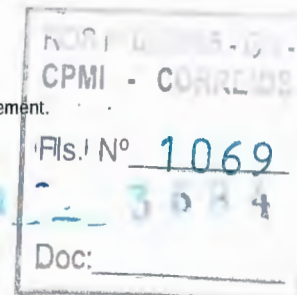
Check on Cisco Release Notes for the recent software feature sets and minimum memory requirements.

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122relnt/index.htm>

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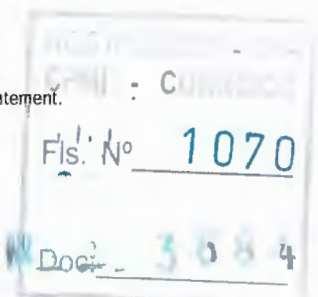


Starting with Cisco IOS Release 12.0, the base feature sets on the 1600/1700 series include some features formerly in the PLUS feature sets: Network Address Translation (NAT), Open Shortest Path First (OSPF), Remote Access Dial-In User Service (RADIUS), and Next Hop Resolution Protocol (NHRP). Plus feature sets contain all the features in their corresponding Base feature sets, plus additional value-added features such as Layer 2 Tunneling Protocol (L2TP), Layer 2 Forwarding (L2F), Border Gateway Protocol (BGP), IP multicast, Frame Relay, Switched Virtual Circuit (SVC), Resource Reservation Protocol (RSVP), PPPoE, NetWare Link Services Protocol (NLSP), AppleTalk Simple Multicast Routing Protocol (SMRP), and Network Timing Protocol (NTP).

Tables 6 through 8 show the features available in the Cisco IOS 1751 feature sets.

**Table 6** Features in Cisco IOS Base Feature Sets

Category	Basic Protocols/Features	IP	IP/ADSL	IP/IPX	IP Firewall	IP/IPX/AT/IBM
LAN	Transparent bridging	X	X	X	X	X
	IP	X	X	X	X	X
	IPX, NetBIOS access lists, name caching			X		X
	AppleTalk phases 1 and 2					X
WAN	Leased lines, Frame Relay, Switched 56, SMDS, HDLC	X	X	X	X	X
	ISDN leased line (IDSL) at 64 and 128 Kbps	X	X	X	X	X
	ISDN Caller ID callback	X	X	X	X	X
	PPP, PPP compression	X	X	X	X	X
	Async, SLIP	X	X	X	X	X
	X.25, X.25 PAD, X.25 over ISDN D channel	X	X	X	X	X
	LLC2, LAPB	X	X	X	X	X
IP Routing	RIP, RIP2, IGRP, Enhanced IGRP, OSPF, NHRP	X	X	X	X	X
	IP policy routing	X	X	X	X	X
	GRE tunneling	X	X	X	X	X
Other Routing	IPX-RIP			X		X
	(AppleTalk) RTMP					X
Security	PAP/CHAP, local password	X	X	X	X	X
	Extended access lists; Lock and Key	X	X	X	X	X
	RADIUS, TACACS+, Token Ring	X	X	X	X	X

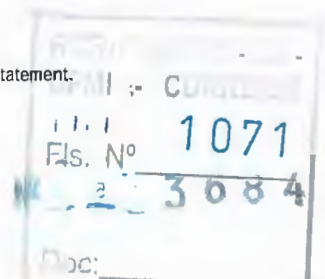




**Table 6** Features in Cisco IOS Base Feature Sets (Continued)

Category	Basic Protocols/Features	IP	IP/ADSL	IP/IPX	IP Firewall	IP/IPX/AT/IBM
Quality of Service (QoS)	Weighted Fair Queueing (WFQ)	X	X	X	X	X
WAN Optimization	Bandwidth on demand, dial on demand	X	X	X	X	X
	IPX and SPX spoofing			X		X
	Snapshot routing	X	X	X	X	X
	Frame Relay FRF.9	X	X	X	X	X
Ease of Use and						
Deployment	ConfigMaker	X	X	X	X	X
	Easy IP (PAT, IPCP, and DHCP server)	X	X	X	X	X
	Network Address Translation (NAT)	X	X	X	X	X
	AutoInstall for leased line and Frame Relay	X	X	X	X	X
Management	SNMP, Telnet, console port	X	X	X	X	X
	CiscoView, CiscoWorks2000	X	X	X	X	X
	Simple Network Timing Protocol (SNTP)	X	X	X	X	X

**Note:** AppleTalk routing and bridging are not supported for asynchronous interfaces.

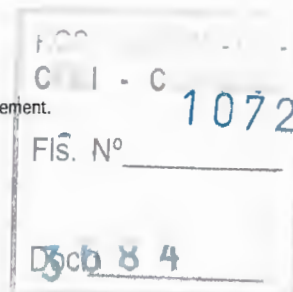






**Table 7** Data Only Plus Feature Sets—Additional Features

	Plus Protocols/ Features	IP/ ADS L Plus	IP/ ADSL Plus IPSec 56	IP/ ADSL Plus IPSec 3DES	IP/ FW/ IDS Plus IPSec 56	IP/ FW/ IDS Plus IPSec 3DES	IP/ ADSL/ IPX FW/ IDS Plus	IP/ ADSL/ IPX/ AT/ IBM Plus	IP/ADSL/ IPX/AT/ IBM FW/ IDS Plus IPSec 56	IP/ADSL/ IPX/AT/ IBM FW/ IDS Plus IPSec 3DES
WAN	Frame Relay SVC	X	X	X	X	X	X	X	X	X
IP Routing	BGP	X	X	X	X	X	X	X	X	X
Other Routing	NetWare Link Services Protocol						X	X	X	X
	AppleTalk AURP, ATIP						X	X	X	X
VPN/ Security	IPSec DES		X	X	X	X			X	X
	IPSec Triple DES			X		X				X
VPN/ Tunnels	L2TP, L2F	X	X	X	X	X	X	X	X	X
QoS	Resource Reservation Protocol (RSVP)	X	X	X	X	X	X	X	X	X
	Random Early Detection (RED)	X	X	X	X	X	X	X	X	X
	Cisco Express Forwarding (CEF)	X	X	X	X	X	X	X	X	X
	Committed access rate (CAR)	X	X	X	X	X	X	X	X	X
	NetFlow	X	X	X	X	X	X	X	X	X
	RTP Header Compression (RTP-HC)	X	X	X	X	X	X	X	X	X





**Table 7** Data Only Plus Feature Sets—Additional Features (Continued)

	Plus Protocols/ Features	IP/ ADSL Plus	IP/ ADSL Plus IPSec 56	IP/ ADSL Plus IPSec 3DES	IP/ ADSL FW/ IDS Plus IPSec 56	IP/ ADSL FW/ IDS Plus IPSec 3DES	IP/ ADSL/ IPX FW/ IDS Plus	IP/ ADSL/ IPX/ AT/ IBM Plus	IP/ADSL/ IPX/AT/ IBM FW/ IDS Plus IPSec 56	IP/ADSL/ IPX/AT/ IBM FW/ IDS Plus IPSec 3DES
Multi media	IP Multicast (Protocol Independent Multicast, or PIM)	X	X	X	X	X	X	X	X	X
	AppleTalk SMRP (multicast)							X	X	X
Manage ment	Network Timing Protocol (NTP)	X	X	X	X	X	X	X	X	X

**Note:** FW denotes Cisco IOS Firewall Feature Set. Encryption is offered in special encryption feature sets (Plus IPSec 56 and Plus IPSec 3DES). To build an IP VPN, the recommended images are IP Firewall Plus IPSec 56 or IP Firewall Plus IPSec 3DES.

**Table 8** Data and Voice Plus Feature Sets—Additional Features

Category	Plus Protocol/ Features	IP/ ADSL Voice Plus	IP/ ADSL/ FW/ IDS/ Voice Plus	IP/ ADSL/ Voice Plus IPSec 56	IP/ ADSL/ Voice Plus IPSec 3DES	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 56	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 3DES	IP/ ADSL/ IPX/AT/ IBM/ FW/ IDS/ Voice Plus IPSec 56	IP/ ADSL/ IPX/AT/ IBM/ FW/ IDS/ Voice Plus IPSec 3DES
WAN	Frame Relay SVC	X	X	X	X	X	X	X	X
IP Routing	BGP	X	X	X	X	X	X	X	X
Other Routing	NetWare Link Services Protocol							X	X
	AppleTalk AURP, ATIP							X	X
VPN/ Security	IPSec DES			X	X	X	X	X	X
	IPSec Triple DES				X		X		X

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**Table 8** Data and Voice Plus Feature Sets—Additional Features (Continued)

Category	Plus Protocol/ Features	IP/ ADSL/ Voice Plus	IP/ ADSL/ FW/ IDS/ Voice Plus	IP/ ADSL/ Voice Plus IPSec 56	IP/ ADSL/ Voice Plus IPSec 3DES	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 56	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 3DES	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 56	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 56	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 3DES
VPN/ Tunnels	L2TP, L2F	X	X	X	X	X	X	X	X	X
QoS	Resource Reservation Protocol (RSVP)	X	X	X	X	X	X	X	X	X
	Random Early Detection (RED)	X	X	X	X	X	X	X	X	X
	Cisco Express Forwarding (CEF)	X	X	X	X	X	X	X	X	X
	Committed Access Rate (CAR)	X	X	X	X	X	X	X	X	X
	NetFlow	X	X	X	X	X	X	X	X	X
	RTP Header Compression (RTP-HC)	X	X	X	X	X	X	X	X	X
Multi media	IP Multicast (Protocol Independent Multicast, or PIM)	X	X	X	X	X	X	X	X	X
	AppleTalk SMRP (multicast)							X	X	
Codes	G.711	X	X	X	X	X	X	X	X	X
	G.729a	X	X	X	X	X	X	X	X	X
	G.723.1	X	X	X	X	X	X	X	X	X
	G.726	X	X	X	X	X	X	X	X	X
Voice Features	Voice over IP	X	X	X	X	X	X	X	X	X
	Fax support (group III fax)	X	X	X	X	X	X	X	X	X

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**Table 8** Data and Voice Plus Feature Sets—Additional Features (Continued)

Category	Plus Protocol/ Features	IP/ ADSL/ Voice Plus	IP/ ADSL/ FW/ IDS/ Voice Plus	IP/ ADSL/ Voice Plus 56	IP/ ADSL/ Voice Plus 3DES	IP/ ADSL/ FW/ IDS/ Voice Plus 56	IP/ ADSL/ FW/ IDS/ Voice Plus 3DES	IP/ ADSL/ FW/ IDS/ Voice Plus	IP/ ADSL/ IPX/AT/ IBM/ FW/ IDS/ Voice Plus 56	IP/ ADSL/ IPX/AT/ IBM/ FW/ IDS/ Voice Plus 3DES
	Private Line Automatic Ringdown (PLAR)	X	X	X	X	X	X	X	X	X
	Support for Off-premise Extension (OPX)	X	X	X	X	X	X	X	X	X
	Support for FXS	X	X	X	X	X	X	X	X	X
	Support for FXO	X	X	X	X	X	X	X	X	X
	Support for E&M	X	X	X	X	X	X	X	X	X
	Support for ISDN NT/TE VIC	X	X	X	X	X	X	X	X	X
	Voice Activity Detection (VAD)	X	X	X	X	X	X	X	X	X
	Busy out	X	X	X	X	X	X	X	X	X
	Comfort noise generation	X	X	X	X	X	X	X	X	X
	H.323 Version 1 and 2	X	X	X	X	X	X	X	X	X
	DTMF relay	X	X	X	X	X	X	X	X	X
	FRF.12	X	X	X	X	X	X	X	X	X
QoS	MLPPP w/ LFI (process-switched)	X	X	X	X	X	X	X	X	X
	FRF traffic shaping with per VC queuing	X	X	X	X	X	X	X	X	X
	IP RTP priority	X	X	X	X	X	X	X	X	X

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**Table 8** Data and Voice Plus Feature Sets—Additional Features (Continued)

Category	Plus Protocol/ Features	IP/ ADSL / Voice Plus	IP/ ADSL/ FW/ IDS/ Voice Plus	IP/ ADSL/ Voice Plus IPSec 56	IP/ ADSL / Voice Plus IPSec 3DES	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 56	IP/ ADSL/ FW/ IDS/ Voice Plus IPSec 3DES	IP/ ADSL/ IPX/AT/ IBM/ IDS/ Voice Plus IPSec 56	IP/ ADSL/ IPX/AT/ IBM/ FW/ IDS/ Voice Plus IPSec 3DES
	cRTP (Fast-switched)	X	X	X	X	X	X	X	X
	MLPPP w/ LFI (fast-switched)	X	X	X	X	X	X	X	X
	LLQ (PQ/ CBWFQ)	X	X	X	X	X	X	X	X
	FRF.11 (VoFR)	X	X	X	X	X	X	X	X
	DiffServ	X	X	X	X	X	X	X	X

### LAN Functionality

**Q.** What types of LANs does the Cisco 1751 router support?

**A.** The Cisco 1751 router supports one autosensing 10/100 Fast Ethernet connection, with one 10/100BaseTX transceiver (RJ-45 connector). The 10/100BaseTX port can connect to an external 10/100BaseTX hub or switch or directly to a PC Ethernet port (using a crossover cable) using inexpensive, unshielded twisted-pair (UTP) wiring.

**Q.** Is the 10BaseT Ethernet WIC supported on the 1751?

**A.** Yes, the 10Base T Ethernet WIC is supported on the 1751 to provide dual Ethernet functionality.

**Q.** What LAN and routing protocols are supported by the Cisco 1751 router?

**A.** The Cisco 1751 router supports IP, Internetwork Packet Exchange (IPX), AppleTalk routing, IBM Systems Network Architecture (SNA), and transparent bridging. Routing protocols supported include IP Routing Information Protocol (RIP), RIP V.2, Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), IPX- RIP, OSPF, on-demand OSPF, NHRP, and AppleTalk Routing Table Maintenance Protocol (RTMP). Additionally, Plus feature sets including: BGP, NLSP and AppleTalk Update-Based Routing Protocol (AURP) are supported in Plus feature sets that support IPX and AppleTalk, respectively.

**Q.** Is it possible to manually set the Fast Ethernet (FE) speed on the Cisco 1751?

**A.** Yes, this feature was implemented in releases 12.1 and 12.1T. With prior releases, the FE port speed is autonegotiated.

**Q.** Is ISL or IEEE802.1Q supported on the Cisco 1751?

**A.** IEEE802.1Q is supported on the Cisco 1751. ISL is not supported. The Cisco 1720 and 1750 do not support VLAN (IEEE 802.1Q or ISL).

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## WAN Functionality

**Q.** What WAN interface cards are available?

**A.** Available WAN interface cards are shown in Table 9.

**Table 9** Available WAN Interface Cards

WAN Interface Card	Interfaces
WIC-1T	1 serial, async and sync (T1/E1)
WIC-2T	2 serial, async and sync (T1/E1)
WIC-2A/S	2 low-speed (up to 128 kbps) serial, async, and sync
WIC-1B-S/T	1 ISDN BRI S/T
WIC-1B-U	1 ISDN BRI U with integrated NT1
WIC-1DSU-56K4	1 integrated 56/64 Kbps 4-wire DSU/CSU
WIC-1DSU-T1	1 integrated T1/fractional T1 DSU/CSU
WIC-1ENET	1 10BaseT Ethernet (only supported in Slot 0)
WIC-1ADSL	1 ADSL
WIC-1SHDSL	1 G.SHDSL
WIC-1AM	1 V.90 modem card
WIC-2AM	2 V.90 modem card

**Q.** Are there any WIC slot dependencies with respect to order or maximum number of a certain type?

**A.** All WICs are supported in any slot and in any combination.

**Q.** Does the Cisco 1751 router support two ISDN BRI interfaces?

**A.** Yes. The Cisco 1751 router supports two BRI interfaces (dial and ISDN leased line) with two ISDN BRI WAN interface cards installed in the two WAN interface card slots. Multilink PPP (MP) can combine the four B channels to achieve data rates up to 256 Kbps.

**Q.** Do the WIC-1T, WIC-2T, and WIC-2A/S WAN interface cards support asynchronous serial when installed in the Cisco 1751 router?

**A.** Yes. The Cisco 1751 router supports asynchronous serial (up to 115.2 Kbps) as well as synchronous serial on the serial WAN interface cards. The onboard aux port also supports asynchronous serial at speeds up to 115.2 Kbps.

**Q.** What WAN protocols does the Cisco 1751 router support?

**A.** Point-to-Point Protocol (PPP), High-Level Data Link Control (HDLC), X.25 Link Access Procedure, Balanced (LAPB), Switched Multimegabit Data Service (SMDS), Frame Relay, and IBM/SNA are supported over permanent or switched digital lines. PPP and Serial Line Internet Protocol (SLIP) are supported over asynchronous analog lines.

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**Q.** Do the serial ports on the Cisco 1751 router support data-communications-equipment (DCE) functionality?

**A.** Yes, the Cisco 1751 router supports DCE (that is, supplies clocking), allowing the Cisco 1751 router to interconnect without requiring a null modem. Also, X.25 packet assembler/disassembler (PAD) functionality is supported. IBM Synchronous Data Link Control (SDLC), bisync, and other serial protocols are supported.

**Q.** Is IDSL supported on the Cisco 1751?

**A.** No.

**Q.** Will the Cisco 1751 support three WICs?

**A.** The Cisco 1751 can only support two WAN interfaces. The AUX port can be used as another WAN port. If your customer needs greater density, the Cisco 2600 would be the solution.

**Q.** Does the Cisco 1751 Router support Modem WIC card?

**A.** Yes. The Cisco 1751 Router supports one and two-port V.90 modem WIC card. Product number is WIC-1AM and WIC-2AM. For more details about the Modem WIC, please refer to the following data sheet:

[http://www.cisco.com/warp/public/cc/pd/rt/1700/prodlit/17srt\\_ds.htm](http://www.cisco.com/warp/public/cc/pd/rt/1700/prodlit/17srt_ds.htm)

#### **Voice Functionality**

**Q.** Does Cisco 1751 support Survivable Remote Site Telephony (SRST)?

**A.** Yes. For the detailed information, please refer to the below documents

Announcement: [http://www.cisco.com/cpropart/salestools/cc/pd/rt/1700/prodlit/1601\\_po.htm](http://www.cisco.com/cpropart/salestools/cc/pd/rt/1700/prodlit/1601_po.htm)

Datasheet: [http://www.cisco.com/warp/partner/synchronicd/cc/pd/unco/srstl/prodlit/srstd\\_ds.htm](http://www.cisco.com/warp/partner/synchronicd/cc/pd/unco/srstl/prodlit/srstd_ds.htm)

**Q.** What voice interface cards (VICs) are supported on the Cisco 1751?

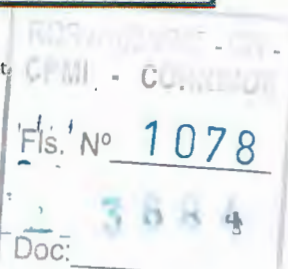
**A.** The voice interface cards currently supported are given in Table 10.

**Table 10** Voice Interface Cards Currently Supported

<b>Voice Interface Card</b>	<b>Interfaces</b>
VIC-2DID	2-port direct inward dial (DID) voice/fax interface card
VIC-2E/M	2-port voice interface card E&M
VIC-2FXO	2-port voice interface card FXO
VIC-2FXS	2-port voice interface card FXS
VIC-2FXO-M1	2-port FXO voice/fax interface card with battery reversal detection and Caller ID support (for U.S. and Canada) [enhanced version of the VIC-2FXO]
VIC-2FXO-M2	2-port FXO voice/fax interface card with battery reversal detection and Caller ID support (for Europe) [enhanced version of the VIC-2FXO-EU]
VIC-2FXO-M3	2-port voice interface card FXO (for Australia)
VIC-2FXO-EU	2-port voice interface card FXO (for Europe)
VIC-2BRI-NT/TE	2-port network side/terminal side ISDN BRI interface

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**Table 10** Voice Interface Cards Currently Supported

<i>Voice Interface Card</i>	<i>Interfaces</i>
VWIC-1MFT-T1	1-port RJ-48 multiflex trunk - T1
VWIC-2MFT-T1	2-port RJ-48 multiflex trunk - T1
VWIC-2MFT-T1-DI	2-port RJ-48 multiflex trunk - T1 with drop and insert
VWIC-1MFT-E1	1-port RJ-48 multiflex trunk - E1
VWIC-2MFT-E1	2-port RJ-48 multiflex trunk - E1
VWIC-2MFT-E1-DI	2-port RJ-48 multiflex trunk - E1 with drop and insert
VWIC-1MFT-G703	1-port RJ-48 multiflex trunk - E1 G.703
VWIC-2MFT-G703	2-port RJ-48 multiflex trunk - E1 G.703

**Q.** How many DSPs are supported in the 1751?

**A.** The 1751 has 2 DSP module slots on the motherboard, each of which supports the 5 DSP module. This provides a DSP density of 10 DSPs.

**Q.** What are the PVDM/VIC combinations that are supported?

**A.** The supported combinations are shown in Table 11.

**Table 11** Supported PVDM/VIC Combinations

<i>PVDM</i>	<i>Number of DSPs Supported</i>	<i>VIC Combinations</i>
PVDM-256K-4	1	1 analog VIC
PVDM-256K-8	2	Up to 2 analog VICs or 1 voice-BRI VIC
PVDM-256K-12	3	Up to 3 analog VICs or 1 analog VIC + 1 voice-BRI VIC
PVDM-256K-16	4	Up to 3 analog VICs or Up to 2 voice-BRI VICs or Up to 2 analog VICs+1 voice-BRIVIC
PVDM-256K-20	5	Up to 3 analog VICs or Up to 2 voice-BRI VICs or Upto 2 analog VICs+1 voice- BRIVIC or 1 analog VIC+up to 2 voice-BRI VICs

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**Q.** Are the PVDM-4 (supported in Cisco 1750) supported in Cisco 1751?

**A.** PVDM-4, 8,12 are not officially supported in the Cisco1751.

**Q.** Are the PVDM-256K-4 (supported in Cisco 1751) supported in Cisco 1750?

**A.** PVDM-256K-4, 8,12 are not officially supported in the Cisco1751.

**Q.** Does the 1751 support digital VICs?

**A.** Yes, the 1751 supports digital VICs. At FCS, the ISDN BRI NT/TE VIC is supported, and 1 or 2 port T1/E1 VWICs are supported in Cisco IOS 12.2(4)YB or later releases.

**Q.** Does the Cisco 1751 support the T1/E1 VWICs (i.e. the multi-flex cards)?

**A.** Yes. From Cisco IOS 12.2(4) YB or later releases. It will roll into 5th 12.2 T train release.

**Q.** How many DSPs are required to support the various VICs?

**Q.** The analog VICs require 1 DSP/VIC, the ISDN BRI VIC requires 2 DSPs/VIC. For T1/E1 VWICs, it depends on the codec and how many voice channels are used. The number of maximum channels support per DSP is listed in Table 12.

**Table 12** Maximum Channels Support per DSP for T1/E1 Multiflex VWICs

Codec	Kbps	Max Channels/DSP (Digital Calls)
G.711	64 (PCM)	6
G.729a	8 (CS-ACELP)	3
G.726	16 (ADPCM)	3
G.723.1	5.3/6.3 (ACELP)	2
G.728	32 (ADPCM/LDCLP)	2

For example, if you are running 12 G.711 digital T1/E1 voice calls, then you will need two DSPs. If these are G.729 calls, then you will need four DSPs.

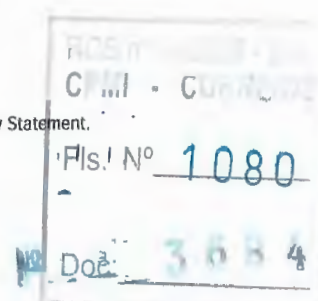
DSP used for the digital calls and for the analog calls have to be calculated separately and one DSP can support multiple Codecs concurrently for T1/E1 VWICs.

**Q.** Does Cisco 1751 support Caller ID?

**A.** Yes, Cisco 1751 supports Caller ID transmission on FXS, FXO-M1 and FXO-M2 interfaces. It provides Caller ID blocking configurable at the source location on FXS, and ability to unblock Caller ID on FXO-M1, M2 interfaces.

**Q.** Does Cisco 1751 support analog DID trunk card?

**A.** Yes.





**Q.** What does toll reduction or toll bypass mean?

**A.** In most of today's corporate networks, voice networks are separate from data networks. Typically, data networks are priced by a monthly fixed cost basis and are usually much cheaper than the voice networks. An example of this is a leased-line environment. In this case, the customer pays for that network, whether data is flowing or not. In a typical phone network, charges are incurred on a usage basis. Therefore, phone expenses on interoffice dialing can be quite expensive, especially since most interoffice calling occurs during "peak" business hours.

When you have the ability to put your interoffice voice calls across a lower-price or fixed-price network with a product such as the Cisco 1751 platform, you can avoid the "toll" that is charged by the long-distance carrier, local exchange carrier (LEC), or Port, Telephone, and Telegraph (PTT). The voice call then travels over the same network that your data travels over and avoids going into the Public Switched Telephone Network (PSTN) and, therefore, does not incur charges.

It is easy for companies to figure out the savings that they will get, because they receive accurate monthly reports that describe their costs from their LECs. Any company that does a great deal of interoffice calling will save more money than one that does more "off-net" PSTN-type calling.

**Q.** What do the terms FXO, FXS, and E&M mean?

**A.** The Cisco 1751 router supports FXO, FXS, and E&M voice interface cards. Each type provides a slightly different interface for connecting to different types of equipment.

#### Foreign Exchange Office

The FXO interface allows an analog connection to be directed at the central office (CO) of the PSTN. This interface is of value for off-premise extension applications. This is the only voice interface card that will be approved to connect to off-premise lines. This interface may be used to provide backup over the PSTN or for Centrex-type operations. This voice interface card needs to be approved by PTTs; it is not available in every country. Check the homologation status page at [http://www.win-eng.cisco.com/Eng/MSABU/Eng\\_Ops/WWW/index.htm](http://www.win-eng.cisco.com/Eng/MSABU/Eng_Ops/WWW/index.htm) for up-to-date availability information.

#### Foreign Exchange Station

The FXS interface allows connection for basic telephone service phones (home phones), fax machines, keysets, and private branch exchange (PBXs) by providing ring voltage, dial tone, and so on. This interface will be used where phones are connecting directly to the router. FXS will be very popular for trials because it allows the phones to be plugged directly into the router.

#### Ear and Mouth

The E&M interface allows connection for PBX trunk lines (tie lines). It is a signaling technique for two- and four-wire telephone and trunk interfaces.

**Q.** What's the difference between FXO and FXO-M1, FXO-M2?

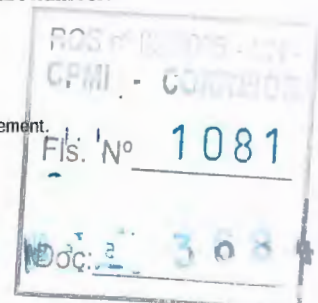
**A.** VIC-2FXO-M1 and VIC-2FXO-M2 support battery reversal detection and Caller ID. While the regular VIC-2FXO doesn't. VIC-2FXO-M1 is for U.S. and Canada, VIC-2FXO-M2 is for Europe.

**Q.** Does the Cisco 1751 support three analog VICs, or six analog voice ports?

**A.** Yes. Customers requiring this capability need to order the PVDM-256k-12 module (part number: PVDM-256k-12=), which provides three DSPs.

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**Q.** Is RAS for H.323 gatekeeper registration supported on the Cisco 1751 platform?

**A.** Yes.

**Q.** In a VoFR and VoIP environment, there are cases where people using OPX extensions would like to use their message waiting lights at the remote sites. To provide functionality, the 150 V signal must be sensed on the originating end and reproduced on the terminating side. Is the message waiting function supported on the Cisco 1751?

**A.** The FXS port does not have the ability to provide the voltage levels necessary to perform this function.

**Q.** What are the key features when implementing voice on the Cisco 1751?

**A.** Please refer to Cisco 1700 Modular Access Voice Feature Overview

[http://wwwin.cisco.com/cmc/cc/pd/rt/1700/sales/orwir\\_st.htm](http://wwwin.cisco.com/cmc/cc/pd/rt/1700/sales/orwir_st.htm)

### **Cisco IOS Security**

**Q.** What security functions are available for the Cisco 1751 router?

**A.** Cisco IOS software supports a wide range of security features. Standard features in base feature sets include access control lists (ACLs); authentication, authorization, and accounting (AAA) features such as Password Authentication Protocol/Challenge Handshake Authentication Protocol (PAP/CHAP), TACACS+, RADIUS, and Token Ring; and Lock and Key. Optional features include the Cisco IOS Firewall Feature Set, IP Security (IPSec) encryption, and tunneling protocols such as IPSec, generic routing encapsulation (GRE), L2F, and L2TP.

**Q.** Can I use the Cisco 1751 router as a firewall?

**A.** Yes. The Cisco IOS Firewall Feature Set is supported in the Cisco 1751 router. This feature set offers enhanced firewall functionality, including context-based access control (CBAC), which enables securing a network on a per-application basis. Additional firewall security features include Java applet blocking, denial-of-service detection and prevention, and more advanced logging capabilities. For more information, see: <http://www.cisco.com/warp/partner/synchronicd/cc/cisco/mkt/security/iosfw/index.htm>

**Q.** Can I encrypt data on the Cisco 1751 router?

**A.** Yes. Two types of encryption technologies are supported: IPSec Data Encryption Standard (DES) 56 and IPSec Triple DES.

### **Processor**

**Q.** What is the processor on the Cisco 1751 router?

**A.** The Cisco 1751 router uses a Motorola MPC860P PowerQUICC at 48 MHz. The Cisco 2600 series uses an MPC860. The 860P processor of the Cisco 1751 router has an integrated Fast Ethernet controller. This has implications on performance, as discussed in the Performance section.



### Performance

**Q.** How does the performance of the Cisco 1700 series compare to that of the Cisco 1600-R series?

**A.** As Table 13 shows, the Cisco 1751 router performance is greater than that of the Cisco 1600-R series.

**Table 13** Performance Comparison of the Cisco 1600-R Series and the Cisco 1751

Feature	Cisco 1600-R Series	Cisco 1751
Encryption IPSec DES 56 (256-byte packets)	128 Kbps	512 Kbps
Encryption IPSec 3DES (256-byte packets)	Not supported	256 Kbps
Fast Switching (64-byte packets)	2 Mbps (4000 pps)	4.3 Mbps (8400 pps)
Processor Switching (64-byte packets)	300 Kbps (600 pps)	768 Kbps (1500 pps)

**Q.** How does the performance of the Cisco 1751 router compare with that of the Cisco 2600 series routers?

**A.** The Cisco 2600 series router has higher fast-switching performance (12,000 to 37,000 pps for 64-byte packets) compared to the Cisco 1751 router (8400 pps). However, the encryption and process switching performance for both platforms are similar (512 Kbps for IPSec DES 56 encryption with 256 byte packets; 768 Kbps or 1500 pps for process switching of 64-byte packets).

**Q.** Why is the fast-switching performance of the Cisco 1751 router not equal to that of the Cisco 2600 series when they appear to use the same processor?

**A.** The Cisco 1751 router uses a Motorola MPC860P processor, which is different from the MPC860 processor on the Cisco 2600 series. The Motorola 860P has an integrated Fast Ethernet controller. This processor uses an arbitration scheme that continuously polls for contenders for the Fast Ethernet bus in a round-robin fashion. Contenders are the serial communications controllers (SCCs), Ethernet controller, and cache. This process of round-robin polling uses up clock cycles, resulting in lower fast-switching performance.

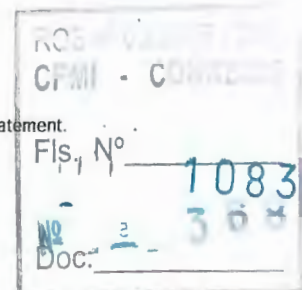
### Internal Expansion Slot and Encryption Card

**Q.** Can the internal expansion slot of the Cisco 1751 router support the advanced integration module (AIM) expansion cards (for example, encryption) that is supported on the Cisco 2600 series?

**A.** No. The Cisco 2600 series has an AIM slot that is based on a protocol control information (PCI)-bus architecture; the Cisco 1751 router, on the other hand, uses a Q-bus to lower cost. Although the expansion cards on these platforms are not the same, the encryption technology is interoperable and, therefore, creates a complete Cisco end-to-end solution.

**Q.** Does the Cisco 1751 support the 1700 VPN module that accelerates DES and 3DES for IPSec?

**A.** Yes. See VPN Module Q&A at: [http://www.in.cisco.com/Mkt/cmc/cc/cisco/mkt/access/1700/internal/vpn17\\_qa.htm](http://www.in.cisco.com/Mkt/cmc/cc/cisco/mkt/access/1700/internal/vpn17_qa.htm).







### Compression

**Q.** Does the Cisco 1751 router support compression?

**A.** Yes. Up to 4:1 compression is supported. The Cisco 1751 router supports both Stac and predictor compression algorithms. Compression performance for the Cisco 1751 router has not been measured yet.

**Q.** What compression algorithms are supported on the Cisco 1751 router?

**A.** The WAN interfaces of the Cisco 1751 router support the types of compression algorithms for each of the WAN encapsulations given in Table 14.

**Table 14** Compression Algorithms Supported on the Cisco 1751 Router

Encapsulation	Compression Algorithm
PPP	Predictor stacker
Frame Relay	Payload
HDLC	Stac
X.25	Payload
LAPB	Predictor Stac

### IBM/SNA Features

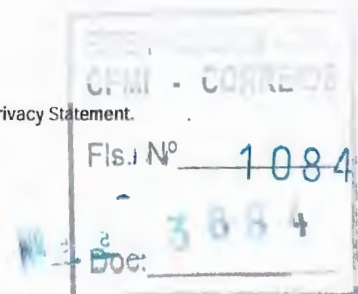
**Q.** What IBM/SNA features are available for Cisco 1751 router?

**A.** The supported IBM/SNA features on the Cisco 1751 router are equivalent to those supported on the Cisco 1600-R, 2500, and 2600 series routers (see Table 15):

**Table 15** IBM/SNA Features Supported on the Cisco 1751 Router

STUN	NetBIOS
SDLC	SNA priority queue
SDLLC	NetView NSP
Bisync	BSTUN native client interface architecture (NCIA) server
DLSW+ (data-link switching plus)	Local acknowledgment
QLLC	RSRB (required for DLSw)
FRAS (BNN, BAN, RFC 1490)	Response time reporter (internetwork performance monitor)
IBM Network Manager/LAN Manager	All CiscoWorks Blue (maps and so on)
DSPU	All Cisco IBM MIBs

**Note:** Token Ring and Advanced Peer-to-Peer Networking (APPN), supported on the Cisco 2500 and 2600 series, are not supported on Cisco 1600-R series and 1751 routers.





**Q.** Will the Cisco 1751 router support Token Ring interfaces?

**A.** No, there are no plans to support Token Ring on the Cisco 1751 router.

**Q.** When do I sell a Cisco 1751 router IBM solution?

**A.** The Cisco 1751 router is best sold for IBM/SNA opportunities that require:

- One Ethernet/1-5 WAN configuration (including the AUX)
- Modularity/flexibility—The Cisco 1751 series provides two WAN interface card slots, allowing customers to add or change WAN services as needed
- Multiservice voice/data integration now or in the future

**Q.** What IBM/SNA software feature sets are available for Cisco 1751 router?

**A.** IBM/SNA feature sets available for Cisco 1751 router include:

- IP/IPX/AppleTalk/IBM
- IP/ADSL/IPX/AppleTalk/IBM Plus
- IP/ADSL/IPX/AT/IBM/FW/IDS Plus IPsec 56
- IP/ADSL/IPX/AT/IBM/FW/IDS Plus IPsec 3DES
- IP/ADSL/IPX/AT/IBM/FW/IDS/Voice Plus IPsec 56
- IP/ADSL/IPX/AT/IBM/FW/IDS/Voice Plus IPsec 3DES

**Note:** Use Plus for L2F, L2TP, BGP, NTP, NLSP, RSVP, IP multicast, Frame Relay SVC, and encryption support.

### **Memory Architecture**

**Q.** What memory architecture does the Cisco 1751 router use?

**Q.** The Cisco 1751 router uses the run-from-RAM memory architecture.

**Q.** What type of DRAM memory does the Cisco 1751 router use?

**A.** The Cisco 1751 router uses synchronous DRAM (SDRAM). The default DRAM is 32 MB fixed onboard for the 1751 model, and 64 MB for the 1751-V model. There is one DIMM slot for adding additional memory in increments of 16, 32, and 64 MB. The maximum DRAM for the 1751 model is 96MB (32 MB onboard plus 64 MB DIMM). The maximum DRAM for the 1751-V model is 128MB (64 MB onboard plus 64 MB DIMM).

	<i>Cisco 1751</i>	<i>Cisco 1751-V</i>
Default DRAM (MB)	32	64
Max. DRAM (MB)	96	128





**Q.** What type of Flash memory does the Cisco 1751 router use?

**A.** The Cisco 1751 router uses onboard (soldered on the motherboard) flash. The Cisco 1751 has 16 MB of flash. The Cisco 1751-V has 32 MB of flash. This is a fixed configuration—it is not upgradeable and there is not a flash card slot on the motherboard to add more flash.

	Cisco 1751	Cisco 1751-V
Default Flash (MB)	16	32
Max. Flash (MB)	16	32

**Q.** What is the flash memory used for?

**A.** Cisco IOS software and configuration files are stored in flash. Also, flash memory allows software upgrades to be downloaded over the WAN or LAN link to be stored in the Mini-Flash card.

**Q.** How are software images and configuration files stored in flash?

**A.** Flash comes preprogrammed with Cisco IOS software. Software upgrades and configuration files must be copied using Trivial File Transfer Protocol (TFTP) onto a Mini-Flash card in a Cisco 1751 router.

**Q.** Is dual Flash bank supported on Cisco 1751 routers?

**A.** Yes. Dual Flash bank is supported. Although both the Cisco 1751 and Cisco 1751-V support dual flash bank, we recommend that customers requiring dual flash bank purchase the Cisco 1751-V model since it comes with 32 MB flash.

**Q.** Does the Cisco 1751 use the same DRAM as the Cisco 1720/1750?

**A.** Yes. However, the Cisco 1751 does not support the 4 and 8 MB DIMM (MEM1700-4D= and MEM1700-8D=). In addition there is a new 64MB DIMM available for the Cisco 1751.

**Q.** Does the Cisco 1751 use the same flash as the Cisco 1720/1750?

**A.** No. The flash in the Cisco 1751 is soldered on the motherboard, and is therefore not upgradeable.

**Q.** Can the amount of shared (input/output [I/O]) memory on a Cisco 1751 router be configured?

**A.** Yes. It can be modified using Cisco IOS command-line interface (CLI) and saved as part of the router configuration.

### **Power Supply**

**Q.** What type of power supplies does the Cisco 1751 router use?

**A.** The Cisco 1751 router uses one universal power supply that is applicable for all countries. There are no country-specific power supplies. The AC input voltage of this universal power supply spans from 100 to 240 V; the frequency from 47 to 64 Hz. (Although this power supply works in all countries, the user still has to specify the power cord appropriate for a particular country.) The router also has a locking connector on the power socket to ensure that the power cord remains securely fastened.



## MTBF

**Q.** What is the mean time between failures (MTBF) for the Cisco 1751 router?

**A.** The predicted MTBF is 514,526 hours. This predicted MTBF includes the chassis and external power supply but not the WAN interface cards or voice interface cards.

## Network Management

**Q.** How is the Cisco 1751 router managed?

**A.** Like all Cisco routers, the Cisco 1751 router can be managed via Simple Network Management Protocol (SNMP), via a Telnet session, and through a directly connected terminal or PC running terminal emulator software.

**Q.** Do CiscoView, CiscoWorks2000, and Cisco Voice Manager support Cisco 1751 routers?

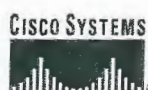
**A.** Yes, CiscoView, CiscoWorks2000 and Cisco Voice Manager supported.

**Q.** Does Cisco ConfigMaker support Cisco 1751 routers?

**A.** Yes, Cisco ConfigMaker supports Cisco 1751 routers, starting with Release 2.5b.

**Q.** Does the Cisco 1751 router support Remote Monitoring (RMON)?

**A.** The Cisco 1751 router supports only RMON lite. RMON lite covers two out of the nine RMON groups, alarms, and events. Full RMON (statistics, history, hosts, hostTopN, matrix, filter, capture) features are available for the Cisco 2500 and 2600 series routers.



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LW3282 5/02

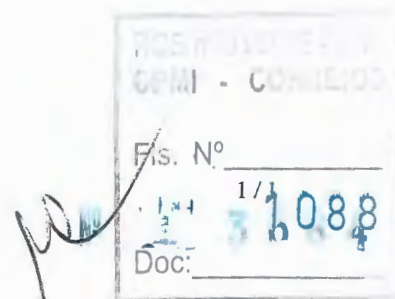
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## ANEXO SERVIDOR DE SEGURANÇA LÓGICA TIPO 01 E 02 PARTE 1



**Servidor de  
Segurança  
Lógica - Tipo 1**

PIX535

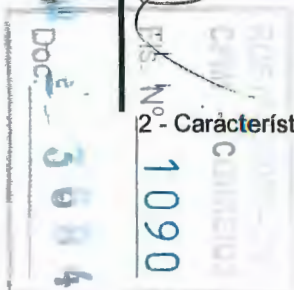
ATRIBUTO	REQUISITOS DO EDITAL	ATRIBUTOS OFERTADOS	ATRIBUTOS OFERTADOS ADICIONALMENTE	CONFIRMA ATENDIMENTO (SIM / NÃO)	PÁGINA DA DOCUMENTAÇÃO TÉCNICA
1 - Descrição	Operar como Firewall, sendo formado por no mínimo por dois módulos que deverão integrar-se aos dois Switches Tipo 1 a serem instalados em BSB e dois módulos que deverão integrar-se aos dois Switches Tipo 1 a serem instalados em SPO	Foram utilizados dois Servidores PIX535, externos aos Switches tipo 1	N/A	N/A	N/A
	Será permitida a utilização de servidores, em substituição aos módulos, considerando-se a razão de um par de servidores em substituição a um módulos. Os servidores deverão trabalhar em pares , com o objetivo de manter a alta disponibilidade do sistema	Conforme Edital Foram utilizados dois Servidores PIX535, externos aos Switches tipo 1	N/A	SIM	Ver propostas Técnica e Comercial
	O produto tem que oferecer controle de acesso, permitindo-se atender a uma política de segurança, definindo o tipo de tráfego que pode entrar/sair das redes protegidas por ele.	Conforme Edital	N/A	SIM	Anexo 29 - pág. 1, 2
	Autenticação	Conforme Edital	N/A	SIM	Anexo 29 - pág. 4
	NAT 1-1 e NAT 1-n	Conforme Edital	N/A	SIM	Anexo 29 - pág. 4





Segurança de conteúdo (antivírus, checagem de URL e Java/ActiveX)	Conforme Edital	N/A	SIM	Anexo 40 - pág. 1 Anexo 41 - pág. 1 Anexo 42 - pág. 1
Auditoria	Conforme Edital	N/A	SIM	Anexo 29 - pág. 3
Disponibilidade. No caso de falha, uma segunda máquina ou módulo deve assumir o controle de forma transparente ao usuário (Stateful Firewall Failover)	Conforme Edital	N/A	SIM	Anexo 29 - pág. 6
Gerar alertas em tempo real por meio de e-mail quando se tentar violar a política de segurança	Conforme Edital	N/A	SIM	Anexo 43 - pág. 1
Proteção baseada no algoritmo de segurança adaptável (ASA - Adaptive Secure Algorithm) ou compatível, que ofereça um firewall orientado à conexão com classificação	Conforme Edital	N/A	SIM	Anexo 29 - pág. 1
Prevenção contra ataques de negação de serviço (Denial-of-Service)	Conforme Edital	N/A	SIM	Anexo 29 - pág. 2
Suporte à aplicações Multimídia	Conforme Edital	N/A	SIM	Anexo 29 - pág. 1
Suporte à gerência de Listas de Acesso em roteadores	Conforme Edital	N/A	SIM	Anexo 44 (todas as páginas) Anexo 45 (todas as páginas) Anexo 46 (todas as páginas)
Configuração e gerência centralizada em cada um dos sites	Conforme Edital	N/A	SIM	Anexo 29 (todas as páginas)
Capacidade de gerenciamento remoto	Conforme Edital	N/A	SIM	Anexo 29 (todas as páginas)

2 - Características e



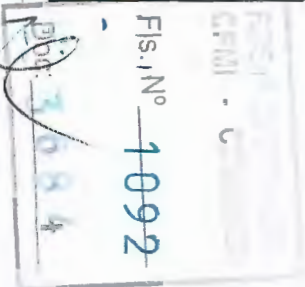
2 - Características e Funcionalidades

Suporte de serviços estendido para todo o protocolo IP, com possibilidade de customização	Conforme Edital	N/A	SIM	Anexo 48 (todas as páginas) Anexo 49 (todas as páginas)
A Interface deve permitir a visualização da política de segurança definida, com opção de ocultar e visualizar grupos de regras desejados e o diagrama da rede protegida	Conforme Edital	N/A	SIM	Anexo 49 (todas as páginas) Anexo 50 (todas as páginas)
Capacidade de gerar relatórios gerenciais, com informações sobre estatísticas de tráfego, regras mais utilizadas e etc.	Conforme Edital	N/A	SIM	Anexo 51 (todas as páginas)
Suportar integração com produtos para sistemas de inspeção de conteúdo (HTTP, FTP, SMTP) de terceiros e suporte ao protocolo H.323	Conforme Edital	N/A	SIM	Anexo 52 - pág. 4-6, 48, 4-9, 4-13
O produto deverá integrar-se perfeitamente com o Sistema para Detecção de Intruso oferecido	Conforme Edital	N/A	SIM	Anexo 29 - pág. 4
Suportar autenticação de usuário, autenticação de sessão e autenticação de cliente, bem como interagir com sistemas de autenticação RADIUS e TACACS	Conforme Edital	N/A	SIM	Anexo 29 (todas as páginas)





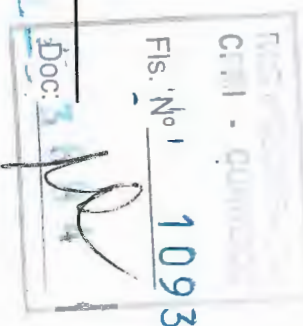
	O sistema de gerenciamento de Firewalls deverá ser disponibilizado pela CONTRATADA em hardware à parte, sendo um sistema em BSB e um sistema em SPO, podendo ser integrado em um mesmo frame work de gerenciamento dos servidores para Detecção de Intrusos, Switch tipo 6 e roteador tipo 1.	Conforme Edital Foram disponibilizados dois servidores Intel para o gerenciamento. Um em BSB e outro em SPO	N/A	SIM	Ver propostas Técnica e Comercial
3 - Características de Desempenho	Capacidade de tratar no mínimo 400.000 conexões simultâneas	Conforme Edital	N/A	SIM	Anexo 29 - pag. 6
	Capacidade de processamento superior a 1.5 Gbps em texto claro	Conforme Edital	N/A	SIM	Anexo 29 - pag. 6
4 - Configuração Física do Equipamento	Em caso de fornecimento de equipamentos externos ao Switch tipo 1, estes deverão possuir no mínimo 06 interfaces 10/100TX e 02 interface 1000BaseSX	Conforme Edital	N/A	SIM	Anexo 29 - pag. 6 Anexo 54 (todas as páginas) Anexo 55 (todas as páginas)
5- Características Adicionais	Todo o ambiente de Firewall deverá ser acompanhado de documentação de instalação e configuração	Conforme Edital	N/A	SIM	A CONTRATADA se responsabilizará por toda a documentação de instalação e configuração
	Possuir alimentação elétrica de acordo com a localidade onde serão instalados os equipamentos, com frequência de 60Hz	Conforme Edital	N/A	SIM	Anexo 29 - pag. 7



**Servidor de  
Segurança  
Lógica - Tipo 2**

PIX525

ATRIBUTO	REQUISITOS DO EDITAL	ATRIBUTOS OFERTADOS	ATRIBUTOS OFERTADOS ADICIONALMENTE	CONFIRMA ATENDIMENTO (SIM / NÃO)	PÁGINA DA DOCUMENTAÇÃO TÉCNICA
1 - Descrição	Operar como Firewall, devendo ser formados por pares de máquinas, com cada par trabalhando em conjunto, com o objetivo de manter a alta disponibilidade do sistema: Um par deverá ser instalado em BSB e um par deverá ser instalado em SPO	Conforme Edital	N/A	SIM	Anexo 53 - pag. 1
	Oferecer controle de acesso permitindo atendimento a política de segurança, definindo o tipo de tráfego de entrada e saída da rede, protegida por ele	Conforme Edital	N/A	SIM	Anexo 53 (todas as páginas)
	Autenticação	Conforme Edital	N/A	SIM	Anexo 53 - pag. 4
	NAT 1-1 e NAT 1-n	Conforme Edital	N/A	SIM	Anexo 53 - pag. 4
	Segurança de conteúdo (antivírus, checagem de URL e Java/ActiveX)	Conforme Edital	N/A	SIM	Anexo 40 - pag. 1 Anexo 41 - pag. 1 Anexo 42 - pag. 1
	Auditoria	Conforme Edital	N/A	SIM	Anexo 53 - pag. 3
	Gerenciamento Corporativo, permitindo que vários equipamentos sejam gerenciados de uma única console	Conforme Edital	N/A	SIM	Anexo 53 - pag. 6





Disponibilidade. No caso de falha, uma segunda máquina ou módulo deve assumir o controle de forma transparente ao usuário (Stateful Firewall Failover)	Conforme Edital	N/A	SIM	Anexo 43 - pág. 1
Gerar alertas em tempo real por meio de e-mail quando se tentar violar a política de segurança	Conforme Edital	N/A	SiM	Anexo 53- pág. 1
Proteção baseada no algoritmo de segurança adaptável (ASA - Adaptive Secure Algorithm) ou compatível, que ofereça um firewall orientado à conexão com classificação	Conforme Edital	N/A	SIM	Anexo 53 - pág. 2
Prevenção contra ataques de negação de serviço (Denial-of-Service)	Conforme Edital	N/A	SIM	Anexo 53 - pág. 1
Suporte à aplicações Multimídia	Conforme Edital	N/A	SIM	Anexo 44 (todas as páginas) Anexo 45 (todas as páginas) Anexo 46 (todas as páginas)
Suporte à gerência de Listas de Acesso em roteadores	Conforme Edital	N/A	SIM	Anexo 53 (todas as páginas)
Configuração e gerência centralizada em cada um dos sites	Conforme Edital	N/A	SIM	Anexo 53 (todas as páginas)
Capacidade de gerenciamento remoto	Conforme Edital	N/A	SIM	Anexo 48 (todas as páginas) Anexo 49 (todas as páginas)
Suporte de serviços estendido para todo o protocolo IP, com possibilidade de customização	Conforme Edital	N/A	SIM	Anexo 49 (todas as páginas) Anexo 50 (todas as páginas)

2 - Características e Funcionalidades

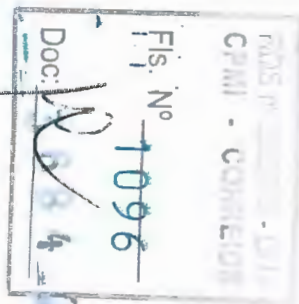


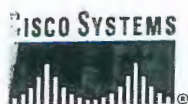
A Interface deve permitir a visualização da política de segurança definida, com opção de ocultar e visualizar grupos de regras desejados e o diagrama da rede protegida	Conforme Edital	N/A	SIM	Anexo 51 (todas as páginas)
Capacidade de gerar relatórios gerenciais, com informações sobre estatísticas de tráfego, regras mais utilizadas e etc.	Conforme Edital	N/A	SIM	Anexo 52 - pág. 4-6, 48, 4-9, 4-13
Suportar integração com produtos para sistemas de inspeção de conteúdo (HTTP, FTP, SMTP) de terceiros e suporte ao protocolo H.323	Conforme Edital	N/A	SIM	Anexo 53 - pág. 4
O produto deverá integrar-se perfeitamente com o Sistema para Detecção de Intruso oferecido	Conforme Edital	N/A	SIM	Anexo 53 (todas as páginas)
Suportar autenticação de usuário, autenticação de sessão e autenticação de cliente, bem como interagir com sistemas de autenticação RADIUS e TACACS	Conforme Edital Foram disponibilizados dois servidores Intel para o gerenciamento. Um em BSB e outro em SPO	N/A	SIM	Ver propostas Técnica e Comercial
Suportar VPN padrão IPSec, com as seguintes características: Algoritmos de criptografia (DES e 3DES), capacidade superior a 1000 conexões simultâneas, capacidade de processamento em 3DES superior a 50Mbps, suporte a certificados digitais X.509v3	Conforme Edital	N/A	SIM	Anexo 53 - pág. 6





	O sistema de gerenciamento de Firewalls deverá ser disponibilizado no mesmo hardware gerenciador dos Servidores de Segurança Lógica tipo 1 em BSB e SPO	Conforme Edital	N/A	SIM	Anexo 53 - pág. 6
3 - Características de Desempenho	Capacidade de tratar no mínimo 280.000 conexões simultâneas	Conforme Edital	N/A	SIM	Anexo 53 - pág. 6 Anexo 54 (todas as páginas) Anexo 55 (todas as páginas)
	Capacidade de processamento superior a 350Mbps em texto claro	Conforme Edital	N/A	SIM	A CONTRATADA se responsabilizará por toda a documentação de instalação e configuração
4 - Configuração Física do Equipamento	Em caso de fornecimento de equipamentos externos ao Switch tipo 1, estes deverão possuir no mínimo 06 interfaces 10/100TX e 01 interface 1000BaseSX	Conforme Edital	N/A	SIM	Anexo 53 - pág. 7
5- Características Adicionais	Todo o ambiente de Firewall deverá ser acompanhado de documentação de instalação e configuração	Conforme Edital	N/A	SIM	A CONTRATADA se responsabilizará por toda a documentação de instalação e configuração
	Possuir alimentação elétrica de acordo com a localidade onde serão instalados os equipamentos, com frequência de 60Hz	Conforme Edital	N/A	SIM	Anexo 53 - pág. 7





## Cisco PIX 535 Security Appliance

The Cisco PIX<sup>®</sup> 535 Security Appliance delivers enterprise-class security for enterprise and service provider networks in a high performance, purpose-built appliance. Its highly modular three-rack unit (3RU) design supports up to ten 10/100 Fast Ethernet interfaces or nine Gigabit Ethernet interfaces as well as redundant power supplies, making it an ideal choice for businesses requiring the highest levels of performance, port density, reliability, and investment protection. Part of the world-leading Cisco PIX Security Appliance Series, the Cisco PIX 535 Security Appliance provides a wide range of rich integrated security services, hardware VPN acceleration capabilities, and powerful remote management capabilities in a highly scalable, high-performance solution.

### Enterprise-Class Security for Large Enterprise and Service Provider Networks

The Cisco PIX 535 Security Appliance delivers a multilayered defense for enterprise and service provider networks through rich, integrated security services including stateful inspection firewalling, protocol and application inspection, virtual private networking (VPN) in-line intrusion protection, and rich multimedia and voice security in a single device. The state-of-the-art Cisco Adaptive Security Algorithm (ASA) provides rich stateful inspection firewall services, tracking the state

of all authorized network communications and preventing unauthorized network access.

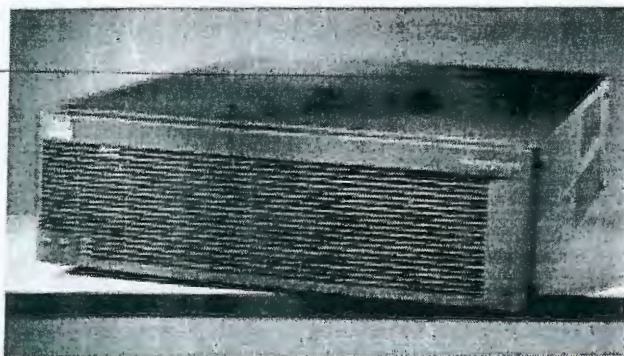
Enterprise networks benefit from an additional layer of security via intelligent, "application-aware" security services that examine packet streams at Layers 4-7, using inspection engines specialized for many of today's popular applications.

Administrators can also easily create custom security policies for firewall traffic by using the flexible access control methods and the more than 100 predefined applications, services, and protocols that Cisco PIX Security Appliances provide.

### Market-Leading Voice-over-IP Security Services Protect Next-Generation Converged Networks

Cisco PIX Security Appliances provide market-leading protection for a wide range of voice-over-IP (VoIP) and multimedia standards, allowing businesses to securely take advantage of the many benefits that converged data, voice, and video networks deliver. By combining VPN with the rich

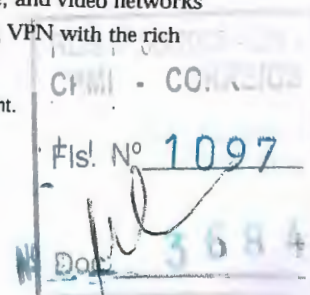
**Figure 1**  
Cisco PIX 535 Security Appliance



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stateful inspection firewall services that Cisco PIX Security Appliances provide for these converged networking standards, businesses can securely extend voice and multimedia services to home office and remote office environments for additional cost savings, improved productivity, and competitive advantage.

### **Flexible VPN Services Extend Networks Economically to Remote Networks and Mobile Users**

Businesses can securely extend their networks across low-cost Internet connections to mobile users, business partners, and remote offices worldwide using the full-featured VPN capabilities provided by the Cisco PIX 535 Security Appliance. Solutions range from standards-based site-to-site VPN leveraging the Internet Key Exchange (IKE) and IP security (IPsec) VPN standards, to the innovative Cisco Easy VPN capabilities found in Cisco PIX Security Appliances and other Cisco security solutions—such as Cisco IOS® routers and Cisco VPN 3000 Series Concentrators. Easy VPN delivers a uniquely scalable, cost-effective, and easy-to-manage remote-access VPN architecture that eliminates the operational costs associated with maintaining remote-device configurations typically required by traditional VPN solutions. Cisco PIX Security Appliances encrypt data using 56-bit Data Encryption Standard (DES), 168-bit Triple DES (3DES), or up to 256-bit Advanced Encryption Standard (AES) encryption. Certain Cisco PIX 535 Security Appliance models have integrated hardware VPN acceleration capabilities, delivering highly scalable, high performance VPN services.

### **Integrated Intrusion Protection Guards Against Popular Internet Threats**

The integrated in-line intrusion-protection capabilities of the Cisco PIX 535 Security Appliance can protect enterprise networks from many popular forms of attacks, including Denial-of-Service (DoS) attacks and malformed packet attacks. Using a wealth of advanced intrusion-protection features, including DNSGuard, FloodGuard, FragGuard, MailGuard, IPVerify and TCP intercept, in addition to looking for more than 55 different attack “signatures,” Cisco PIX Security Appliances keep a vigilant watch for attacks, can optionally block them, and can notify administrators about them in real time.

### **Award-Winning Resiliency Provides Maximum Business Uptime**

Select models of Cisco PIX 535 Security Appliances provide stateful failover capabilities that ensure resilient network protection for enterprise network environments. Employing a cost-effective, active-standby, high-availability architecture, Cisco PIX Security Appliances that are configured as a failover pair continuously synchronize their connection state and device configuration data. Synchronization can take place over a high-speed LAN connection, providing another layer of protection through the ability to geographically separate the failover pair. In the event of a system or network failure, network sessions are automatically transitioned between appliances, with complete transparency to users.

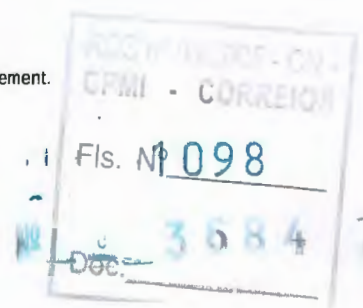
### **Robust Remote-Management Solutions Lower Total Cost of Ownership**

The Cisco PIX 535 Security Appliance is a reliable, easy-to-maintain platform that provides a wide variety of methods for configuring, monitoring, and troubleshooting. Management solutions range from centralized, policy-based management tools to integrated, Web-based management to support for remote monitoring protocols such as Simple Network Management Protocol (SNMP) and syslog.

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Administrators can easily manage large numbers of remote Cisco PIX Security Appliances using CiscoWorks VPN/ Security Management Solution (VMS). This suite consists of numerous modules including Management Center for Firewalls, Auto Update Server Software and Security Monitor. This powerful combination provides a highly scalable, next-generation, three-tier management solution that includes the following features:

- Comprehensive configuration and software image management
- Device hierarchy with "Smart Rules"-based configuration inheritance
- Customizable administrative roles and access privileges
- Comprehensive enterprise change management and auditing
- "Touchless" software image management for remote Cisco PIX Security Appliances
- Support for dynamically addressed appliances

Additional integrated event management and inventory solutions are also available as part of the CiscoWorks VMS network management suite.

The integrated Cisco PIX Device Manager provides an intuitive, Web-based management interface for remotely configuring, monitoring, and troubleshooting a Cisco PIX 535 Security Appliance—without requiring any software (other than a standard Web browser) to be installed on an administrator's computer. A setup wizard is provided for easy installation into any network environment.

Alternatively, through methods including Telnet and Secure Shell (SSH), or out of band through a console port, administrators can remotely configure, monitor, and troubleshoot Cisco PIX Security Appliances using a command-line interface (CLI).

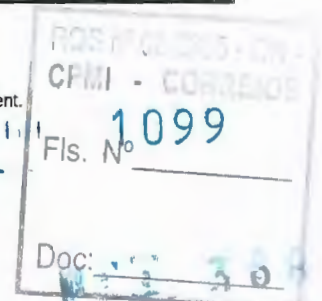
**Table 1** Key Product Features and Benefits

Key Features	Benefit
<b>Enterprise-Class Security</b>	
True security appliance	<ul style="list-style-type: none"><li>• Uses a proprietary, hardened operating system that eliminates security risks associated with general purpose operating systems</li><li>• Cisco quality and no moving parts provide a highly reliable security platform</li></ul>
Stateful inspection firewall	<ul style="list-style-type: none"><li>• Provides perimeter network security to prevent unauthorized network access</li><li>• Uses state-of-the-art Cisco ASA for robust stateful inspection firewall services</li><li>• Provides flexible access-control capabilities for over 100 predefined applications, services and protocols, with the ability to define custom applications and services</li><li>• Includes numerous application-aware inspection engines that secure advanced networking protocols such as H.323 Version 4, Session Initiation Protocol (SIP), Cisco Skinny Client Control Protocol (SCCP), Real-Time Streaming Protocol (RTSP), Internet Locator Service (ILS), and more</li><li>• Includes content filtering for Java and ActiveX applets</li></ul>
Easy VPN Server	<ul style="list-style-type: none"><li>• Provides remote access VPN concentrator services for a wide variety of Cisco software or hardware-based VPN clients</li><li>• Pushes VPN policy dynamically to Cisco Easy VPN Remote-enabled solutions upon connection, ensuring the latest corporate security policies are enforced</li><li>• Extends VPN reach into environments using Network Address Translation (NAT) or Port Address Translation (PAT), via support of Internet Engineering Task Force (IETF) UDP-based draft standard for NAT traversal</li></ul>

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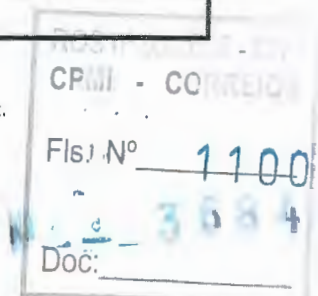
**Table 1** Key Product Features and Benefits

Key Features	Benefit
Site-to-site VPN	<ul style="list-style-type: none"><li>• Supports IKE and IPsec VPN standards</li><li>• Ensures data privacy/integrity and strong authentication to remote networks and remote users over the Internet</li><li>• Supports 56-bit DES, 168-bit 3DES and up to 256-bit AES data encryption to ensure data privacy</li></ul>
Intrusion protection	<ul style="list-style-type: none"><li>• Provides protection from over 55 different types of popular network-based attacks ranging from malformed packet attacks to DoS attacks</li><li>• Integrates with Cisco Network Intrusion Detection System (IDS) sensors for the ability to dynamically block/shun hostile network nodes via the firewall</li></ul>
AAA support	<ul style="list-style-type: none"><li>• Integrates with popular authentication, authorization, and accounting services via TACACS+ and RADIUS support</li><li>• Provides tight integration with Cisco Secure Access Control Server (ACS)</li></ul>
X.509 certificate and CRL support	<ul style="list-style-type: none"><li>• Supports SCEP-based enrollment with leading X.509 solutions from Baltimore, Entrust, Microsoft, and VeriSign</li></ul>
Integration with leading third-party solutions	<ul style="list-style-type: none"><li>• Supports the broad range of Cisco AVVID (Architecture for Voice, Video and Integrated Data) partner solutions that provide URL filtering, content filtering, virus protection, scalable remote management, and more</li></ul>
<b>Robust Network Services/Integration</b>	
Virtual LAN (VLAN)-based virtual interfaces	<ul style="list-style-type: none"><li>• Provides increased flexibility when defining security policies and eases overall integration into switched network environments by supporting the creation of logical interfaces based on IEEE 802.1q VLAN tags, and the creation of security policies based on these virtual interfaces</li><li>• Supports multiple virtual interfaces on a single physical interface through VLAN trunking</li><li>• Supports multiple VLAN trunks per Cisco PIX Security Appliances</li><li>• Supports up to 24 VLANs on Cisco PIX 535 Security Appliances</li></ul>
Open Shortest Path First (OSPF) dynamic routing	<ul style="list-style-type: none"><li>• Provides comprehensive OSPF dynamic routing services using technology based on world-renowned Cisco IOS Software</li><li>• Offers improved network reliability through fast route convergence and secure, efficient route distribution</li><li>• Delivers a secure routing solution in environments using NAT through tight integration with Cisco PIX Security Appliance NAT services</li><li>• Supports MD5-based OSPF authentication, in addition to plaintext OSPF authentication, to prevent route spoofing and various routing-based DoS attacks</li><li>• Provides route redistribution between OSPF processes, including OSPF, static, and connected routes</li><li>• Supports load balancing across equal-cost multipath routes</li></ul>
DHCP server	<ul style="list-style-type: none"><li>• Provides DHCP Server services one or more interfaces for devices to obtain IP addresses dynamically</li><li>• Includes extensions for support of Cisco IP Phones and Cisco SoftPhone IP telephony solutions</li></ul>
DHCP relay	<ul style="list-style-type: none"><li>• Forwards DHCP requests from internal devices to an administrator-specified DHCP server, enabling centralized distribution, tracking, and maintenance of IP addresses</li></ul>
NAT/PAT support	<ul style="list-style-type: none"><li>• Provides rich dynamic/static NAT and PAT capabilities</li></ul>

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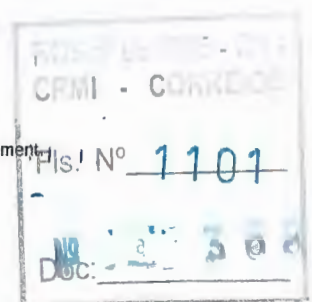
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**Table 1** Key Product Features and Benefits

Key Features	Benefit
<b>Rich Management Capabilities</b>	
CiscoWorks VPN/ Security Management Solution (CiscoWorks VMS)	<ul style="list-style-type: none"><li>• Comprehensive management suite for large scale deployments</li><li>• Integrates policy management, software maintenance, and security monitoring</li></ul>
PIX Device Manager (PDM)	<ul style="list-style-type: none"><li>• Intuitive, Web-based GUI enables simple, secure remote management of Cisco PIX Security Appliances</li><li>• Provides wide range of informative, real-time, and historical reports which give critical insight into usage trends, performance baselines, and security events</li></ul>
Auto Update	<ul style="list-style-type: none"><li>• Provides "touchless" secure remote management of Cisco PIX Security Appliance configuration and software images via a unique push/pull management model</li><li>• Next-generation secure XML/HTTPS management interface can be leveraged by Cisco and third-party management applications for remote Cisco PIX Security Appliance configuration management, inventory, software image management/deployment and monitoring</li><li>• Integrates seamlessly with Management Center for Firewalls and Auto Update Server for robust, scalable remote management of up to 1000 Cisco PIX Security Appliances (per management server)</li></ul>
Cisco PIX CLI	<ul style="list-style-type: none"><li>• Allows customers to use existing PIX CLI knowledge for easy installation and management without additional training</li><li>• Accessible through variety of methods including console port, Telnet and SSH</li></ul>
Command-level authorization	<ul style="list-style-type: none"><li>• Enables businesses to create up to 16 customizable administrative roles/profiles for accessing Cisco PIX Security Appliances (for example, monitoring only, read-only access to configuration, VPN administrator, firewall/NAT administrator, and so on)</li><li>• Leverages either the internal administrator database or outside sources via TACACS+, such as Cisco Secure ACS</li></ul>
SNMP and syslog support	<ul style="list-style-type: none"><li>• Provide remote monitoring and logging capabilities, with integration into Cisco and third-party management applications</li></ul>
<b>Highly Flexible Expansion Capabilities</b>	
Fast Ethernet and Gigabit Ethernet expansion options	<ul style="list-style-type: none"><li>• Supports easy installation of additional network interfaces via four 66-Mhz/64-bit and 5 33-MHz/32-bit PCI expansion slots</li><li>• Supports expansion cards including single-port Fast Ethernet card, 4-port Fast Ethernet card, and single-port Gigabit Ethernet card</li></ul>
Hardware VPN acceleration options	<ul style="list-style-type: none"><li>• Delivers high speed VPN services via support of VPN Accelerator Card (VAC) and VPN Accelerator Card+ (VAC+)</li></ul>







### License Options

The Cisco PIX 535 Security Appliance is available in three primary models that provide different levels of interface density, failover capabilities, and VPN throughput.

#### Restricted Software License

The Cisco PIX 535 "Restricted" (PIX 535-R) model provides an excellent value for organizations looking for robust Cisco PIX Security Appliance services with gigabit firewall throughput, high interface density, maximum investment protection, and moderate VPN throughput requirements. It includes 512 MB of RAM and support for up to eight 10/100 Fast Ethernet or eight Gigabit Ethernet interfaces.

#### Unrestricted Software License

The PIX 535 "Unrestricted" (PIX 535-UR) model extends the capabilities of the family with support for stateful failover, additional LAN interfaces, and increased VPN throughput via integrated hardware-based VPN acceleration. It includes an integrated VAC or VAC+ hardware VPN accelerator, 1 GB of RAM, and support for up to ten 10/100 Fast Ethernet or nine Gigabit Ethernet interfaces. The Cisco PIX 535-UR also adds the ability to share state information with a hot-standby Cisco PIX Security Appliance for resilient network protection.

#### Failover Software License

The Cisco PIX 535 "Failover" (PIX 535-FO) model is designed for use in conjunction with a PIX 535-UR, providing a cost-effective, high-availability solution. It operates in hot-standby mode acting as a complete redundant system that maintains current session state information. With the same hardware configuration as the Cisco PIX 535-UR, it delivers the ultimate in high availability for a fraction of the price.

### Performance Summary

Cleartext throughput: 1.7 Gbps

Concurrent connections: 500,000

168-bit 3DES IPsec VPN throughput: Up to 440 Mbps with VAC+ or 100 Mbps with VAC

128-bit AES IPsec VPN throughput: Up to 535 Mbps with VAC+

256-bit AES IPsec VPN throughput: Up to 440 Mbps with VAC+

Simultaneous VPN tunnels: 2000

### Technical Specifications

Processor: 1-GHz Intel Pentium III Processor

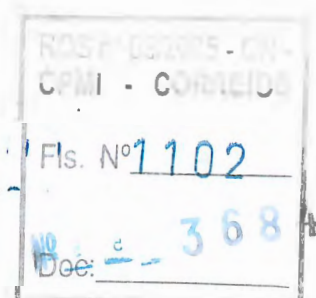
Random access memory: 512 MB or 1 GB of SDRAM

Flash memory: 16 MB

Cache: 256 KB level 2 at 1-GHz

System buses: Two 64-bit, 66 MHz PCI, one 32-bit, 33-MHz PCI

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## **Environmental Operating Ranges**

### **Operating**

Temperature: -25° to 131°F (-5° to 55°C)

Relative Humidity: 5% to 95%, noncondensing

Altitude: 0 to 9843 ft (3000 m)

Shock: 1.14 m/sec (45 in./sec) 1/2 sine input

Vibration: 0.41 Grms<sup>2</sup> (3-500 Hz) random input

Acoustic Noise: 65 dBa maximum

### **Nonoperating**

Temperature: -13° to 158°F (-25° to 70°C)

Relative Humidity: 5% to 95%, noncondensing

Altitude: 0 to 15,000 ft (4570 m)

Shock: 30 G

Vibration: 0.41 Grms<sup>2</sup> (3-500 Hz) random input

### **Power**

#### **Input (per power supply)**

Range Line Voltage: 100V to 240V AC or 48V DC

Nominal Line Voltage: 100V to 240V AC or 48V DC

Current: 4-2 Amps

Frequency: 50 to 60 Hz, single phase

Power: 220W (dual hot swap power supply capable)

#### **Output**

Steady State: 135W

Maximum Peak: 220W

Maximum Heat Dissipation: 750 BTU/hr, full power usage (220W)

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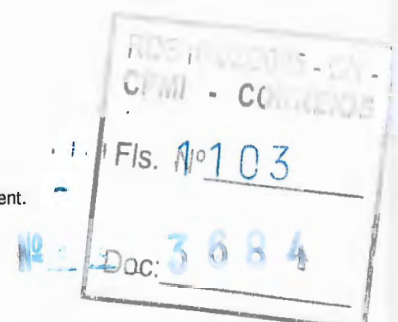
## **Physical Specifications**

### **Dimensions and Weight Specifications**

Form factor: 3 RU, standard 19-in. rack mountable

Dimensions (H x W x D): 5.25 x 17.5 x 18.25 in. (13.33 x 44.45 x 46.36 cm)

Weight (one power supply): 32 lb (14.5 kg)







### Expansion

Four 64-bit/66-MHz PCI slots

Five 32-bit/33-MHz PCI slots

Six 168-pin DIMM RAM slots, supporting up to 1 GB PC133 DRAM

### Interfaces

Console Port: RS-232 (RJ-45) 9600 baud

Failover Port: RS-232 (DB-15) 115 Kbps (Cisco specified cable required)

Two integrated 10/100 Fast Ethernet ports, auto-negotiate (half/full duplex), RJ-45

### Regulatory and Standards Compliance

#### Safety

UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950, AS/NZS3260, TS001, IEC60825, EN 60825, 21CFR1040

#### Electro Magnetic Compatibility (EMC)

FCC Part 15 (CFR 47) Class A, ICES 003 Class A with UTP, EN55022 Class A with UTP, CISPR 22 Class A with UTP, AS/NZ 3548 Class A with UTP, VCCI Class A with UTP, EN55024, EN50082-1 (1997), CE marking, EN55022 Class B with FTP, Cispr 22 Class B with FTP, AS/NZ 3548 Class B with FTP, VCCI Class B with FTP

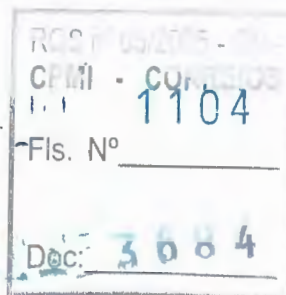
### Product Ordering Information

PIX-535	PIX 535 chassis only
PIX-535-R-BUN	PIX 535 restricted bundle (chassis, restricted software, 2 10/100 ports, 512 MB RAM)
PIX-535-UR-BUN	PIX 535 unrestricted bundle (chassis, unrestricted software, 2 10/100 ports, 1 GB RAM, VAC or VAC+)
PIX-535-FO-BUN	PIX 535 failover bundle (chassis, failover software, 2 10/100 ports, 1 GB RAM, VAC or VAC+)
PIX-535-HW=	PIX 535 rack mount kit, console cable, failover serial cable
PIX-FO=	PIX failover serial cable
PIX-4FE	4-port 10/100 Fast Ethernet PCI expansion card
PIX-1FE	Single-port 10/100 Fast Ethernet PCI expansion card
PIX-1GE-66	Single-port Gigabit Ethernet 64-bit/66-MHz PCI expansion card, Multimode (SX) SC connector
PIX-VPN-ACCEL	3DES IPsec hardware VAC
PIX-VAC-PLUS	3DES/AES IPsec hardware VAC+
PIX-VPN-3DES	168-bit 3DES and up to 256-bit AES encryption software license

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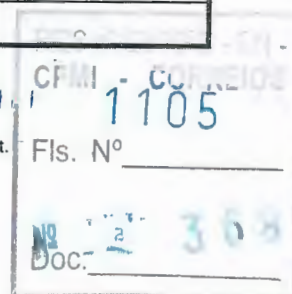
PIX-VPN-3DES=	168-bit 3DES and up to 256-bit AES encryption software license
PIX-VPN-DES	56-bit DES encryption software license
PIX-VPN-DES=	56-bit DES encryption software license

### Support Services

Support services are available from Cisco and Cisco partners. Cisco SMARTnet service augments customer support resources, and provides anywhere, anytime access to technical resources (both online and by telephone), the ability to download updated system software, and hardware advance replacement.

### Support Ordering Information

CON-SNT-PIX535	SMARTnet 8x5xNBD service for PIX 535 chassis only
CON-SNT-PIX535R	SMARTnet 8x5xNBD service for PIX 535-R bundle
CON-SNT-PIX535UR	SMARTnet 8x5xNBD service for PIX 535-UR bundle
CON-SNT-PIX535FO	SMARTnet 8x5xNBD service for PIX 535-FO bundle
CON-SNTE-PIX535	SMARTnet 8x5x4 service for PIX 535 chassis only
CON-SNTE-PIX535R	SMARTnet 8x5x4 service for PIX 535-R bundle
CON-SNTE-PIX535UR	SMARTnet 8x5x4 service for PIX 535-UR bundle
CON-SNTE-PIX535FO	SMARTnet 8x5x4 service for PIX 535-FO bundle
CON-SNTP-PIX535	SMARTnet 24x7x4 service for PIX 535 chassis only
CON-SNTP-PIX535R	SMARTnet 24x7x4 service for PIX 535-R bundle
CON-SNTP-PIX535UR	SMARTnet 24x7x4 service for PIX 535-UR bundle
CON-SNTP-PIX535FO	SMARTnet 24x7x4 service for PIX 535-FO bundle
CON-S2P-PIX535	SMARTnet 24x7x2 service for PIX 535-R chassis only
CON-S2P-PIX535R	SMARTnet 24x7x2 service for PIX 535-R bundle
CON-S2P-PIX535UR	SMARTnet 24x7x2 service for PIX 535-UR bundle
CON-S2P-PIX535FO	SMARTnet 24x7x2 service for PIX 535-FO bundle
CON-OS-PIX535	SMARTnet On-Site 8x5xNBD service for PIX 535 chassis only
CON-OS-PIX535R	SMARTnet On-Site 8x5xNBD service for PIX 535-R bundle
CON-OS-PIX535UR	SMARTnet On-Site 8x5xNBD service for PIX 535-UR bundle
CON-OS-PIX535FO	SMARTnet On-Site 8x5xNBD service for PIX 535-FO bundle
CON-OSE-PIX535	SMARTnet On-Site 8x5x4 service for PIX 535 chassis only
CON-OSE-PIX535R	SMARTnet On-Site 8x5x4 service for PIX 535-R bundle
CON-OSE-PIX535UR	SMARTnet On-Site 8x5x4 service for PIX 535-UR bundle







CON-OSE-PIX535FO	SMARTnet On-Site 8x5x4 service for PIX 535-FO bundle
CON-OSP-PIX535	SMARTnet On-Site 24x7x4 service for PIX 535 chassis only
CON-OSP-PIX535R	SMARTnet On-Site 24x7x4 service for PIX 535-R bundle
CON-OSP-PIX535UR	SMARTnet On-Site 24x7x4 service for PIX 535-UR bundle
CON-OSP-PIX535FO	SMARTnet On-Site 24x7x4 service for PIX 535-FO bundle

#### Additional Information

For more information, please visit the following links:

Cisco PIX Security Appliance Series:

<http://www.cisco.com/go/pix>

Cisco PIX Device Manager:

[http://www.cisco.com/warp/public/cc/pd/fw/sqfw500/prodlit/pixd3\\_ds.pdf](http://www.cisco.com/warp/public/cc/pd/fw/sqfw500/prodlit/pixd3_ds.pdf)

Cisco Secure ACS:

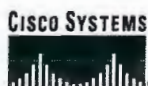
<http://www.cisco.com/go/acs>

CiscoWorks VMS, Management Center for Firewalls, Auto Update Server Software and Security Monitor:

<http://www.cisco.com/go/vms>

SAFE Blueprint from Cisco:

<http://www.cisco.com/go/safe>



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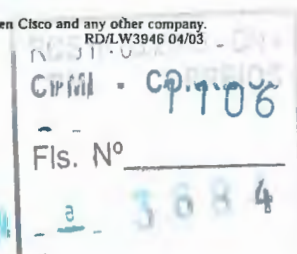
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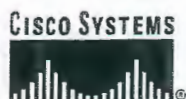
**Cisco Web site at [www.cisco.com/go/offices](http://www.cisco.com/go/offices)**

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## Cisco PIX 525 Security Appliance

The Cisco PIX® 525 Security Appliance delivers enterprise-class security for medium-to-large enterprise networks in a reliable, purpose-built appliance. Its modular two-rack unit (2RU) design supports up to eight 10/100 Fast Ethernet interfaces or three Gigabit Ethernet interfaces, making it an ideal choice for businesses requiring a resilient, high performance, Gigabit Ethernet-ready solution that provides solid investment protection. Part of the world-leading Cisco PIX Security Appliance Series, the Cisco PIX 525 Security Appliance provides a wide range of rich integrated security services, hardware VPN acceleration capabilities, and powerful remote management capabilities in a cost-effective, highly-resilient solution.

### Enterprise-Class Security for Medium-to-Large Enterprise Networks

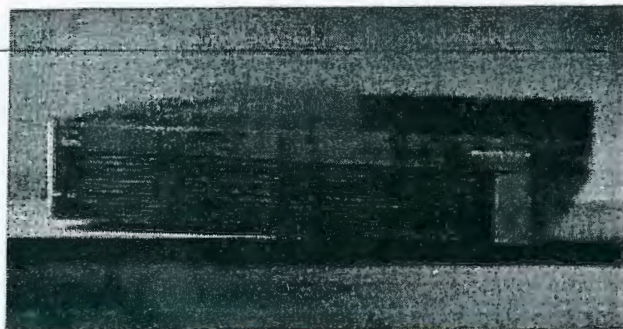
The Cisco PIX 525 Security Appliance delivers a multilayered defense for large enterprise networks through rich, integrated security services including stateful inspection firewalling, protocol and application inspection, virtual private networking (VPN) in-line intrusion protection and rich multimedia and voice security in a single device. The state-of-the-art Cisco Adaptive Security Algorithm (ASA) provides rich stateful inspection firewall services, tracking the state of all authorized network communications and preventing unauthorized network access.

Enterprise networks benefit from an additional layer of security via intelligent, "application-aware" security services that examine packet streams at Layers 4-7, using inspection engines specialized for many of today's popular applications. Administrators can also easily create custom security policies for firewall traffic by using the flexible access control methods and the more than 100 predefined applications, services, and protocols that Cisco PIX Security Appliances provide.

### Market-Leading Voice-over-IP Security Services Protect Next-Generation Converged Networks

Cisco PIX Security Appliances provide market-leading protection for a wide range of voice-over-IP (VoIP) and multimedia standards, allowing businesses to securely take advantage of the many benefits that converged data, voice, and video networks deliver. By combining VPN with the rich stateful inspection firewall services that Cisco PIX Security Appliances provide for these converged networking standards, businesses

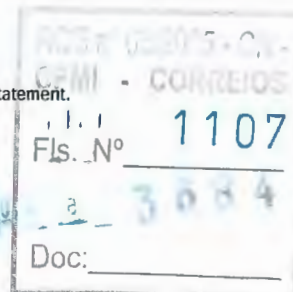
**Figure 1**  
Cisco PIX 525 Security Appliance



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can securely extend voice and multimedia services to home office and remote office environments for additional cost savings, improved productivity, and competitive advantage.

### **Flexible VPN Services Extend Networks Economically to Remote Networks and Mobile Users**

Businesses can securely extend their networks across low-cost Internet connections to mobile users, business partners, and remote offices worldwide using the full-featured VPN capabilities provided by the Cisco PIX 525 Security Appliance. Solutions range from standards-based site-to-site VPN leveraging the Internet Key Exchange (IKE) and IP security (IPsec) VPN standards, to the innovative Cisco Easy VPN capabilities found in Cisco PIX Security Appliances and other Cisco security solutions—such as Cisco IOS® routers and Cisco VPN 3000 Series Concentrators. Easy VPN delivers a uniquely scalable, cost-effective, and easy-to-manage remote-access VPN architecture that eliminates the operational costs associated with maintaining remote-device configurations typically required by traditional VPN solutions. Cisco PIX Security Appliances encrypt data using 56-bit Data Encryption Standard (DES), 168-bit Triple DES (3DES), or up to 256-bit Advanced Encryption Standard (AES) encryption. Certain Cisco PIX 525 Security Appliance models have integrated hardware VPN acceleration capabilities, delivering highly scalable, high performance VPN services.

### **Integrated Intrusion Protection Guards Against Popular Internet Threats**

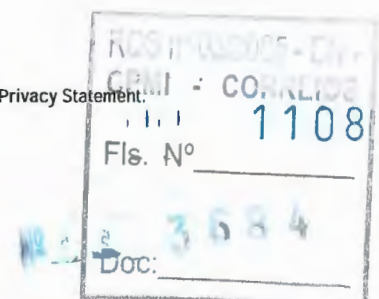
The integrated in-line intrusion-protection capabilities of the Cisco PIX 525 Security Appliance can protect enterprise networks from many popular forms of attacks, including Denial-of-Service (DoS) attacks and malformed packet attacks. Using a wealth of advanced intrusion-protection features, including DNSGuard, FloodGuard, FragGuard, MailGuard, IPVerify and TCP intercept, in addition to looking for more than 55 different attack “signatures,” Cisco PIX Security Appliances keep a vigilant watch for attacks, can optionally block them, and can notify administrators about them in real time.

### **Award-Winning Resiliency Provides Maximum Business Uptime**

Select models of Cisco PIX 525 Security Appliances provide stateful failover capabilities that ensure resilient network protection for enterprise network environments. Employing a cost-effective, active-standby, high-availability architecture, Cisco PIX Security Appliances that are configured as a failover pair continuously synchronize their connection state and device configuration data. Synchronization can take place over a high-speed LAN connection, providing another layer of protection through the ability to geographically separate the failover pair. In the event of a system or network failure, network sessions are automatically transitioned between appliances, with complete transparency to users.

### **Robust Remote-Management Solutions Lower Total Cost of Ownership**

The Cisco PIX 525 Security Appliance is a reliable, easy-to-maintain platform that provides a wide variety of methods for configuring, monitoring, and troubleshooting. Management solutions range from centralized, policy-based management tools to integrated, Web-based management to support for remote monitoring protocols such as Simple Network Management Protocol (SNMP) and syslog.





Administrators can easily manage large numbers of remote Cisco PIX Security Appliances using CiscoWorks VPN/Security Management Solution (VMS). This suite consists of numerous modules including Management Center for Firewalls, Auto Update Server Software and Security Monitor. This powerful combination provides a highly scalable, next-generation, three-tier management solution that includes the following features:

- Comprehensive configuration and software image management
- Device hierarchy with "Smart Rules"-based configuration inheritance
- Customizable administrative roles and access privileges
- Comprehensive enterprise change management and auditing
- "Touchless" software image management for remote Cisco PIX Security Appliances
- Support for dynamically addressed appliances

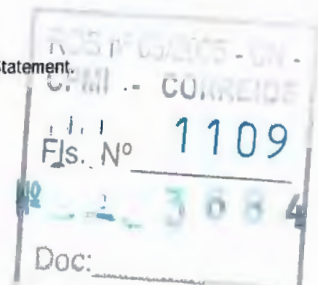
Additional integrated event management and inventory solutions are also available as part of the CiscoWorks VMS network management suite.

The integrated Cisco PIX Device Manager provides an intuitive, Web-based management interface for remotely configuring, monitoring, and troubleshooting a Cisco PIX 525 Security Appliance—without requiring any software (other than a standard Web browser) to be installed on an administrator's computer. A setup wizard is provided for easy installation into any network environment.

Alternatively, through methods including Telnet and Secure Shell (SSH), or out of band through a console port, administrators can remotely configure, monitor, and troubleshoot Cisco PIX Security Appliances using a command-line interface (CLI).

**Table 1** Key Product Features and Benefits

Key Features	Benefit
<b>Enterprise-Class Security</b>	
True security appliance	<ul style="list-style-type: none"><li>• Uses a proprietary, hardened operating system that eliminates security risks associated with general purpose operating systems</li><li>• Cisco quality and no moving parts provide a highly reliable security platform</li></ul>
Stateful inspection firewall	<ul style="list-style-type: none"><li>• Provides perimeter network security to prevent unauthorized network access</li><li>• Uses state-of-the-art Cisco ASA for robust stateful inspection firewall services</li><li>• Provides flexible access-control capabilities for over 100 predefined applications, services and protocols, with the ability to define custom applications and services</li><li>• Includes numerous application-aware inspection engines that secure advanced networking protocols such as H.323 Version 4, Session Initiation Protocol (SIP), Cisco Skinny Client Control Protocol (SCCP), Real-Time Streaming Protocol (RTSP), Internet Locator Service (ILS), and more</li><li>• Includes content filtering for Java and ActiveX applets</li></ul>
Easy VPN Server	<ul style="list-style-type: none"><li>• Provides remote access VPN concentrator services for a wide variety of Cisco software or hardware-based VPN clients</li><li>• Pushes VPN policy dynamically to Cisco Easy VPN Remote-enabled solutions upon connection, ensuring the latest corporate security policies are enforced</li><li>• Extends VPN reach into environments using Network Address Translation (NAT) or Port Address Translation (PAT), via support of Internet Engineering Task Force (IETF) UDP-based draft standard for NAT traversal</li></ul>







**Table 1** Key Product Features and Benefits

Key Features	Benefit
Site-to-site VPN	<ul style="list-style-type: none"><li>• Supports IKE and IPsec VPN standards</li><li>• Ensures data privacy/integrity and strong authentication to remote networks and remote users over the Internet</li><li>• Supports 56-bit DES, 168-bit 3DES and up to 256-bit AES data encryption to ensure data privacy</li></ul>
Intrusion protection	<ul style="list-style-type: none"><li>• Provides protection from over 55 different types of popular network-based attacks ranging from malformed packet attacks to DoS attacks</li><li>• Integrates with Cisco Network Intrusion Detection System (IDS) sensors for the ability to dynamically block/shun hostile network nodes via the firewall</li></ul>
AAA support	<ul style="list-style-type: none"><li>• Integrates with popular authentication, authorization, and accounting services via TACACS+ and RADIUS support</li><li>• Provides tight integration with Cisco Secure Access Control Server (ACS)</li></ul>
X.509 certificate and CRL support	<ul style="list-style-type: none"><li>• Supports SCEP-based enrollment with leading X.509 solutions from Baltimore, Entrust, Microsoft, and VeriSign</li></ul>
Integration with leading third-party solutions	<ul style="list-style-type: none"><li>• Supports the broad range of Cisco AVVID (Architecture for Voice, Video and Integrated Data) partner solutions that provide URL filtering, content filtering, virus protection, scalable remote management, and more</li></ul>
<b>Robust Network Services/Integration</b>	
Virtual LAN (VLAN)-based virtual interfaces	<ul style="list-style-type: none"><li>• Provides increased flexibility when defining security policies and eases overall integration into switched network environments by supporting the creation of logical interfaces based on IEEE 802.1q VLAN tags, and the creation of security policies based on these virtual interfaces</li><li>• Supports multiple virtual interfaces on a single physical interface through VLAN trunking</li><li>• Supports multiple VLAN trunks per Cisco PIX Security Appliance</li><li>• Supports up to 10 VLANs on Cisco PIX 525 Security Appliances</li></ul>
Open Shortest Path First (OSPF) dynamic routing	<ul style="list-style-type: none"><li>• Provides comprehensive OSPF dynamic routing services using technology based on world-renowned Cisco IOS Software</li><li>• Offers improved network reliability through fast route convergence and secure, efficient route distribution</li><li>• Delivers a secure routing solution in environments using NAT through tight integration with Cisco PIX Security Appliance NAT services</li><li>• Supports MD5-based OSPF authentication, in addition to plaintext OSPF authentication, to prevent route spoofing and various routing-based DoS attacks</li><li>• Provides route redistribution between OSPF processes, including OSPF, static, and connected routes</li><li>• Supports load balancing across equal-cost multipath routes</li></ul>
DHCP server	<ul style="list-style-type: none"><li>• Provides DHCP Server services one or more interfaces for devices to obtain IP addresses dynamically</li><li>• Includes extensions for support of Cisco IP Phones and Cisco SoftPhone IP telephony solutions</li></ul>
DHCP relay	<ul style="list-style-type: none"><li>• Forwards DHCP requests from internal devices to an administrator-specified DHCP server, enabling centralized distribution, tracking, and maintenance of IP addresses</li></ul>
NAT/PAT support	<ul style="list-style-type: none"><li>• Provides rich dynamic/static NAT and PAT capabilities</li></ul>

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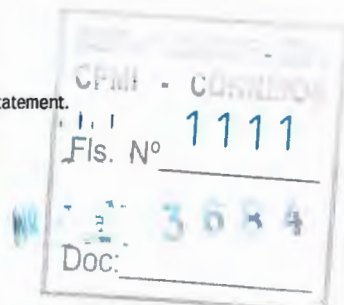
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**Table 1** Key Product Features and Benefits

Key Features	Benefit
<b>Rich Remote Management Options</b>	
CiscoWorks VPN/ Security Management Solution (CiscoWorks VMS)	<ul style="list-style-type: none"><li>• Comprehensive management suite for large scale deployments</li><li>• Integrates policy management, software maintenance, and security monitoring</li></ul>
PIX Device Manager (PDM)	<ul style="list-style-type: none"><li>• Intuitive, Web-based GUI enables simple, secure remote management of Cisco PIX Security Appliances</li><li>• Provides wide range of informative, real-time, and historical reports which give critical insight into usage trends, performance baselines, and security events</li></ul>
Auto Update	<ul style="list-style-type: none"><li>• Provides "touchless" secure remote management of Cisco PIX Security Appliance configuration and software images via a unique push/pull management model</li><li>• Next-generation secure XML/HTTPS management interface can be leveraged by Cisco and third-party management applications for remote Cisco PIX Security Appliance configuration management, inventory, software image management/deployment and monitoring</li><li>• Integrates seamlessly with CiscoWorks Management Center for Firewalls and Auto Update Server for robust, scalable remote management of up to 1000 Cisco PIX Security Appliances (per management server)</li></ul>
Cisco PIX CLI	<ul style="list-style-type: none"><li>• Allows customers to use existing PIX CLI knowledge for easy installation and management without additional training</li><li>• Accessible through variety of methods including console port, Telnet, and SSH</li></ul>
Command-level authorization	<ul style="list-style-type: none"><li>• Enables businesses to create up to 16 customizable administrative roles/profiles for accessing Cisco PIX Security Appliances (for example, monitoring only, read-only access to configuration, VPN administrator, firewall/NAT administrator, and so on)</li><li>• Leverages either the internal administrator database or outside sources via TACACS+, such as Cisco Secure ACS</li></ul>
SNMP and syslog support	<ul style="list-style-type: none"><li>• Provide remote monitoring and logging capabilities, with integration into Cisco and third-party management applications</li></ul>
<b>Flexible Expansion Capabilities</b>	
Fast Ethernet and Gigabit Ethernet expansion options	<ul style="list-style-type: none"><li>• Supports easy installation of additional network interfaces via 3 PCI expansion slots</li><li>• Supports expansion cards including single-port Fast Ethernet card, 4-port Fast Ethernet card, and single-port Gigabit Ethernet card</li></ul>
Hardware VPN acceleration options	<ul style="list-style-type: none"><li>• Delivers high speed VPN services via support of VPN Accelerator Card (VAC) and VPN Accelerator Card+ (VAC+)</li></ul>







### License Options

The Cisco PIX 525 Security Appliance is available in three primary models that provide different levels of interface density, failover capabilities, and VPN throughput.

#### Restricted Software License

The Cisco PIX 525 "Restricted" (PIX 525-R) model provides an excellent value for organizations looking for robust Cisco PIX Security Appliance services with Gigabit Ethernet support, medium interface density, and moderate VPN throughput requirements. It includes 128 MB of RAM and support for up to six 10/100 Fast Ethernet or three Gigabit Ethernet interfaces.

#### Unrestricted Software License

The PIX 525 "Unrestricted" (PIX 525-UR) model extends the capabilities of the family with support for stateful failover, additional LAN interfaces, and increased VPN throughput via integrated hardware-based VPN acceleration. It includes an integrated VAC or VAC+ hardware VPN accelerator, 256 MB of RAM, and support for up to eight 10/100 Fast Ethernet or three Gigabit Ethernet interfaces. The Cisco PIX 525-UR also adds the ability to share state information with a hot-standby Cisco PIX Security Appliance for resilient network protection.

#### Failover Software License

The Cisco PIX 525 "Failover" (PIX 525-FO) model is designed for use in conjunction with a PIX 525-UR, providing a cost-effective, high-availability solution. It operates in hot-standby mode acting as a complete redundant system that maintains current session state information. With the same hardware configuration as the Cisco PIX 525-UR, it delivers the ultimate in high availability for a fraction of the price.

### Performance Summary

Cleartext throughput: 330 Mbps

Concurrent connections: 280,000

168-bit 3DES IPsec VPN throughput: Up to 155 Mbps with VAC+ or 72 Mbps with VAC

128-bit AES IPsec VPN throughput: Up to 165 Mbps with VAC+

256-bit AES IPsec VPN throughput: Up to 170 Mbps with VAC+

Simultaneous VPN tunnels: 2000

### Technical Specifications

Processor: 600-MHz Intel Pentium III Processor

Random access memory: 128 MB or 256 MB of SDRAM

Flash memory: 16 MB

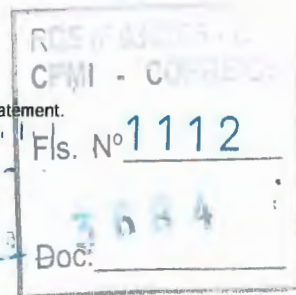
Cache: 256 KB level 2 at 600 MHz

System bus: Single 32-bit, 33-MHz PCI

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## **Environmental Operating Ranges**

### **Operating**

Temperature: -25° to 104°F (-5° to 40°C)

Relative Humidity: 5% to 95%, noncondensing

Altitude: 0 to 6500 ft (2000 m)

Shock: 1.14 m/sec (45 in./sec) 1/2 sine input

Vibration: 0.41 Grms2 (3-500 Hz) random input

Acoustic Noise: 45 dBA maximum

### **Nonoperating**

Temperature: -13° to 158°F (-25° to 70°C)

Relative Humidity: 5% to 95%, noncondensing

Altitude: 0 to 15,000 ft (4570 m)

Shock: 30G

Vibration: 0.41 Grms2 (3-500 Hz) random input

## **Power**

### **Input (per power supply)**

Range Line Voltage: 100V to 240V AC or 48V DC to 60V DC

Nominal Line Voltage: 100V to 240V AC or 48V DC to 60V DC

Current: 5-2.5 Amps AC or 12 Amps DC

Frequency: 50 to 60 Hz, single phase

### **Output**

Steady State: 50W

Maximum Peak: 65W

Maximum Heat Dissipation: 410 BTU/hr, full power usage (65W)

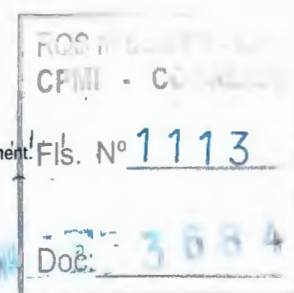
## **Physical Specifications**

### **Dimensions and Weight Specifications**

Form factor: 2 RU, standard 19-in. rack mountable

Dimensions (H x W x D): 3.5 x 17.5 x 18.25 in. (8.89 x 44.45 x 46.36 cm)

Weight (one power supply): 32 lb (14.5 kg)







### Expansion

Three 32-bit/33-MHz PCI slots

Two 168-pin DIMM RAM slots, supporting up to 256 MB memory maximum

### Interfaces

Console Port: RS-232 (RJ-45) 9600 baud

Failover Port: RS-232 (DB-15) 115 Kbps (Cisco specified cable required)

Two integrated 10/100 Fast Ethernet ports, auto-negotiate (half/full duplex), RJ-45

### Regulatory and Standards Compliance

#### Safety

UL 1950, CSA C22.2 No. 950, EN 60950 IEC 60950, AS/NZS3260, TS001

#### Electro Magnetic Compatibility (EMC)

CE marking, FCC Part 15 Class A, AS/NZS 3548 Class A, VCCI Class A, EN55022 Class A, CISPR22 Class A, EN61000-3-2, EN61000-3-3

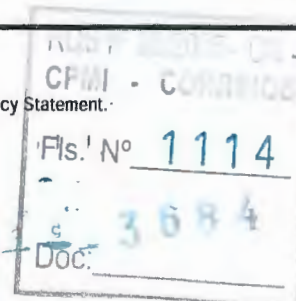
### Product Ordering Information

PIX-525	PIX 525 chassis only
PIX-525-DC	PIX 525 DC chassis only
PIX-525-R-BUN	PIX 525 restricted bundle (chassis, restricted software, 2 10/100 ports, 128 MB RAM)
PIX-525-UR-BUN	PIX 525 unrestricted bundle (chassis, unrestricted software, 2 10/100 ports, 256 MB RAM, VAC or VAC+)
PIX-525-UR-GE-BUN	PIX 525 unrestricted 2 GE + 2 FE bundle (chassis, unrestricted software, 2 Gigabit Ethernet + 2 10/100 ports, 256 MB RAM, VAC or VAC+)
PIX-525-FO-BUN	PIX 525 failover bundle (chassis, failover software, 2 10/100 ports, 256 MB RAM, VAC or VAC+)
PIX-525-FO-GE-BUN	PIX 525 failover 2 GE + 2 FE bundle (chassis, failover software, 2 Gigabit Ethernet + 2 10/100 ports, VAC or VAC+)
PIX-525-HW=	PIX 525 rack-mount kit, console cable and failover serial cable
PIX-FO=	PIX failover serial cable
PIX-4FE	4-port 10/100 Fast Ethernet PCI expansion card
PIX-1FE	Single-port 10/100 Fast Ethernet PCI expansion card
PIX-1GE-66	Single-port Gigabit Ethernet 64-bit/66-MHz PCI expansion card, Multimode (SX) SC connector
PIX-VPN-ACCEL	3DES IPsec hardware VAC
PIX-VAC-PLUS	3DES/AES IPsec hardware VAC+

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PIX-VPN-3DES	168-bit 3DES and up to 256-bit AES encryption software license
PIX-VPN-3DES=	168-bit 3DES and up to 256-bit AES encryption software license
PIX-VPN-DES	56-bit DES encryption software license
PIX-VPN-DES=	56-bit DES encryption software license

### Support Services

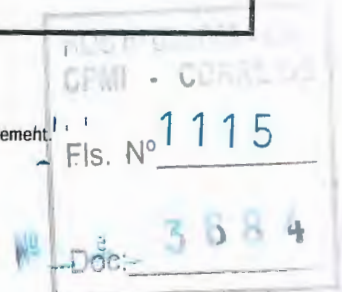
Support services are available from Cisco and Cisco partners. Cisco SMARTnet service augments customer support resources, and provides anywhere, anytime access to technical resources (both online and by telephone), the ability to download updated system software, and hardware advance replacement.

### Support Ordering Information

CON-SNT-PIX525	SMARTnet 8x5xNBD service for PIX 525 chassis only
CON-SNT-PIX525R	SMARTnet 8x5xNBD service for PIX 525-R bundle
CON-SNT-PIX525UR	SMARTnet 8x5xNBD service for PIX 525-UR bundle
CON-SNT-PIX525FO	SMARTnet 8x5xNBD service for PIX 525-FO bundle
CON-SNTE-PIX525	SMARTnet 8x5x4 service for PIX 525 chassis only
CON-SNTE-PIX525R	SMARTnet 8x5x4 service for PIX 525-R bundle
CON-SNTE-PIX525UR	SMARTnet 8x5x4 service for PIX 525-UR bundle
CON-SNTE-PIX525FO	SMARTnet 8x5x4 service for PIX 525-FO bundle
CON-SNTP-PIX525	SMARTnet 24x7x4 service for PIX 525 chassis only
CON-SNTP-PIX525R	SMARTnet 24x7x4 service for PIX 525-R bundle
CON-SNTP-PIX525UR	SMARTnet 24x7x4 service for PIX 525-UR bundle
CON-SNTP-PIX525FO	SMARTnet 24x7x4 service for PIX 525-FO bundle
CON-S2P-PIX525R	SMARTnet 24x7x2 service for PIX 525-R bundle
CON-S2P-PIX525UR	SMARTnet 24x7x2 service for PIX 525-UR bundle
CON-S2P-PIX525FO	SMARTnet 24x7x2 service for PIX 525-FO bundle
CON-OS-PIX525	SMARTnet On-Site 8x5xNBD service for PIX 525 chassis only
CON-OS-PIX525R	SMARTnet On-Site 8x5xNBD service for PIX 525-R bundle
CON-OS-PIX525UR	SMARTnet On-Site 8x5xNBD service for PIX 525-UR bundle
CON-OS-PIX525FO	SMARTnet On-Site 8x5xNBD service for PIX 525-FO bundle
CON-OSE-PIX525	SMARTnet On-Site 8x5x4 service for PIX 525 chassis only
CON-OSE-PIX525R	SMARTnet On-Site 8x5x4 service for PIX 525-R bundle
CON-OSE-PIX525UR	SMARTnet On-Site 8x5x4 service for PIX 525-UR bundle

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CON-OSE-PIX525FO	SMARTnet On-Site 8x5x4 service for PIX 525-FO bundle
CON-OSP-PIX525	SMARTnet On-Site 24x7x4 service for PIX 525 chassis only
CON-OSP-PIX525R	SMARTnet On-Site 24x7x4 service for PIX 525-R bundle
CON-OSP-PIX525UR	SMARTnet On-Site 24x7x4 service for PIX 525-UR bundle
CON-OSP-PIX525FO	SMARTnet On-Site 24x7x4 service for PIX 525-FO bundle

#### Additional Information

For more information, please visit the following links:

Cisco PIX Security Appliance Series:

<http://www.cisco.com/go/pix>

Cisco PIX Device Manager:

[http://www.cisco.com/warp/public/cc/pd/fw/sqfw500/prodlit/pixd3\\_ds.pdf](http://www.cisco.com/warp/public/cc/pd/fw/sqfw500/prodlit/pixd3_ds.pdf)

Cisco Secure ACS:

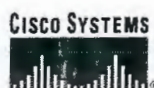
<http://www.cisco.com/go/acs>

CiscoWorks VMS, Management Center for Firewalls, Auto Update Server Software and Security Monitor:

<http://www.cisco.com/go/vms>

SAFE Blueprint from Cisco:

<http://www.cisco.com/go/safe>



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Fax: 408 527-0883

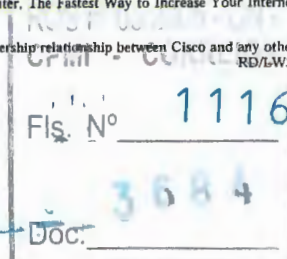
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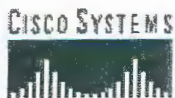
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 Design Guide for F-Secure  
 Anti-Virus

## Design Guide for F-Secure Anti-Virus

### Design Guide

#### Cisco AVVID Partner Design Guide for F-Secure Anti-Virus for Internet Mail

##### Introduction and Overview

This Cisco Security Design Guide describes F-Secure Anti-Virus for Internet E-Mail (F-Secure version 5.0, the latest anti-virus gateway solution from F-Secure. This product is designed to cooperate with the Cisco PIX<sup>®</sup> Firewall version 5.1.4 (or later) by providing anti-virus protection (scanning and disinfecting) for Internet (Simple Mail Transfer Protocol [SMTP] mail traffic entering and leaving the organization.

##### Description of Product

F-Secure Anti-Virus for Internet E-Mail detects and disinfects computer viruses from data transmissions through the SMTP server by functioning as a proxy to the SMTP server. It receives data from the hosts and forwards it to the F-Secure Anti-Virus Content Scanning Server for virus detection; this all takes place behind the Cisco PIX Firewall.

##### Philosophy of Protection

###### Assumptions

Alone, the Cisco PIX Firewall does not protect users from the most common method of virus transmission today, viruses received via e-mail. Used in conjunction with the Cisco PIX Firewall, F-Secure Anti-Virus for Internet E-Mail provides unparalleled data protection against such threats. F-Secure Anti-Virus for Internet E-Mail integrates into the F-Secure Policy Manager for centralized, policy-based management distribution. This model also allows easy updating of the software and virus database without physically visiting each local site.

###### Threats

Before the explosive growth of the Internet and e-mail, most viruses were distributed by means of floppies and executable files. In 1995, this all changed with the advent of the macro virus. Viruses were no longer confined to executables and floppy boot sectors, but could be hidden in documents that were being e-mailed to thousands of unsuspecting users. Today, sending viruses via e-mail is the number one transmission method in the connected organization.

###### Organization Security Policies

Implementing F-Secure Anti-Virus for Internet E-Mail will likely change the organization's security policies in the context of sending and receiving Internet e-mail. Without protection, an organization may have imposed certain restrictions on e-mail, such as:

- Not allowing unknown e-mail to be read
- Not allowing employees to open e-mail with attachments
- Not allowing employees to send attachments
- Defining the size of attachments

With F-Secure Anti-Virus for Internet E-Mail installed, the administrator can ease those restrictions because all e-mail is scanned for viruses before it reaches the end user.

###### Typical Implementation

Typical implementations are environments where the Cisco PIX Firewall and a mail server (sitting either behind the firewall or in the DMZ) have been deployed and require strong virus scanning services for e-mail and attachments therein.

The F-Secure strategy is to place the F-Secure Content Scanning Server (FSCSS) in front of the Cisco PIX Firewall and the mail server. The firewall passes SMTP traffic through the FSCSS and forwards that traffic to the CSS. The CSS scans for Trojans, viruses, and other malicious code that is usually contained in attachments (zipped files, macro code, Word and





spreadsheet files, and so on).

#### Anti-Virus for Internet Mail Installation and Deployment

The FSCSS is implemented in conjunction with the Cisco PIX Firewall in several phases. Each phase is documented in a separate section of this document.

- Installation of the FSCSS—This involves readying a server to receive data packets from the Cisco PIX Firewall and forwarding them to the mail server of choice. The platform is a Microsoft NT server with a service pack level of 3 or greater.
- Configuration of Cisco PIX Firewall—This involves a simple configuration set that
  - o Identifies the CSS to the Cisco PIX Firewall
- Instructs the Cisco PIX Firewall to forward all SMTP traffic to the CSS

#### Protected Assets/Self-Protection

The FSCSS should be used to protect the all-sensitive internal corporate mail and data. The same convention will also protect other corporate clients and associates from the same attacks because it will detect and destroy possible Trojan horses and worms. Preventing the distribution of the same infectious malware to other network environments effectively curbs the further distribution of a destructive entity. This entity can represent itself by either distributing/destroying sensitive (accessing end-user) data or distributing mail address sensitive corporate clients.

#### Assurance

The best way to ensure that the F-Secure Anti-Virus for Internet E-Mail is actually protecting your mail assets is to send a bogus virus through the CSS in the form of a mail attachment. F-Secure provides a bogus, nondestructive code for this purpose.

#### Reporting

Every F-Secure anti-virus product has a built-in mechanism for alerting and reporting. Administrators can set thresholds for alerts levels and can have this information logged. The log can be viewed by a simple text editor or through the F-Secure Policy Management Console (FSPMC). Such reports would include the detection and disposal of viruses, the CSS status, which address is sending the virus, and its intended destination.

#### Management

F-Secure AV for Internet E-Mail is managed by the F-Secure Policy Manager. This management is based on F-Secure's comprehensive management architecture. This management would include the aforementioned FSPMC and the F-Secure Management Agent (FSMA), installed at the CSS.

#### Scope of Scale

F-Secure AV for Internet E-Mail and its architecture has been designed to protect large corporate infrastructures. It scales very well with the Cisco PIX Firewall and takes advantage of future Cisco PIX features, such as load balancing.

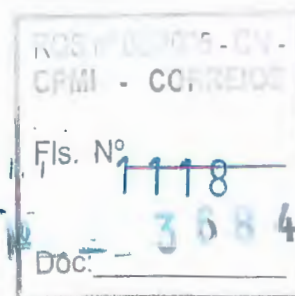
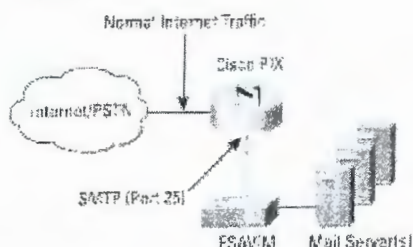
The performance of the FSAVIM is dependant solely upon the CPU and memory. The performance can be achieved with a Pentium II or better with clock speeds of 200 MHz or better. In today's computing world, Pentium III CPUs are easily considered the accepted standard for most environments.

#### Testbed

This example shows the configuration when applying F-Secure's AV for Internet E-Mail solution to a Cisco PIX Firewall. The connection assumes that all mail traffic passes through the firewall and is forwarded to Port 25 (SMTP) to the FSAVIM. All mail is scanned and forwarded to the user-designated mail server for processing and distribution.

The example in Figure 1 shows a network with FSAVIM deployment:

Figure 1:



Typical FSAVIM Deployment  
In this scenario:

Internet traffic is directed to the Cisco PIX Firewall.

The Cisco PIX Firewall filters Port 25 (SMTP) traffic and forwards it to the FSAVIM gateway.

The FSAVIM scans, cleans, and forwards mail traffic to the corporate servers.

#### Configurations

The following is a partial Cisco PIX configuration identifying the FSAVIM server:

```
Static (inside, outside) <inside-address> <SMTP server - FSAVIM>
```

```
Netmask 255.xxx.xxx.xxx xx xx
```

```
Conduit permit tcp host <inside-address> eq smtp any
```

Note If you are using Mail Guard, you can restrict access with the following command:  
`fixup protocol smtp 25`

Note You should consult your Cisco PIX documentation for additional configuration considerations.

#### Customer Expectations—Risks, Exposures, and Possible Consequences

When setting up the FSAVIM, it is important to have clear and specific network documentation. This is critical when you configure the FSAVIM; you will need to consider the following:

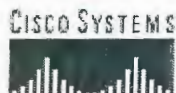
- Where in the network is the firewall?
- What will the IP address assignment of the FSAVIM be?
- Where is the mail server? Are multiple servers involved?
- Will addressing be public or private?
- Is the CPU scalable enough for future needs/requirements?

Although the actual installation of the FSAVIM is not complicated, the design and deployment can be. Additional issue considerations follow:

- Server access (who and why)
- Administrator control
- Additional server protection (use of F-Secure Distribute Firewall to extend and complement the Cisco PIX Firewall solution)

If your network administrator is not familiar or confident with performing network changes, the risk of implementing this solution should be considered very high for network integrity.





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Design Guide for Websense Enterprise v4.2, Cisco PIX Firewall

## Design Guide for Websense Enterprise v4.2, Cisco PIX Firewall

## Design Guide

Websense **Enterprise v4.2,**  
**Cisco Secure PIX Firewall Edition**

## Introduction and Overview

Websense Enterprise v4.2 provides integrated Internet filtering for the Cisco Secure PIX Firewall, helping network administrators effectively monitor and control network traffic. plug-in for the Cisco Secure PIX Firewall, Websense tells the firewall to block or permit Internet traffic. Websense is compatible with Netscape Navigator, Microsoft Internet Explorer and other common Internet browsers and programs.

## Description of Product

Websense Enterprise v4.2, Cisco Secure PIX Firewall Edition is an employee Internet management system that enables organizations to monitor, manage, and report on Internet access from an internal network.

Network administrators assign policies which restrict Internet use within organizations. Websense Enterprise then filters network activity according to the pre-established policies, monitoring, and reporting on the activity. Websense Enterprise integrates with the Cisco Secure PIX Firewall, providing the engine by which content filtering is enforced. Using Websense Master Database of URLs in conjunction with Cisco Secure PIX Firewall, you create flexible, high-performance, content-filtering policies.

Websense can be installed on a Windows NT, Windows 2000, or Solaris machine connected to the network. Websense can run on systems with other applications as well, as long as they are not too processor or memory intensive.

Internet requests are sent to the Cisco Secure PIX Firewall, which queries Websense to determine whether the request should be permitted or blocked. At the same time, the Firewall sends the original request to the Internet.

By sending the request to the Internet before receiving confirmation from Websense, the Cisco Secure PIX Firewall does not slow down authorized business access. Unauthorized access is prevented by requiring Websense confirmation before returning the site to the requesting user.

When Websense receives a request, it checks the source to find out if the workstation requesting the URL is to be blocked completely from the Internet. If it is not, Websense determines whether a custom setting has been established for the requested URL. If not, Websense consults its database of URLs to check if the site is in a blocked category.

Since Websense runs on a single-server computer, it provides filtering for an entire network. Websense provides transparent content filtering to the network environment with no client configuration needed.

## Philosophy of Protection

**Assumptions.** Rapid advances in communications technology have combined to create a connectivity explosion that has businesses, schools, and local service providers increased their Internet access. New users are accessing the Internet at a staggering pace and new Web sites are added as quickly.

This global connectivity lets commerce and information flow across time zones and national boundaries.

Corporate networks, once isolated from the outside world, have suddenly opened up, creating potential security risks. Internally, Web-enabled users may gain access to enormous quantities of material, deemed inappropriate or undesirable in the workplace by security administrators. Websense provides advanced network-to-Internet monitoring, reporting, and management. These powerful features help organizations identify and limit unproductive surfing, control access to content such as illegal or pornographic materials, and reduce unnecessary bandwidth consumption.



**Threats.** This wide-open access also provides unregulated access to large amounts of frivolous, offensive, and controversial material, as well as material that is not job-related. As a result, many organizations must determine how to permit unhindered access to the Internet while restricting access to undesirable content.

Websense Enterprise, an "intelligent" software product, offers organizations and individuals greater flexibility and security while preventing access to objectionable or inappropriate materials on the Internet. Rather than attempting to block access at each local computer, Websense is server-based, high-performance, and capable of filtering information through a set of policies.

**Organizational Security Policies.** Inside organizations, initial security measures usually include a written Internet Access Policy (IAP) and basic monitoring tools that let the network administrator observe network traffic patterns and bandwidth consumption levels.

Websense Enterprise enables organizations to better control their network resources and enforce a variety of Internet Access Policies throughout the enterprise.

Organizations are also implementing measures that help reduce unproductive employee "surfing" (and thereby save costs) through the use of Internet management tools and content filtering applications that enforce IAPs by limiting access to sites deemed undesirable.

With Websense, network managers enforce organizational IAPs by configuring policies that limit and/or prohibit access to certain sites. Policy enforcement controls may also be established based on date and time.

#### Standards References

Websense Enterprise complies with basic protocol standards and has received ICSA certification. Please see <http://www.icsa.net> for further information.

#### Typical Implementation

Websense Enterprise v4.2, Cisco Secure PIX Firewall Edition should be deployed with the server behind the Cisco Secure PIX Firewall. All HTTP requests should be sent through the Cisco Secure PIX Firewall that is connected to the server running Websense, to ensure proper filtering.

Customers should be familiar with configuring the Cisco Secure PIX Firewall. The installation and configuration of Websense Enterprise is thoroughly explained in the documentation provided with the product. No extra training is needed to install or set up Websense.

Typical implementation, which includes installation, configuration of Cisco Secure PIX Firewall, and definition of filtering policies, takes about one hour. Minimum requirements are discussed in the following section.

#### Secure Installation and Deployment

The Websense Manager lets you configure Websense Enterprise locally or from any Windows NT, Windows 2000, or Solaris workstation behind the firewall that meets or exceeds the system requirements.

Before installing Websense, be sure you have the following:

- Websense Enterprise v4.2, Cisco Secure PIX Firewall Edition
- A valid Websense license or evaluation key
- Cisco Secure PIX Firewall software version 4.4 or greater
- Windows NT 4.0 (Server version recommended because its networking abilities are faster than Windows Workstation) with at least SP5, Windows 2000 with at least SP1, or Solaris 2.6 (with Recommended Patch Cluster) or Solaris 2.7 (with Recommended Patch Cluster)
- Customer address and contact information

For Windows installations, Websense recommends at minimum a Pentium II class processor with 128 MB of RAM. For Solaris installations, Websense recommends a Sun Ultra SPARC with 128 MB of RAM.

The Websense installation program is a single executable program that installs the Websense Manager and the Websense Server. Before installing any Websense components, be sure your system time is set correctly. Websense uses the system clock to determine the proper time for downloading the database and to enforce time-based filtering policies.

To enable Websense filtering, enter a valid registration key. This key allows you to download the Websense Master Database of Web sites.



Internet access through Websense depends on the license level that you purchased. Each Websense license key may be used on only one computer, which filters the number of workstations authorized by your license level. License levels do not refer to simultaneous users, but instead refer to the total number of computers accessing the Internet during a 24-hour period.

Websense works by consulting a growing database of Internet sites, organized into predefined categories. The database resides locally on the same machine as Websense.

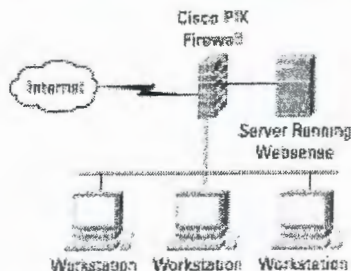
Every day, during a configurable time period, Websense downloads the latest update of the Master Database. The connection is established via the HTTP protocol over the Internet. The customer site must allow outbound HTTP access. The Websense machine is programmed to go to one of three national or international database servers to download the Master Database, which is transferred in a special, proprietary format. During installation, user specifies which of these database servers is used.

When Websense requests a database update, it transmits the customer's registration information to the Websense download site for verification. This registration information informs Websense customers about new versions of the product.

The database has both site names and full URL path names to specifically control which material is blocked. Although Websense Enterprise filters only HTTP sites, the database contains sites accessed via FTP, Gopher, TELNET, IRC, USENET News, and RealAudio sites.

Websense, Inc. continually updates its Master Database. Using automated tools, a team of Web Analysts scans the Internet looking for new sites to add to the Database. Each site is personally verified by a Web Analyst before being added to the database. In addition, supervisors conduct quality checks on all sites to ensure accuracy and consistency of categorization. Finally, the Master Database is re-checked regularly and obsolete sites are removed.

Using the Websense Master Database of URLs in conjunction with Cisco Secure PIX Firewall, you can create and enforce powerful, high-performance, content filtering policies. Choose from Websense Enterprise's preconfigured policies or create or modify custom policies. When access to sites in unblocked categories is permitted, Websense can observe and log access to permitted sites based on your configuration.



This diagram shows Websense running on a server separate from the Cisco Secure PIX Firewall. The firewall can be configured to deny session attempts, protecting Websense and the other functions of the server from malicious internal attacks and from any external attacks. The server is not accessible to any internal or external networks.

The Websense Server must be given physical protection, allowing only authorized network security administrators physical access to the Websense server.

#### Assets Protected

The Websense Enterprise architecture, in concert with the Cisco Secure PIX Firewall, provides robust security features and access management. Through development and implementation of Internet Access Policies that are enforced by Websense, companies preserve bandwidth by limiting Internet access to appropriate and authorized activities. Websense also protects and enhances corporate productivity by limiting unauthorized "surfing." In addition, corporate liability can be reduced because Websense can exclude offensive and illegal material from being brought into the company network via the Internet.

#### Self Protection

The server running Websense relies on the mechanisms of the Windows NT, Windows 95, or Solaris operating systems for protection against malicious attacks.

The database download is protected because the customer must enter a valid license key, which can be used on only one computer. Each time the Websense Server contacts the Master Database server, it automatically sends the customer's key and contact information to verify the key with each download request.

Websense can be configured via the graphical Websense Manager. Access to the Manager is controlled by the license key.



limited to authorized administrators with correct user names and passwords.

#### Assurance

The Websense Master Database can be tested by browsing sites to see if they are being monitored. You can also verify enforcement of your security policy by using Websense Reporter as described in the next section.

#### Reporting

Websense Enterprise features a separate program called Websense Reporter, which provides detailed log entries for each request it processes. Using the Reporter function, you can generate tabular reports and bar charts that show Internet access activity by your employees.

Websense Reporter prepares reports of three different types. Detailed reports provide specific information on requested sites and the clients who requested them. Information is presented for every site or category for each client and protocol selected. Dates and times are included to provide a complete picture of Internet access. Summary reports give an overview of Internet usage for selected clients and sites. Totals reveal hits and bytes transferred depending upon the report format selected. Charts show usage trends by presenting an overview in the form of a bar graph.

Reporter comes equipped with more than 50 different formats to choose from. Reports can be customized to suit your individual needs; these formats can then be saved for use at a later time. You can also schedule reports to be generated at specific times (such as overnight when network traffic is low). Reports can be saved to a specified directory or sent to an email address with a valid e-mail address.

In addition to selecting the type of report and sites included, you can also choose date ranges, clients (users, groups, and workstations), and protocols to be reported (please note that time and bytes do not show up when using Websense Enterprise, Cisco Secure PIX Firewall Edition). These options let network administrators pinpoint the information of interest and generate meaningful reports.

When running on Windows NT or Windows 2000, Websense Enterprise logs status messages in the Windows NT Application Event Log, which can be viewed with the Windows NT Event Viewer.

**Note** For performance reasons, Cisco Secure PIX Firewall has the option to cache some Websense responses so that it can permit or block those sites without contacting Web Sites that are permitted or blocked directly by PIX are only logged by Websense when PIX firmware 5.2(1) or later.

#### Management

Websense is managed via a Java application that runs on any Windows NT, Windows 2000, or Solaris machine on the network behind the Cisco Secure PIX Firewall.

The Websense installation program is a single executable program run via the Windows 2000 GUI, or the Solaris command line. It installs Websense Enterprise v4.2 Secure PIX Firewall Edition, which includes the Websense Manager. Once installed, you use Websense Manager to configure and manage the program: register, define filtering policies, define database download periods, and define logging requirements.

Websense Manager also ensures that the database has been downloaded during the specified period. The Download Database dialog box shows the day when the database was last downloaded. It also lets you manage logging and reporting via the Logging Tab and the license expiration date via the Download Tab.

#### Scope of Scale

Websense Enterprise, Cisco Secure PIX Firewall Edition can scale to 1,000 HTTP requests per second, assuming proper configuration of the Cisco Secure PIX Firewall.

#### Continuous Protection

The redundancy of Websense is provided through the Cisco Secure PIX Firewall itself. You can configure the firewall to allow Websense to fail open or fail closed. Fail open means that if Websense shuts down, all users will be able to access the Internet without filtering. Fail closed means that if Websense shuts down, all access to the Internet will be prohibited.

Websense automatically downloads an update to the Master Database by choosing a period during the time interval specified by the customer. If Websense is unable to connect to the Master Database site at that time, it retries every 10 minutes, up to a total of 10 tries, within the specified timeframe, until it successfully downloads a new update to the database. If the download cannot be completed, Websense continues filtering with the last database that was successfully downloaded.

If the download is unsuccessful, the Date field in the Download Database dialog box (in Websense Manager) will not be updated and the Last Download Result field will report



respective error. Administrators can be notified via e-mail if the download fails, by checking box on the E-mail Tab of the Server Configuration dialog box in Websense Manager.

#### Protection Testing

##### Testbed

The machines used in the testbed conformed with the following specifications:

- Intel Pentium II.
- 128 MB of RAM.
- 100 MB free disk space.
- Windows NT 4.0 (server version) Service Pack 5.
- Placed on an Ethernet network.
- Included a T-1 line to the Internet.
- There was no other traffic to the Internet.

The product's functionality was tested thoroughly. A load generator tool was used to generate HTTP requests based on an input data file of thousands of URLs. The tool returns a message indicating whether a site is blocked or not blocked. The number of threads (25, 50, 100) and the time to wait to launch subsequent requests (0, 10, 20, 30 milliseconds) can be specified.

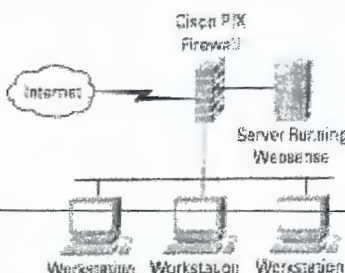
- Ran HTTP requests in blocked category; all categories blocked; non demo-database. Expected result is 100 percent blocked.
- Ran HTTP requests in blocked category; all categories "not" blocked; non demo-database. Expected result is 100 percent blocked.
- Ran HTTP requests in customer URL and sites blocked in customer URL. Expected result is 100% blocked.

#### Configurations

There are no configuration requirements for the user's workstation or for routers in a private network.

It is recommended that Websense Enterprise be put on its own interface for performance reasons (as reflected in the following diagram). Websense can share the DMZ interface of a router's internal interface. Your performance impact depends on how much traffic you have on internal and DMZ networks. With Websense on its own interface, there is no chance of network adding latency.

Websense recommends that only administrators access the Websense machine.



Expected behavior of Websense during testing:

Follow these steps to modify the Global policy.

Step 1. Open Websense Manager. If you have not already entered a valid registration key and downloaded the Master Database, please do so. Refer to your *Setup Guide* for instructions.

Step 2. Right-click the icon of the appropriate Websense Server (if you have added more than one) and select Connect to Server. Enter the password established when you added the Server.

Step 3. Open the Policies topic in the navigation pane and select Global The Global

is set to enforce the `DefaultSettings` category set from 08:00 to 17:00 (8:00 am to 5:00 pm) seven days a week. The `Basic Filtering` category set is in effect at all other times.

To change enforcement times and/or category sets enforced by the `GlobalPolicy`, click `Policy` to open the `Edit Policy` dialog box. After you make changes, click `OK` to exit the `Policy` dialog box.

**Step 4.** Open the `Category Set` topic in the navigation pane and then select `Default Settings`. The `DefaultSettings` category set is configured to block some categories, permit others, and provide the option to defer viewing for other categories. Modify these settings to suit your needs. Websense enforces your settings when the `Default Settings` category set is active.

To edit the `DefaultSettings` category set, click `Edit Category Set` and then change the filtering option for any category you want to modify. After you make changes, click `OK` in the `Edit Category` dialog box.

**Step 5.** Configure Websense Server options by right-clicking the `Websense Server` icon and then selecting `Configure Server`. Open the tabs on the `Server Configuration` dialog box to configure the settings as appropriate.

**Step 6.** Click the `Save All` button to update the Websense Server with any changes you make. When you click the `Save All` button, you are required to click `Done` after the save is finished to exit the `Saving Data` dialog box.

#### Installation

Typically, Websense Server (the filtering engine) and Websense Manager (the user interface) are installed together. However, you can also install them on separate machines. Both components must be installed in order to filter Internet requests.

Additionally, you can install Websense Manager on multiple machines in the network to enable remote configuration of the Websense Server. You can install Websense Server and Websense Manager on different operating systems. For example, you can use the Websense Manager on a Windows machine to configure a Websense Server running on a Solaris machine. Simply install each component on the appropriate machine according to the installation instructions for that operating system.

Detailed installation instructions for both Windows and Solaris are included in the `Web Enterprise v4.2, Cisco Secure PIX Firewall Edition Setup Guide`. Following is a summary of those installation instructions.

#### Windows NT Installation

1. Run the `wseXXX.exe` setup program, where XXX is the version number. This is an extracting ZIP file that extracts the README file, the setup guide, and the installation program into a temporary directory.
2. Run the installation program, `Setup.exe`.
3. Follow on-screen instructions provided by the InstallShield installation program. The installation creates a Websense Enterprise program group that contains:
  - Websense program files.
  - Documentation in Adobe Acrobat format.
  - An online HELP system.
  - README text file.

#### Installing Websense on Solaris

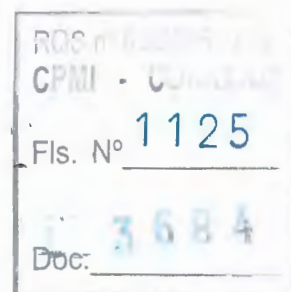
1. Log in to the installation machine as the `root` user.
2. Copy the `wse###.tgz` file (### is the version number) to the installation directory.
3. Enter the following command to unzip the file:

```
>>gunzip wse###.tgz<<
```

4. Expand the file into its components with the following command:

```
>>tar -xvf wse###.tar<<
```

This places the following files into the installation directory:





`installsh`—the installation program  
`websense.tar`—an archive file containing all the Websense components, including the Websense Administrator's Guide (`wsed.pdf`) and the uninstall program (`uninstallsh`)  
`license.txt`—the Websense license agreement.

5. Run the installation program:

```
./installsh
```

6. Follow the on-screen instructions provided.

#### WebSense Configuration

Run Websense Manager, found in the Websense Enterprise program group (NT) or the `start_manager` script found in the Manager subdirectory (Solaris). Enter the Websense key to begin downloading the Websense Master Database.

1. Click **Server** in the Websense Manager menu, then select **Configure** to bring up the **Server Configuration** dialog box.
2. Select the **Download** tab and enter the registration key. Your Internet connection will contact the Websense database server; the license will be validated; expiration limits will be checked; and a database download will be initiated.
3. Modify other configuration settings by opening the appropriate tab and changing the settings.
4. Configure the Cisco Secure PIX Firewall to send Internet requests to Websense instance:

```
enable
configure terminal
url-server host 10.1.1.1 timeout 5
```

The Websense server will access and download the Master Database, on each day specified by the customer, via outbound HTTP access that is configured to be allowed by the Cisco Secure PIX Firewall.

#### Configuring the Cisco Secure PIX Firewall

Before Websense can filter Internet requests, the Cisco Secure PIX Firewall must be configured to use Websense as a URL filter.

1. Access the Cisco Secure PIX Firewall, either from a console or from a remote terminal using TELNET.
2. Enter your login password.
3. Put the Cisco Secure PIX Firewall into Enabled mode by entering `>>enable<<` and your enable password.
4. Place the Cisco Secure PIX Firewall into Configure mode by entering `>>configure terminal<<`.
5. Tell the Cisco Secure PIX Firewall that the Websense Server exists by entering

```
>>url-server host <IP> timeout <#>]<<
```

where:

- `<IP>` is the IP address of the Websense machine.
- `<#>` is an optional number of seconds PIX will wait for a response from the URL server before timing out. (The default is 5 seconds.)

6. Tell the Cisco Secure PIX Firewall how to filter URL requests by entering:

```
>>filter url http <local_ip> <netmask> <foreign_ip> <netmask>]<<
```

where:

- `<local_ip>` is the address of local/internal host/network, which is the source of connections to be filtered.
- `<foreign_ip>` is the address of the foreign/external host/network, which is the destination for connections to be filtered.
- `<netmask>` is the netmask to apply.

Typically, the last two entries should be zeroes to filter access to all Web sites.

through Websense. For example:

```
filterurlhttp 10.5.0.0 255.255.0.0 0 0
filters the 10.5 network going to any destination.
```

7. Save changes by entering >>write memory<<.

You can view the current URL server rules by entering >>show url-server<<. review all the filter rules, enter >>show filter<<. For help on individual commands enter >>help<<, followed by the command. For example, >>help filter<< show complete syntax for the filter command and explains each of the arguments.

**Note** If you need to discontinue filtering for any reason, enter each original filter command preceded by the word no. For example:

```
>>no filterurlhttp 10.5.0.0 255.255.0.0 0 0<<.
```

#### Customer Expectations— Risks, Exposures, and Consequences

Designed for the Cisco Secure PIX Firewall, Websense provides filtering, monitoring, and reporting capabilities. With its flexibility, Websense Enterprise saves organizations money on bandwidth and provides protection against legal liability.

Users who do not read the documentation and/or configure the product improperly may experience the following consequences:

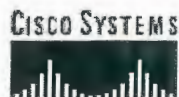
- No Master Database download.
- Database download during a busy period instead of a quiet period.
- Cisco Secure PIX Firewall not configured to use Websense as a URL filter.
- Open, unfiltered access to the Internet because license limit is exceeded.
- Not all URL requests logged and reported because of Cisco Secure PIX Firewall caching.

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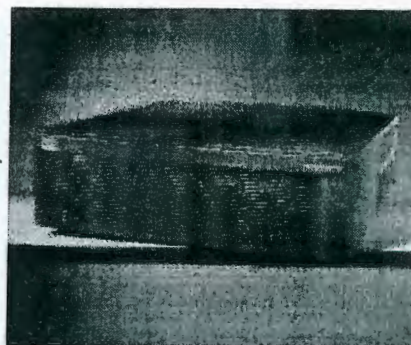
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## CISCO PIX 500 SERIES FIREWALLS

## Introduction

The world-leading Cisco PIX® Security Appliance Series provides robust, enterprise-class, integrated network security services including stateful inspection firewalling, protocol and application inspection, virtual private networking (VPN), in-line intrusion protection, and rich multimedia and voice security-in-cost-effective, easy-to-deploy solutions. These integrated technologies create a strong multi-layered defense for today's ever-changing network environments. Ranging from compact, "plug-and-play" desktop firewalls for small and home offices to modular, carrier-class gigabit firewalls for the most demanding enterprise and service-provider environments, Cisco PIX Security Appliances provide robust security, performance, and reliability for network environments of all sizes.



## Ordering

Built upon a hardened, purpose-built operating system designed for delivering rich security services, Cisco PIX Security Appliances provide the highest levels of security and have earned many industry accolades including Common Criteria Evaluation Assurance Level (EAL) 4 status, as well as ICASA Labs Firewall and IPsec certification. Cisco PIX Security Appliances provide a wide range of security and networking services including VLAN (802.1q tag) support, OSPF dynamic routing, Network Address Translation (NAT), Port Address Translation (PAT), content filtering (Java/ActiveX), URL filtering, AAA (RADIUS/TACACS+) integration, support for leading X.509 PKI solutions, DHCP client/server/relay, PPPoE support and much more.

Cisco PIX Security Appliances also provide advanced security services for multimedia and voice standards including H.323 Version 4, Session Initiation Protocol (SIP), Cisco Skinny Client Control Protocol (SCCP), Real Time Streaming Protocol (RTSP), and Media Gateway Control Protocol (MGCP)-allowing businesses to securely take advantage of the many benefits that converged data, voice, and video networks deliver.

Businesses can securely extend their networks across low-cost Internet connections to mobile users, business partners and remote offices worldwide using the full-featured VPN capabilities provided by Cisco PIX Security Appliances. Solutions range from standards-based site-to-site VPN leveraging the Internet Key Exchange (IKE) and IP Security (IPSec) VPN standards, to the innovative Easy VPN capabilities found in Cisco PIX Security Appliances and other Cisco security solutions-such as Cisco IOSR routers and Cisco VPN 3000 Series Concentrators. Easy VPN delivers a uniquely scalable, cost-effective, and easy-to-manage remote-access VPN architecture that eliminates the operational costs associated with maintaining remote-device configurations typically required by traditional VPN solutions.

Cisco PIX Security Appliances support a wide range of remote access VPN clients including Cisco software VPN clients (available on many platforms including Microsoft Windows, Linux, Solaris and Mac OS X), Cisco hardware VPN clients (such as the PIX 501/506E, VPN 3002 or Cisco 800/1700 Series Routers), as well as PPTP and L2TP clients found within Microsoft Windows operating systems. Cisco PIX Security Appliances encrypt data using 56-bit Data Encryption Standard (DES), 168-bit Triple DES (3DES), or up to 256-bit Advanced Encryption Standard (AES) encryption. Many Cisco PIX Security Appliance models support modular upgrades, have integrated hardware VPN acceleration capabilities, delivering highly scalable, high performance VPN services.

Administrators can choose from a wide variety of solutions for remotely

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[Tech Notes](#)

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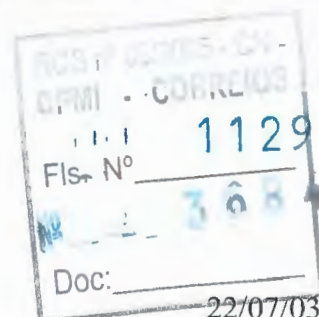
[Bulletins](#)  
[End-of-Life and End-of-Sale Notices](#)  
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[Password Recoveries](#)  
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**Software Center (1)**

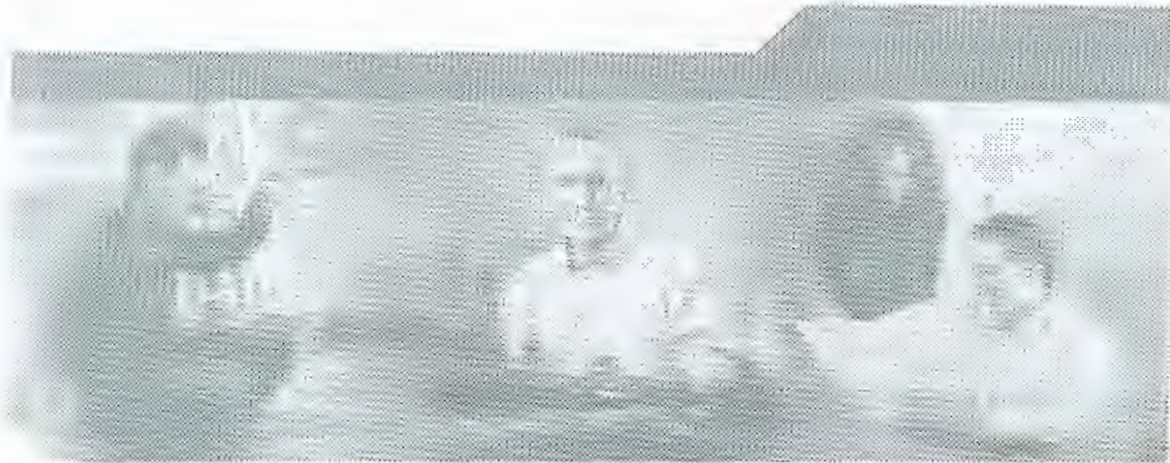
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## Using Monitoring Center for Security 1.0

CiscoWorks2000

### Corporate Headquarters

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## Event Rules

---

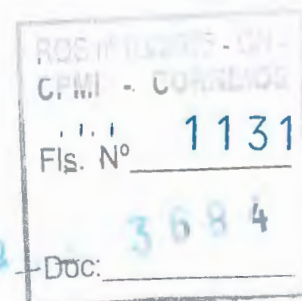
When one or more security devices are deployed to protect a network, they can generate large amounts of event data. Event rules allow you to define filters for the event data generated by your monitored devices and specify an action to occur when filter conditions are met. Actions include sending an e-mail notification, logging a console notification to the audit log, and executing a script.

This chapter contains the following sections:

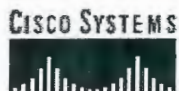
- Adding an Event Rule, page 4-1
- Editing an Event Rule, page 4-14
- Activating an Event Rule, page 4-15
- Deactivating an Event Rule, page 4-16
- Deleting an Event Rule, page 4-16

## Adding an Event Rule

Adding an event rule defines the parameters and actions for the event rule. For the actions that you specify to occur, you must activate the event rule. For more information, see [Activating an Event Rule](#), page 4-15.







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## CISCOWORKS ACCESS CONTROL LIST MANAGER

### Access Control List Manager 1.4

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Access Control List Manager 1

#### Data Sheet

#### CiscoWorks Access Control List Manager 1.4

CiscoWorks Access Control List Manager (ACLM) is an important component of the CiscoWorks family of products, and is available as part of the CiscoWorks Routed WAN Management Solution. ACLM is a Windows- and Solaris-based solution for the management of Access Control List features of the Cisco IOS and the Catalyst operating system. It provides a Web interface to a set of applications that manage the ACLs of Cisco device enterprise network environments. ACL Manager provides tools to set up and manage international packet exchange (IPX) filtering and device access control. These tools include access list editors, policy template managers, network and service class managers for scalability, access list navigation tools for troubleshooting, and automated distribution access list updates.

Figure 1: ACL Manager Main GUI

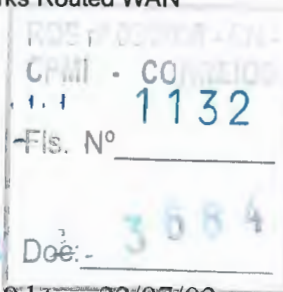


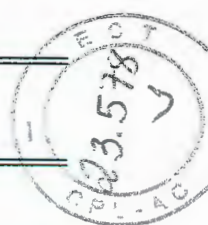
ACL Manager dramatically reduces the time needed to develop new filters and maintain existing traffic filters in large-scale deployments of Cisco devices. ACL Manager helps improve the reliability of your network by ensuring accurate and consistent deployment of filters in the network. Its browser interface and use of templates provides an important alternative to the error-prone and redundant effort required to edit access lists individually from a command-line interface (CLI). In larger networks, its template manager and auto deployment feature allows you to centrally manage the deployment of access list configurations for groups of users, devices, access servers, virtual private network (VPN) routers, Web servers, and e-mail servers. Additionally, ACL Manager helps optimize the contents of an access list, including removing redundant entries and appropriately merging and consolidating access list entries to ensure device-lookup processor cycles are reduced and packet-forwarding speeds are increased.

ACL Manager helps secure the access list management task by linking to the new CiscoWorks management server multilevel security system. Through this system, the administrator controls user access to the ACL Manager tools, and many of the others in the Routed wide-area network (WAN) Management Solution.

ACL Manager leverages the CiscoWorks management server application-access security facilities and the Resource Manager Essentials inventory and configuration information. Manager reflects the Cisco commitment to deliver client and server solutions built on standards. It adds important new task-oriented solutions to the Cisco vision of a true management intranet. ACL Manager is a member of the CiscoWorks Routed WAN Management Solution.

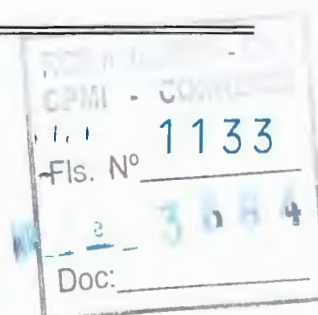
#### Supported Cisco Devices





Routers	Devices
Cisco 800 Series	801, 802, 805
Cisco 7000 Series	7000, 7010, 7120, 7140, 7200, 7202, 7204, 7204VXR, 7206, 7206VXR, 7401, 7505, 7506, 7507, 7513, 7576
Gigabit Switch Router Series	12004, 12008, 12012, 12016, 12404, 12406, 12416
Cisco 4000 Series	4000, 4000-M, 4500, 4500-M, 4700, 4700-M
Cisco 3600 Series	3620, 3640, 3660, CPA3640, CPA3620, 3661AC, 3662AC, 3662DC, 3662AC-CO, 3662DC-CO
Cisco 3500 Series	3550-12T, 3550-24, 3550-48,
Cisco 2950 Series	2950-C24
Cisco 2600 Series	2610, 2611, 2612, 2613, 2620, 2621, 2650XM, 2651
Cisco 2500 Series	2500 - 2525, 2501CF, 2501LF, 2502LF
Cisco 1700 Series	1710, 1720, 1760
Cisco 1600 Series	1601, 1602, 1603, 1604, 1605, CPA1601, CPA1602, CPA1603, CPA1604
Cisco 1000 Series	1000, 1003, 1004, 1005, 1020, CPA1003, CPA1004, CPA1005
Cisco 900 UBR Series	UBR-904, UBR-905, UBR-924, UBR-925
Cisco 10000 UBR Series	10012
Catalyst 2948G L3 Switch/Router	2948G-L3

Supported Cisco Devices (continued)







Access Servers	Devices
Cisco AS5000 Series	AS5200, AS5300, AS5350, AS5800, AS5850
Cisco 2500 Series	2509RJ, 2511RJ, CPA2500
Cisco switching access concentrator	MC3810

Switches	Devices
Catalyst 8500	8510CSR, 8510MSR, 8515CSR, 8540CSR, 8540CSR with ACL Daughter card, 8540MSR with ACL Daughter card
Catalyst 6000	MSFC, MSFC II, 6006, 6009, 6509, 6506, 6509-NEBS 6513. (Catalyst 6000 series switches running the native IOS are supp
Catalyst 5000	RSFC, RSM
Catalyst 2900-XL	2916M-XL, 2924-XL, 2924C-XL, 2924-XLv, 2924C-XLv, 2912-X 2924M-XL, 2912Mf-XL
Catalyst 3500-XL	3508G-XL, 3512-XL, 3524-XL, 3548-XL, 3524T-XLEn

#### Supported Cisco IOS Versions

- Cisco IOS Release 10.3 through 12.2

#### Supported Catalyst OS Versions

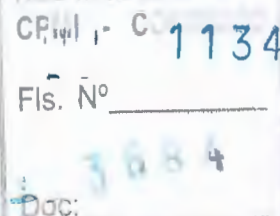
- CatOS 5.3 CSX through CatOS 7.1

#### Supported Operating Systems and Naming Services

Operating System	Naming Service
Solaris Version 2.7 and 2.8	DNS, NIS, HOST NISplus
Windows 2000 Professional and Server with support for Service pack	DNS, WINS, LMHOSTS

#### Supported ACL Features

- Creating new and editing existing ACLs
- Naming, renaming and numbering ACLs





- Reordering ACEs
- VLAN ACLs (VACLs) on Catalyst 6000
- Printing of ACL Manager data
- Copying configuration file to disk on download
- Options for saving configuration file to disk
- Support for optimizing ACL statements to eliminate redundancies

### Server, Client, and Web Browser System Requirements

- Server support (Solaris)—Solaris versions 2.7 and 2.8
- Server support (Windows)—Windows 2000 Professional and Server with supp Service Pack
- Client browser support (Solaris)—Netscape 4.76
- Client browser support (Windows)—Netscape 4.76, 4.77, 4.78 and Internet Ex 5.5 with SP2 and 6.0

### Service and Support

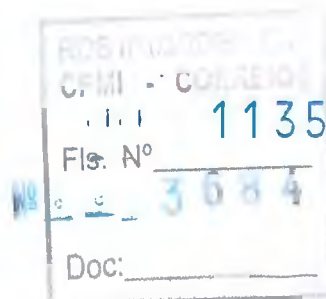
The CiscoWorks family of products is eligible to participate in the Cisco Software Appl Service (SAS) program. This service program offers customers contract-based 7x24 a the Cisco Technical Assistance Center (TAC), full Cisco Connection on-line (CCO) pri and minor software maintenance updates. A Software Application Service contract en that customers have easy access to the information and services needed to stay up-t with newly supported device packages, patches, and minor updates. For further infor on service and support offerings, contact your local sales office.

### Ordering Information

ACL Manager is part of the Routed WAN Management Solution. For more information Manager and the Routed WAN Management Solution go to:  
[www.cisco.com/warp/public/cc/pd/wr2k/rtnwrmn/](http://www.cisco.com/warp/public/cc/pd/wr2k/rtnwrmn/)

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## CHAPTER

## 1

## Installing ACL Manager

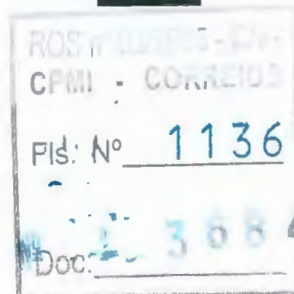
This installation guide provides information about ACL Manager requirements and installing ACL Manager on Windows 2000 and Solaris.

ACL Manager runs on top of CiscoWorks2000 Resource Manager Essentials (Essentials) Version 3.4.

## System Requirements for ACL Manager

The system requirements for ACL Manager are given in this section. ACL Manager requirements are the same as Essentials requirements, except where noted.

ACL Manager supports Cisco routers with Cisco IOS Releases 10.3 through 12.2, and Catalyst 6000 switches running Catalyst OS Releases 5.3 through 7.1.





## Windows 2000 Requirements

This section describes the minimum requirements for running ACL Manager on Windows 2000.

### Server Requirements

The ACL Manager server must:

- Be installed on a machine that is running Essentials, Release 3.4.
- Be an IBM PC-compatible with 550 MHz or faster Pentium III processor running Windows 2000 Server or Professional, with Service Pack 2.
- Have the following disk space and memory in addition to the requirements for Essentials:
  - 128 MB of memory RAM (minimum)
  - 70 MB of available disk space (minimum)

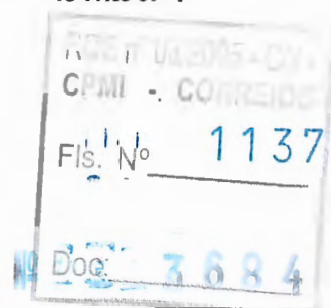
## Solaris Requirements

This section describes the minimum requirements for running ACL Manager on Solaris.

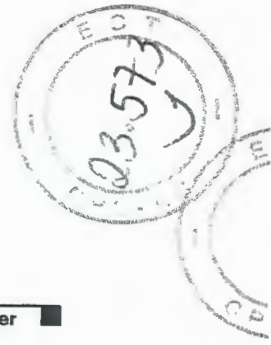
### Server Requirements

The ACL Manager server must:

- Be installed on a machine that is running Essentials, Release 3.4.
- Be a member of the Sun Ultra 60 family of products running Solaris 2.7 and 2.8.
- Have the following disk space and memory in addition to the requirements for Essentials:
  - 128 MB of memory RAM (minimum)
  - 50 MB of available disk space (minimum)







## Java Plug-in Requirements

Java Plug-in improves the performance of ACL Manager, and allows it to use the latest Java runtime functionality. The plug-in caches Java applets and speeds up the loading of the ACL Manager application.

Ensure that Java Plug-in version 1.3.1 is installed.

## Installing Java Plug-in

See Chapter 3 of *User Guide for CiscoWorks2000 Server*, for instructions on how to install Java Plug-in.

## ACL Manager on Multi-homed Machines

ACL Manager 1.4 is supported on multi-homed machines (machines with multiple Network Interface Cards (NICs), each configured with different IP addresses).

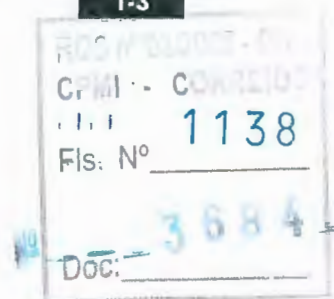
To run ACL Manager on a multi-homed machine, there are two requirements:

- All IP addresses must be configured in DNS.
- Only one IP address can be used by the client/browser to access ACL Manager Server. This is an ACL Manager restriction.

To ensure that ACL Manager runs properly on multi-homed machines, you must open and modify the gatekeeper configuration file. The file location is:

- *CiscoWorks2000 Installation Directory*\lib\vbroker\gatekeeper.cfg, on Windows.
- /opt/CSCOpX/lib/vbroker/gatekeeper.cfg, on Solaris.

It is recommended that you back up the gatekeeper configuration file before modifying it.





To modify the gatekeeper configuration file:

**Step 1** Stop the Daemon Manager by entering:

On Windows,

```
net stop crmdmgt
```

On Solaris,

```
/etc/init.d/dmgt stop
```

**Step 2** Replace every instance of *external-IP-address* with the external IP address that you choose, and remove the character "#", from the following:

```
#vbroker.gatekeeper.backcompat.callback.host=external-IP-address
```

```
#vbroker.se.exterior.host=external-IP-address
```

```
#vbroker.se.iiop_tp.host=external-IP-address
```

```
#vbroker.se.interior.host=external-IP-address
```

**Step 3** After modifying the gatekeeper configuration file, restart the Daemon Manager by entering:

On Windows,

```
net start crmdmgt
```

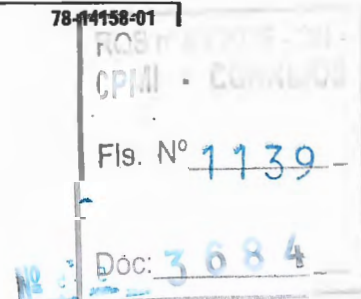
On Solaris,

```
/etc/init.d/dmgt start
```

## TCP Ports Used by ACL Manager

ACL Manager uses the ports 1683 and 8088, in addition to the ports documented for CiscoWorks2000.

If 1683 is blocked by a firewall, ACL Manager uses the port 8088.







## Installing ACL Manager on Windows 2000

This section describes how to install ACL Manager on Windows 2000.



**Note**

You have to be the administrator of the system or have admin privileges to perform installation.

### Installing the ACL Manager Server

To install the ACL Manager server:

- Step 1** Make sure your system meets all of the requirements described in the "Windows 2000 Requirements" section on page 1-2.
- Step 2** Close all applications.
- Step 3** Insert the ACL Manager CD into your CD-ROM drive.
- Step 4** Launch Windows Explorer, and double-click the CD-ROM drive icon.



**Note**

You can click **Cancel** to end the installation at any time. If you end the installation before it is complete, you must begin the installation again from this step.

- Step 5** Double-click the setup.exe icon.

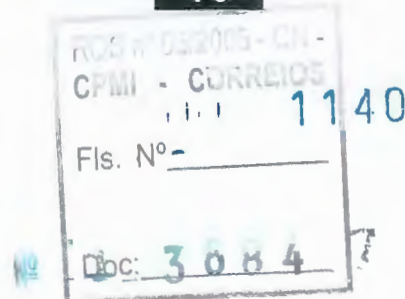
If Essentials is not installed, or a correct version of Essentials is not installed, ACL Manager exits with an appropriate message. To install Essentials, follow the instructions in *Installation and Set Up Guide for Resource Manager Essentials on Windows 2000*.

If you are upgrading from ACL Manager 1.3 to ACL Manager 1.4, the install program prompts you to back up data from the previous release.

If you are installing ACL Manager for the first time, skip to Step 8.

- Step 6** Click **Yes** in the dialog box that asks whether you want to back up your previous data.

A Directory Selection dialog box appears.





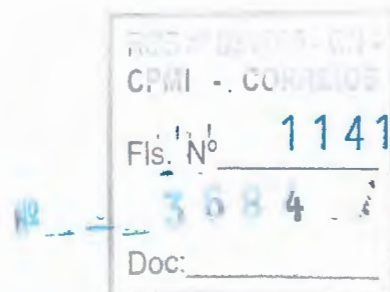
- Step 7** Accept the default destination or enter a new path, then click **Next**.  
After the data has been backed up, the program continues installing ACL Manager.
- Step 8** Click **Next** in the Welcome dialog box that appears.
- Step 9** Accept the default name and company or enter new data in the User Information dialog box.
- Step 10** Click **Next**.  
A dialog box appears displaying the directory where ACL Manager will be installed.
- Step 11** Click **Next**.  
If Essentials is running, the install program asks you whether you want to stop the CiscoWorks2000 Daemon Manager. Click **Yes** to continue installing ACL Manager. If you click **No**, the installation program exits.  
If you clicked **Yes**, the installation program stops CiscoWorks2000 Server Manager and the Start Copying Files Window appears. After all files are copied, the ACL Manager Program settings are modified. ACL Manager gets registered in the CiscoWorks2000 data backup framework. The install program displays a message that the CiscoWorks2000 Daemon Manager is starting.
- Step 12** Click **Finish** in the Setup Complete dialog box to complete the installation.

## Upgrading ACL Manager Data from a Remote Windows 2000

If you have installed ACL Manager 1.4, and you also have ACL Manager 1.3 on another server, you have to upgrade the existing data to ACL Manager 1.4.

**Note**

You must upgrade Essentials and CMF data before you can upgrade ACL Manager data.







Upgrading data from a remote machine consists of:

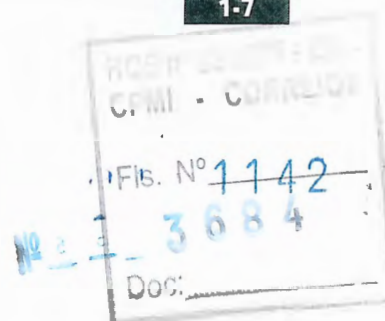
- Exporting ACL Manager data from the server that has ACL Manager 1.3
- Importing this data into the server that has ACL Manager 1.4

To export ACL Manager data:

- Step 1** Access the server that has ACL Manager 1.3.
- Step 2** Set the *NMSROOT* variable to CiscoWorks2000 install directory.
- Step 3** To shut down ACL Manager, enter:  
`%NMSROOT%\bin\pdterm AclmServer`
- Step 4** Insert the ACL Manager 1.4 CD into the CD-ROM drive.
- Step 5** At the command prompt, corresponding to the drive where the CD-ROM contents can be accessed, enter:  
`%NMSROOT%\bin\perl.exe export_aclm.pl`
- Step 6** Enter the backup directory name at the prompt. The *aclmdata.tar* file will be stored at the specified location.  
You can also enter the backup directory name as a command line option:  
`%NMSROOT%\bin\perl.exe export_aclm.pl backup directory`
- Step 7** Copy the *aclmdata.tar* file to any location on the machine where ACL Manager 1.4 is installed.
- Step 8** Start the ACL Manager. Enter:  
`%NMSROOT%\bin\pdexec AclmServer`

**Note**

You must import Essentials and CMF data before you can import ACL Manager data.





To import ACL Manager data:

**Step 1** Access the server that has ACL Manager 1.4.

**Step 2** Shut down ACL Manager. Enter:

```
%NMSROOT%\bin\pdterm AclmServer
```

**Step 3** Enter:

```
cd %NMSROOT%\rigel\scripts
%nmsroot%\bin\perl.exe import_aclm.pl
```

where *NMSROOT* is the directory in which CiscoWorks2000 is installed (c:\program files\CSCOpX by default).

**Step 4** Enter the location and name of the file (*aclmdata.tar*) at the prompt.

After you enter the backup directory and filename, this message appears on the screen:

```
Restoring removes all existing data including jobs.
Remove existing data and continue [y/n]?
```

**Step 5** Enter *y*, and then press **Return**.

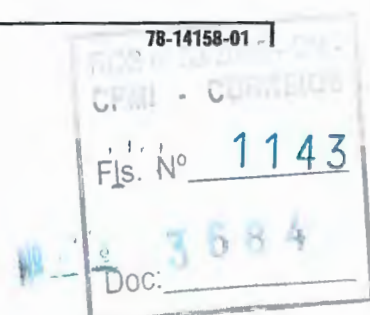
**Step 6** Start ACL Manager. Enter:

```
%NMSROOT%\bin\pdexec AclmServer
```

## Installing ACL Manager on Solaris

This section describes how to install ACL Manager on a Solaris machine.

You can install the ACL Manager on a local disk or on a network-mounted Network File System (NFS) disk to which you have root access.







## Installing the ACL Manager Server

To install the ACL Manager server:

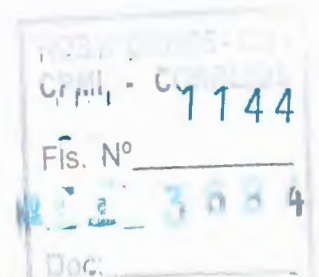
- Step 1** Make sure your system meets all of the requirements as described in Solaris Requirements, page 1-2.
- Step 2** To become superuser, enter **su** and the root password at the command prompt, or log in as **root**.
- Step 3** Insert the ACL Manager CD into your CD-ROM drive.
- The CD-ROM is automatically mounted into the `/cdrom/cdrom0` directory. If you are running File Manager, a separate File Manager window displays the contents of the CD-ROM.
- Step 4** Enter:
- ```
# cd /cdrom/cdrom0
# ./setup.sh
```
- Step 5** Enter **y** to agree to the terms of the copyright, then press **Return**.
- If you are upgrading ACL Manager 1.3 to 1.4, the install program prompts you to back up data from the previous release.
- Step 6** Enter **y** at the command prompt, then press **Return**.
- Step 7** Enter the path for the backup directory, then press **Return**.
- After the data has been backed up, if the correct version of Essentials is not installed, an error message appears and the installation terminates. To install Essentials, follow the instructions in *Installation and Set Up Guide for Resource Manager Essentials on Solaris*.

If Essentials is installed, this message appears on your screen:

Select component(s) you wish to install (all/none/q)?[all]:



**Note** If you are installing ACL Manager for the first time and Essentials is installed, this message will appear after Step 5.





**Step 8** Enter **a11**, then press **Return**.

If Essentials is running, the install program asks you whether you want to stop the CiscoWorks2000 Daemon Manager. Type **y** to continue installing ACL Manager. If you type **n**, the installation program exits.

The installation program displays the names of the server files being installed. If you have upgraded from ACL Manager 1.3 to 1.4, the data is updated. ACL Manager gets registered in the CiscoWorks2000 data backup framework. After the installation is complete, the installation program restarts the CiscoWorks2000 Daemon Manager.

## Upgrading ACL Manager Data from a Remote Solaris Machine

If you have installed ACL Manager 1.4 on a Solaris machine, and you have ACL Manager 1.3 on another Solaris machine, you will have to upgrade the existing data to ACL Manager 1.4.

**Note**

You must upgrade Essentials and CMF data before you can upgrade ACL Manager data.

Upgrading data from a remote machine consists of:

- Exporting ACL Manager data from the server that has ACL Manager 1.3.
- Importing this data into the server that has ACL Manager 1.4.

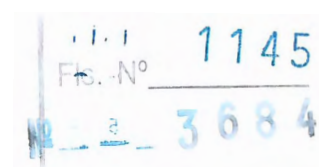
To export ACL Manager data:

**Step 1** Access the server that has ACL Manager 1.3.

**Step 2** To shut down ACL Manager, enter:

```
$NMSROOT/bin/pdterm AclmServer
```

where *\$NMSROOT* is the directory in which CiscoWorks2000 is installed (/opt/CSCOpX by default).







**Step 3** Mount the ACL Manager 1.4 CD-ROM. Enter:

```
cd cdrom/cdrom0
```

**Step 4** Enter:

```
./export_aclm.pl
```

**Step 5** Enter the backup directory name at the prompt. The *aclmdata.tar* file will be stored at the specified location.

You can also enter the backup directory name as a command line option:

```
./export_aclm.pl backup_directory
```

The *aclmdata.tar* file will be stored at the specified location.

**Step 6** Do an ftp of *aclmdata.tar* in the binary mode to the machine that has ACL Manager 1.4.

**Step 7** Start ACL Manager. Enter:

```
$NMSROOT/bin/pdexec AclmServer
```



**Note** You must import Essentials and CMF data before you can import ACL Manager data.

To import ACL Manager data:

**Step 1** Access the server that has ACL Manager 1.4.

**Step 2** Shut down ACL Manager. Enter:

```
$NMSROOT/bin/pdterm AclmServer
```

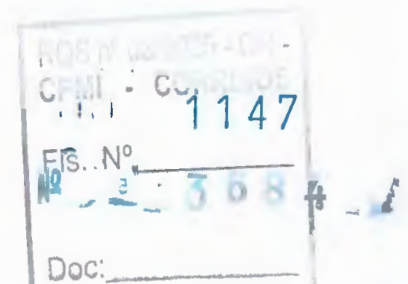
**Step 3** Enter these commands:

```
cd $NMSROOT/rigel/scripts
./import_aclm.pl
```

where *\$NMSROOT* is the directory in which CiscoWorks2000 is installed (/opt/CSCOpX by default).

CPMI  
1146

3684







**Note** After you uninstall ACL Manager, some directories and files might remain. If this is the case, delete these directories and files, manually. If you cannot delete them and the message, The file is in use, appears, reboot your system. You should then be able to delete the remaining files.

## Uninstalling ACL Manager on Solaris

You need to have root privileges to uninstall ACL Manager.

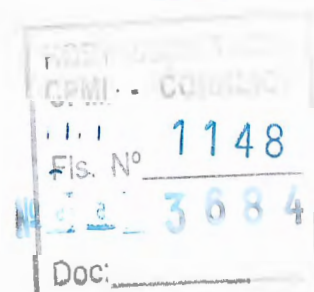
To uninstall the ACL Manager server:

**Step 1** Enter this command:

```
# /usr/sbin/pkgrm CSCOaclds
```

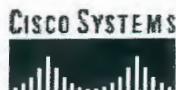
A message appears, asking you if you want to remove this package.

**Step 2** Enter **y**, then press **Return**.








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## CISCOWORKS VPN/SECURITY MANAGEMENT SOLUTION

### Introduction

CiscoWorks VPN/Security Management Solution (VMS) is an [Ordering](#) integral part of the Cisco SAFE Blueprint for Enterprise network security and protects the productivity of organizations by combining web-based tools for configuring, monitoring, and trouble-shooting VPNs, firewalls, and network- and host-based intrusion detection systems (IDSs). CiscoWorks VMS also delivers network device inventory, change audit and software distribution features.

CiscoWorks VMS is organized into several functional areas:

- Firewall Management
- IDS Management, network and host-based
- VPN Router Management
- Security Monitoring
- VPN Monitoring
- Operational Management

To configure and manage PIX for smaller environments, on a device-by-device basis, refer to [Cisco PIX Device Manager](#)

Applications included in CiscoWorks VMS 2.2:

[CiscoWorks Management Center for Firewalls](#)

[CiscoWorks Auto Update Server Software](#)

[CiscoWorks Management Center for IDS Host Sensors](#)

[CiscoWorks Management Center for Cisco Security Agents](#)

[CiscoWorks Management Center for VPN Routers](#)

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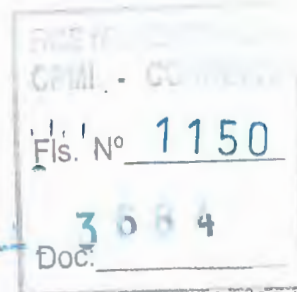
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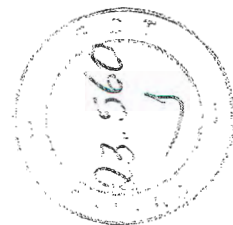
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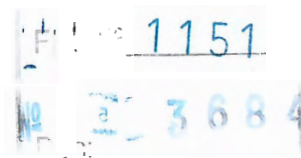
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# CHAPTER 3

## A through B Commands

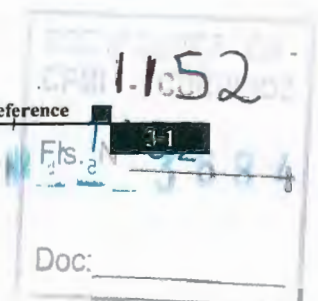
### aaa accounting

Enable, disable, or view LOCAL, TACACS+, or RADIUS user accounting (on a server designated by the **aaa-server** command). (Configuration mode.)

| Configure with the command...                                                                                                                                          | Remove with the command...                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>aaa accounting include   exclude</b><br><i>acctg_service inbound   outbound  </i><br><i>if_name local_ip local_mask foreign_ip</i><br><i>foreign_mask group_tag</i> | <b>no aaa accounting include   exclude</b><br><i>authn_service inbound   outbound  </i><br><i>if_name group_tag</i><br><br><b>clear aaa [accounting include   exclude</b><br><i>authn_service inbound   outbound  </i><br><i>if_name group_tag]</i> |
| <b>aaa accounting match acl_name inbound  </b><br><b>outbound   if_name group_tag</b>                                                                                  | <b>no aaa accounting match acl_name</b><br><b>inbound   outbound   if_name</b><br><b>group_tag</b>                                                                                                                                                  |
| Show command options                                                                                                                                                   | Show command output                                                                                                                                                                                                                                 |
| <b>show aaa</b>                                                                                                                                                        | Displays the AAA authentication configuration.                                                                                                                                                                                                      |

#### Syntax Description

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>accounting</b>    | Enable or disable accounting services with authentication server. Use of this command requires that you previously used the <b>aaa-server</b> command to designate an authentication server.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>acctg_service</i> | The accounting service. Accounting is provided for all services or you can limit it to one or more services. Possible values are <b>any</b> , <b>ftp</b> , <b>http</b> , <b>telnet</b> , or <i>protocol/port</i> . Use <b>any</b> to provide accounting for all TCP services. To provide accounting for UDP services, use the <i>protocol/port</i> form.<br><br>For <i>protocol/port</i> , the TCP <i>protocol</i> appears as 6, the UDP protocol appears as 17, and so on, and port is the TCP or UDP destination port. A port value of 0 (zero) means all ports. For protocols other than TCP and UDP, the <i>port</i> is not applicable and should not be used. |
| <i>foreign_ip</i>    | The IP address of the hosts you want to access the <i>local_ip</i> address. Use 0 to mean all hosts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



The **clear access-group** command removes all entries from an access list indexed by *acl\_ID*. If *acl\_ID* is not specified, all **access-list** command statements are removed from the configuration.

### Examples

The following example shows use of the **access-group** command:

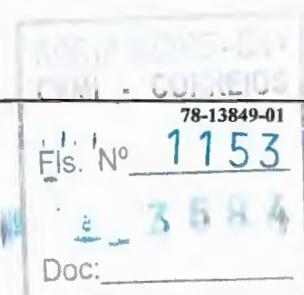
```
static (inside,outside) 209.165.201.3 10.1.1.3
access-list acl_out permit tcp any host 209.165.201.3 eq 80
access-group acl_out in interface outside
```

The **static** command statement provides a global address of 209.165.201.3 for the web server at 10.1.1.3. The **access-list** command statement lets any host access the global address using port 80. The **access-group** command specifies that the **access-list** command statement applies to traffic entering the outside interface.

## access-list

Create an access list, or use downloadable access lists. (Downloadable access lists are supported for RADIUS servers only). (Configuration mode.)

| Configure with the command...                                                                                                                                                                                                                                                                                                                                                                                                            | Remove with the command...                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>access-list [<i>acl_ID</i>] compiled</b>                                                                                                                                                                                                                                                                                                                                                                                              | <b>no access-list [<i>acl_ID</i>] compiled</b>                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>access-list <i>acl_ID</i> {deny   permit} icmp</b><br>{ <i>source_addr</i>   <i>local_addr</i> }<br>{ <i>source_mask</i>   <i>local_mask</i> }<br>{ <i>destination_addr</i>   <i>remote_addr</i> }<br>{ <i>destination_mask</i>   <i>remote_mask</i> }<br><i>icmp_type</i>                                                                                                                                                            | <b>no access-list [<i>acl_ID</i>] {deny   permit} icmp</b><br>{ <i>source_addr</i>   <i>local_addr</i> }<br>{ <i>source_mask</i>   <i>local_mask</i> }<br>{ <i>destination_addr</i>   <i>remote_addr</i> }<br>{ <i>destination_mask</i>   <i>remote_mask</i> }<br><i>icmp_type</i>                                                                                                                                                           |
| <b>access-list <i>id</i> {deny   permit} icmp</b><br>{ <i>source_addr</i>   <i>local_addr</i> }<br>{ <i>source_mask</i>   <i>local_mask</i> }  <br><b>object-group <i>network_obj_grp_id</i></b><br>{ <i>destination_addr</i>   <i>remote_addr</i> }<br>{ <i>destination_mask</i>   <i>remote_mask</i> }  <br><b>object-group <i>network_obj_grp_id</i></b><br>[ <i>icmp_type</i>   <b>object-group</b><br><i>icmp_type_obj_grp_id</i> ] | <b>no access-list <i>id</i> {deny   permit} {icmp</b><br>{ <i>source_addr</i>   <i>local_addr</i> }<br>{ <i>source_mask</i>   <i>local_mask</i> }  <br><b>object-group <i>network_obj_grp_id</i></b><br>{ <i>destination_addr</i>   <i>remote_addr</i> }<br>{ <i>destination_mask</i>   <i>remote_mask</i> }  <br><b>object-group <i>network_obj_grp_id</i></b><br>[ <i>icmp_type</i>   <b>object-group</b><br><i>icmp_type_obj_grp_id</i> ] |
| <b>access-list <i>acl_ID</i> {deny   permit} protocol</b><br>{ <i>source_addr</i>   <i>local_addr</i> }<br>{ <i>source_mask</i>   <i>local_mask</i> } [ <i>operator</i><br><i>port</i> [ <i>port</i> ] { <i>destination_addr</i>  <br><i>remote_addr</i> } { <i>destination_mask</i>  <br><i>remote_mask</i> } [ <i>operator port</i> [ <i>port</i> ]                                                                                    | <b>no access-list <i>acl_ID</i> [{deny   permit}</b><br><i>protocol</i> { <i>source_addr</i>   <i>local_addr</i> }<br>{ <i>source_mask</i>   <i>local_mask</i> } [ <i>operator</i><br><i>port</i> [ <i>port</i> ] { <i>destination_addr</i>  <br><i>remote_addr</i> } { <i>destination_mask</i>  <br><i>remote_mask</i> } [ <i>operator port</i> [ <i>port</i> ]]                                                                            |





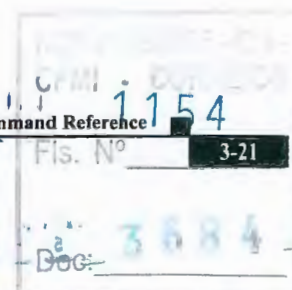


| Configure with the command...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Remove with the command...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>access-list</b> <i>id</i> {deny   permit} {protocol  <br><b>object-group</b> <i>protocol_obj_grp_id</i><br>{source_addr   local_addr}<br>{source_mask   local_mask}  <br><b>object-group</b> <i>network_obj_grp_id</i><br>[operator port [port]   <b>object-group</b><br><i>service_obj_grp_id</i> ] {destination_addr  <br>remote_addr} {destination_mask  <br>remote_mask}   <b>object-group</b><br><i>network_obj_grp_id</i> [operator port<br>[port]   <b>object-group</b><br><i>service_obj_grp_id</i> ]} | <b>no access-list</b> <i>id</i> {deny   permit} {protocol  <br><b>object-group</b> <i>protocol_obj_grp_id</i><br>{source_addr   local_addr}<br>{source_mask   local_mask}  <br><b>object-group</b> <i>network_obj_grp_id</i><br>[operator port [port]   <b>object-group</b><br><i>service_obj_grp_id</i> ] {destination_addr  <br>remote_addr} {destination_mask  <br>remote_mask}   <b>object-group</b><br><i>network_obj_grp_id</i> [operator port<br>[port]   <b>object-group</b><br><i>service_obj_grp_id</i> ]} |
| <b>debug access-list all   standard   turbo</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>no debug access-list all   standard   turbo</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>clear access-list</b> [ <i>acl_ID</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>clear access-list</b> <i>acl_ID</i> counters                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Show command options                                            | Show command output                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show access-list</b> [[ <i>acl_ID</i> ] <i>source_addr</i> ] | <p>Displays the <b>access-list</b> command statements in the configuration, the hit count of the number of times each element has been matched during an <b>access-list</b> command search, and whether or not the list is configured for TurboACL.</p> <p>The <i>source_addr</i> option filters the show output so that only those access-list elements that match the source IP address (or with <b>any</b> as source IP address) are displayed.</p> |

#### Syntax Description

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>acl_ID</i>   | Name of an access list. You can use either a name or number.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>compiled</b> | <p>When used in conjunction with the <b>access-list</b> command, this turns on TurboACL unless the <b>no</b> qualifier is used, in which case the command <b>no access-list</b> <i>acl_ID</i> <b>compiled</b> turns off TurboACL for that access list.</p> <p>To use TurboACL globally, enter the <b>access-list compiled</b> command and to globally turn off TurboACL, enter the <b>no access-list compiled</b> command.</p> <p>After TurboACL has been globally configured, individual access lists or groups can have TurboACL enabled or disabled using individual [<b>no</b>] <b>access-list</b> <i>acl_ID</i> <b>compiled</b> commands.</p> <p>TurboACL is compiled only if the number of access list elements is greater than or equal to 19.</p> |
| <b>debug</b>    | Outputs access list debugging information to the console.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |





## D through F Commands

### debug

You can debug packets or ICMP tracings through the PIX Firewall. The **debug** command provides information that helps troubleshoot protocols operating with and through the PIX Firewall. (Configuration mode.)

| Start logging with the command...                                                                                                                                                                                                            | Stop logging with the command...                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>debug access-list all   standard   turbo</b>                                                                                                                                                                                              | <b>no debug access-list all   standard   turbo</b>                                                                                                                                                                                              |
| <b>debug crypto ca [level]</b>                                                                                                                                                                                                               | <b>no debug crypto ca [level]</b>                                                                                                                                                                                                               |
| <b>debug crypto ipsec [level]</b>                                                                                                                                                                                                            | <b>no debug crypto ipsec [level]</b>                                                                                                                                                                                                            |
| <b>debug crypto isakmp [level]</b>                                                                                                                                                                                                           | <b>no debug crypto isakmp [level]</b>                                                                                                                                                                                                           |
| <b>debug dhcp detail   error   packet</b>                                                                                                                                                                                                    | <b>no debug dhcp detail   error   packet</b>                                                                                                                                                                                                    |
| <b>debug dhcpd event   packet</b>                                                                                                                                                                                                            | <b>no debug dhcpd event   packet</b>                                                                                                                                                                                                            |
| <b>debug dns {resolver   all}</b>                                                                                                                                                                                                            | <b>no debug dns {resolver   all}</b>                                                                                                                                                                                                            |
| <b>debug fixup {udp   tcp}</b>                                                                                                                                                                                                               | <b>no debug fixup {udp   tcp}</b>                                                                                                                                                                                                               |
| <b>debug fover option</b>                                                                                                                                                                                                                    | <b>no debug fover option</b>                                                                                                                                                                                                                    |
| <b>debug h323 h225 [asn   event]</b>                                                                                                                                                                                                         | <b>no debug h323 h225 [asn   event]</b>                                                                                                                                                                                                         |
| <b>debug h323 h225 [h245   ras event   asn]</b>                                                                                                                                                                                              | <b>no debug h323 h225 [h245   ras event   asn]</b>                                                                                                                                                                                              |
| <b>debug h323 h245 [asn   event]</b>                                                                                                                                                                                                         | <b>no debug h323 h245 [asn   event]</b>                                                                                                                                                                                                         |
| <b>debug h323 ras [asn   event]</b>                                                                                                                                                                                                          | <b>no debug h323 ras [asn   event]</b>                                                                                                                                                                                                          |
| <b>debug icmp trace</b>                                                                                                                                                                                                                      | <b>no debug icmp trace</b>                                                                                                                                                                                                                      |
| <b>debug ils</b>                                                                                                                                                                                                                             | <b>no debug ils</b>                                                                                                                                                                                                                             |
| <b>debug ntp [adjust   authentication   events  <br/>loopfilter   packets   params   select  <br/>sync   validity]</b>                                                                                                                       | <b>no debug ntp [adjust   authentication  <br/>events   loopfilter   packets   params  <br/>select   sync   validity]</b>                                                                                                                       |
| <b>debug packet if_name [src source_ip<br/>[netmask mask]] [dst dest_ip [netmask<br/>mask]] [[proto icmp]   [proto tcp [sport<br/>src_port] [dport dest_port]]   [proto<br/>udp [sport src_port] [dport dest_port]]<br/>[rx   tx   both]</b> | <b>no debug packet if_name [src source_ip<br/>[netmask mask]] [dst dest_ip [netmask<br/>mask]] [[proto icmp]   [proto tcp [sport<br/>src_port] [dport dest_port]]   [proto<br/>udp [sport src_port] [dport dest_port]]<br/>[rx   tx   both]</b> |
| <b>debug pdm history</b>                                                                                                                                                                                                                     | <b>no debug pdm history</b>                                                                                                                                                                                                                     |
| <b>debug ppp error   io   uauth   upap   chap  <br/>negotiation</b>                                                                                                                                                                          | <b>no debug ppp error   io   uauth   upap   chap<br/>  negotiation</b>                                                                                                                                                                          |



## fixup protocol

Modifies PIX Firewall protocol fixups to add, delete, or change services and feature defaults.  
(Configuration mode.)

| Configure with the command...                        | Remove with the command...                              |
|------------------------------------------------------|---------------------------------------------------------|
| <b>fixup protocol ftp</b> [strict] [port]            | <b>no fixup protocol</b> [protocol_name] [port]         |
| <b>fixup protocol http</b> [port[-port]]             | <b>clear fixup</b>                                      |
| <b>fixup protocol h323</b> {h225   ras} port [-port] | <b>no fixup protocol h323</b> {h225   ras} port [-port] |
| <b>fixup protocol ils</b> [port[-port]]              |                                                         |
| <b>fixup protocol rsh</b> [514]                      |                                                         |
| <b>fixup protocol rtsp</b> [port]                    |                                                         |
| <b>fixup protocol sip</b> [5060]                     |                                                         |
| <b>fixup protocol skinny</b> [2000]                  |                                                         |
| <b>fixup protocol smtp</b> [port[-port]]             |                                                         |
| <b>fixup protocol sqlnet</b> [port[-port]]           |                                                         |
| <b>fixup protocol skinny port</b> [-port]            |                                                         |

| Show command options                           | Show command output                                             |
|------------------------------------------------|-----------------------------------------------------------------|
| <b>show fixup</b>                              | Displays the current fixup configuration and port values.       |
| <b>show fixup protocol protocol</b> [protocol] | Displays the port values for the individual protocol specified. |
| <b>show conn state sip</b>                     | Displays the connection state of the designated protocol.       |
| <b>show timeout sip</b>                        | Displays the timeout value of the designated protocol.          |

| Syntax Description                                      |                                                                                                                                                                                                                           |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>fixup protocol protocol</b> [protocol] [port[-port]] | Modifies PIX Firewall protocol fixups to add, delete, or change services and feature defaults.                                                                                                                            |
| <b>fixup protocol ils</b>                               | Provides support for Microsoft NetMeeting, SiteServer, and Active Directory products that use LDAP to exchange directory information with an ILS server.                                                                  |
| <b>ftp</b>                                              | Specifies to change the ftp port number.                                                                                                                                                                                  |
| <b>h323 ras</b>                                         | Specifies to use RAS with H.323 to enable dissimilar communication devices to communicate with each other. H.323 defines a common set of CODECs, call setup and negotiating procedures, and basic data transport methods. |

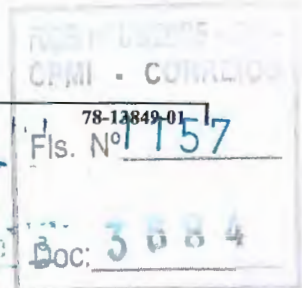
|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>h323 h225</b>                            | Specifies to use H.225, the ITU standard that governs H.225.0 session establishment and packetization, with H.323. H.225.0 actually describes several different protocols: RAS, use of Q.931, and use of RTP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>http</b> [ <i>port</i> [- <i>port</i> ]] | The default port for HTTP is 80. Use the <i>port</i> option to change the HTTP port, or the <i>port-port</i> option to specify a range of HTTP ports.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>ils</b>                                  | Specifies the Internet Locator Service. The default port is TCP LDAP server port 389.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>no</b>                                   | Disables the fixup of a protocol by removing all fixups of the protocol from the configuration using the <b>no fixup</b> command. After removing all fixups for a protocol, the <b>no fixup</b> form of the command or the default port is stored in the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>port</b>                                 | Specify the port number or range for the application protocol. The default ports are: TCP 21 for <b>ftp</b> , TCP LDAP server port 389 for <b>ils</b> , TCP 80 for <b>http</b> , TCP 1720 for <b>h323 h225</b> , UDP 1718-1719 for <b>h323 ras</b> , TCP 514 for <b>rsh</b> , TCP 554 for <b>rtsp</b> , TCP 2000 for <b>skinny</b> , TCP 25 for <b>smtp</b> , TCP 1521 for <b>sqlnet</b> , and TCP 5060 for <b>sip</b> . The default port value for <b>rsh</b> cannot be changed, but additional port statements can be added. See the "Ports" section in Chapter 2, "Using PIX Firewall Commands" for a list of valid port literal names. The port over which the designated protocol travels. |
| <b>protocol</b>                             | Specifies the protocol to fix up.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>protocol_name</b>                        | The protocol name.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>ras</b>                                  | Registration, admission, and status (RAS) is a signaling protocol that performs registration, admissions, bandwidth changes, status, and disengage procedures between the VoIP gateway and the gatekeeper.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>sip</b>                                  | Enable or change the port assignment of the Session Initiation Protocol (SIP) for TCP connections. UDP SIP is on by default and cannot be disabled and the port assignment is nonconfigurable. PIX Firewall Version 6.2 introduces PAT support for SIP.                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>skinny</b>                               | Enable SCCP. SCCP protocol supports IP telephony and can coexist in an H.323 environment. An application layer ensures that all SCCP signaling and media packets can traverse the PIX Firewall and interoperate with H.323 terminals.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>strict</b>                               | Prevent web browsers from sending embedded commands in FTP requests. Each FTP command must be acknowledged before a new command is allowed. Connections sending embedded commands are dropped.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Defaults

The default ports for the PIX Firewall fixup protocols are as follows:

```
fixup protocol ftp 21
fixup protocol http 80
fixup protocol h323 h225 1720
fixup protocol h323 ras 1718-1719
fixup protocol ils 389
fixup protocol rsh 514
fixup protocol rtsp 554
fixup protocol smtp 25
fixup protocol sqlnet 1521
fixup protocol sip 5060
fixup protocol skinny 2000
```

(These are the defaults that are enabled on a PIX Firewall running software version 6.2.)







### Usage Guidelines

The **fixup protocol** commands let you view, change, enable, or disable the use of a service or protocol through the PIX Firewall. The ports you specify are those that the PIX Firewall listens at for each respective service. You can change the port value for each service except **rsh** and **sip**. The **fixup protocol** commands are always present in the configuration and are enabled by default.

The **fixup protocol** command performs the Adaptive Security Algorithm based on different port numbers other than the defaults. This command is global and changes things for both inbound and outbound connections, and cannot be restricted to any **static** command statements.

The **clear fixup** command resets the fixup configuration to its default. It does not remove the default **fixup protocol** commands.

You can disable the fixup of a protocol by removing all fixups of the protocol from the configuration using the **no fixup** command. After you remove all fixups for a protocol, the **no fixup** form of the command or the default port is stored in the configuration.

### fixup protocol ftp

Use the **fixup protocol ftp** command to specify the listening port or ports for the File Transfer Protocol (FTP). The following describes the features and usage of this command:

- The PIX by default listens to port 21 for FTP.
- Multiple ports can be specified.
- Only specify the port for the FTP control connection and not the data connection. The PIX stateful inspection will dynamically prepare the data connection as necessary. For instance, the following is incorrect:

#### INCORRECT

```
fixup protocol ftp 21
fixup protocol ftp 20
```

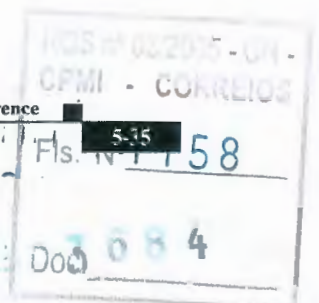
#### CORRECT

```
fixup protocol ftp 21
```

- Use caution when moving FTP to a higher port. For example, if you set the FTP port to 2021 by entering **fixup protocol ftp 2021** all connections that initiate to port 2021 will have their data payload interpreted as FTP commands.

The following is an example of a **fixup protocol ftp** configuration that uses multiple FTP fixups:

```
:
: For a PIX Firewall with two interfaces
:
ip address outside 192.168.1.1 255.255.255.0
ip address inside 10.1.1.1 255.255.255.0
:
: There is an inside host 10.1.1.15 that will be
: exported as 192.168.1.15. This host runs the FTP
: services at port 21 and 1021
:
static (inside, outside) 192.168.1.15 10.1.1.15
:
: Construct an access list to permit inbound FTP traffic to
: port 21 and 1021
:
access-list outside permit tcp any host 192.168.1.15 eq ftp
access-list outside permit tcp any host 192.168.1.15 eq 1021
access-group outside in interface outside
:
: Specify that traffic to port 21 and 1021 are FTP traffic
```



```

:
fixup protocol ftp 21
fixup protocol ftp 1021

```

If you disable FTP fixups with the **no fixup protocol ftp** command, outbound users can start connections only in passive mode, and all inbound FTP is disabled.

The **strict** option to the **fixup protocol ftp** command prevents web browsers from sending embedded commands in FTP requests. Each FTP command must be acknowledged before a new command is allowed. Connections sending embedded commands are dropped. The **strict** option only lets an FTP server generate the 227 command and only lets an FTP client generate the PORT command. The 227 and PORT commands are checked to ensure they do not appear in an error string.

#### **fixup protocol h323 {h225 | ras}**

The **fixup protocol h323 {h225 | ras}** command provides support for H.323 compliant applications such as Cisco CallManager and VocalTec Gatekeeper. H.323 is a suite of protocols defined by the International Telecommunication Union (ITU) for multimedia conferences over LANs. Version 5.3 and higher supports H.323 version 2. H.323 version 2 adds the following functionality to the PIX Firewall:

- Fast Connect or Fast Start Procedure for faster call setup
- H.245 tunneling for resource conservation, call synchronization, and reduced set up time

PIX Firewall software versions 6.2 and higher support PAT for H.323.

When upgrading from any pre-PIX Firewall software version 6.2 release, the following will be added to the configuration:

```
fixup protocol h323 ras 1718-1719
```

Additionally, **fixup protocol h323 port** becomes **fixup protocol h323 h225 port**.

You can disable H.225 signalling or RAS fixup (or both) with the **no fixup protocol h323 {h225 | ras} port [-port]** command.

#### **fixup protocol http**

The **fixup protocol http** command sets the port for Hypertext Transfer Protocol (HTTP) traffic. The default port for HTTP is 80.

Use the **port** option to change the default port assignments from 80. Use the **port-port** option to apply HTTP application inspection to a range of port numbers.

Note

The **no fixup protocol http** command statement also disables the **filter url** command.

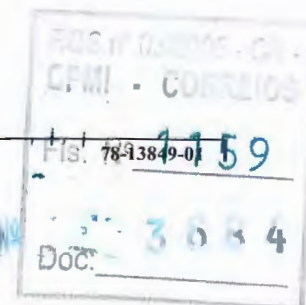
HTTP inspection performs several functions:

- URL logging of GET messages
- URL screening through N2H2 or Websense
- Java and ActiveX filtering

The latter two features must be configured in conjunction with the **filter** command.

#### **fixup protocol ils**

The **fixup protocol ils** command provides NAT support for Microsoft NetMeeting, SiteServer, and Active Directory products that use Lightweight Directory Access Protocol (LDAP) to exchange directory information with an Internet Locator Service (ILS) server.







### **fixup protocol rtsp**

The **fixup protocol rtsp** command lets PIX Firewall pass Real Time Streaming Protocol (RTSP) packets. RTSP is used by RealAudio, RealNetworks, Apple QuickTime 4, RealPlayer, and Cisco IP/TV connections.

If you are using Cisco IP/TV, use RTSP TCP port 554 and TCP 8554:

```
fixup protocol rtsp 554
fixup protocol rtsp 8554
```

The following restrictions apply to the **fixup protocol rtsp** command:

1. This PIX Firewall will not fix RTSP messages passing through UDP ports.
2. PAT is not supported with the **fixup protocol rtsp** command.
3. PIX Firewall does not have the ability to recognize HTTP cloaking where RTSP messages are hidden in the HTTP messages.
4. PIX Firewall cannot perform NAT on RTSP messages because the embedded IP addresses are contained in the SDP files as part of HTTP or RTSP messages. Packets could be fragmented and PIX Firewall cannot perform NAT on fragmented packets.
5. With Cisco IP/TV, the number of NATs the PIX Firewall performs on the SDP part of the message is proportional to the number of program listings in the Content Manager (each program listing can have at least six embedded IP addresses).
6. You can configure NAT for Apple QuickTime 4 or RealPlayer. Cisco IP/TV only works with NAT if the Viewer and Content Manager are on the outside network and the server is on the inside network.
7. When using RealPlayer, it is important to properly configure transport mode. For the PIX Firewall, add an **access-list** command statement from the server to the client or vice versa. For RealPlayer, change transport mode by clicking **Options>Preferences>Transport>RTSP Settings**.

If using TCP mode on the RealPlayer, select the **Use TCP to Connect to Server** and **Attempt to use TCP for all content** check boxes. On the PIX Firewall, there is no need to configure the fixup.

If using UDP mode on the RealPlayer, select the **Use TCP to Connect to Server** and **Attempt to use UDP for static content** check boxes, and for live content not available via Multicast. On the PIX Firewall, add a **fixup protocol rtsp port** command statement.

### **fixup protocol sip**

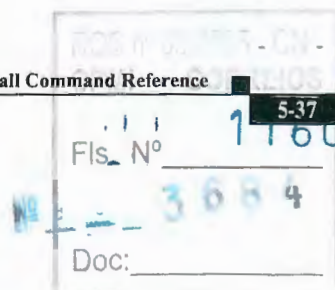
Session Initiation Protocol (SIP), as defined by the Internet Engineering Task Force (IETF), enables call handling sessions and two-party audio conferences (calls). SIP works with Session Description Protocol (SDP) for call signalling. SDP specifies the ports for the media stream. Using SIP, the PIX Firewall can support any SIP Voice over IP (VoIP) gateway or VoIP proxy server. SIP and SDP are defined in the following RFCs:

- SIP: Session Initiation Protocol, RFC 2543
- SDP: Session Description Protocol, RFC 2327

To support SIP, calls through the PIX Firewall, signaling messages for the media connection addresses, media ports, and embryonic connections for the media must be inspected. This is because while the signaling is sent over a well known destination port (UDP/TCP 5060), the media streams are dynamically allocated. Therefore, SIP is a text-based protocol and contains the IP addresses throughout the text. The packets are inspected and NAT is provided for the IP addresses.

PIX Firewall software version 6.2 and higher support PAT for SIP.

The **fixup protocol sip** command enables SIP on the interface.





The SIP fixup is always in effect when UDP signaling is used, even if the command **no fixup protocol sip 5060** is issued. With TCP signaling, the fixup can be disabled with the command **no fixup protocol sip 5060**.

For additional information about the SIP protocol see RFC 2543. For additional information about the Session Description Protocol (SDP), see RFC 2327.



Note

If Cisco CallManager is configured for NAT and outside phones register to it via TFTP, the connection will fail because PIX Firewall currently does not support NAT TFTP messages.

#### **fixup protocol skinny**

Skinny Client Control Protocol (SCCP or “skinny”) protocol supports IP telephony and can coexist in an H.323 environment. An application layer ensures that all SCCP signaling and media packets can traverse the PIX Firewall and interoperate with H.323 terminals.

#### **fixup protocol smtp**

The **fixup protocol smtp** command enables the Mail Guard feature, which only lets mail servers receive the RFC 821, section 4.5.1, commands of HELO, MAIL, RCPT, DATA, RSET, NOOP, and QUIT. All other commands are translated into X's which are rejected by the internal server. This results in a message such as “500 Command unknown: 'XXX'.” Incomplete commands are discarded.



Note

During an interactive SMTP session, various SMTP security rules may reject or deadlock your telnet session. These rules include the following: SMTP commands must be at least four characters in length; must be terminated with carriage return and line feed; and must wait for a response before issuing the next reply.

As of PIX Firewall software version 5.1 and higher, the **fixup protocol smtp** command changes the characters in the SMTP banner to asterisks except for the “2”, “0”, “0” characters. Carriage return (CR) and linefeed (LF) characters are ignored.

In PIX Firewall software version 4.4, all characters in the SMTP banner are converted to asterisks.

#### **fixup protocol sqlnet**

PIX Firewall uses port 1521 for SQL\*Net. This is the default port used by Oracle for SQL\*Net; however, this value does not agree with IANA port assignments.

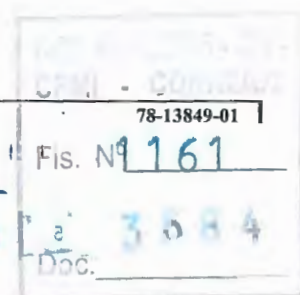
#### **Examples**

The following example enables access to an inside server running Mail Guard:

```
static (inside,outside) 209.165.201.1 192.168.42.1 netmask 255.255.255.255
access-list acl_out permit tcp host 209.165.201.1 eq smtp any
access-group acl_out in interface outside
fixup protocol smtp 25
```

The following example shows the commands to disable Mail Guard:

```
static (dmz1,outside) 209.165.201.1 10.1.1.1 netmask 255.255.255.255
access-list acl_out permit tcp host 209.165.201.1 eq smtp any
access-group acl_out in interface outside
no fixup protocol smtp 25
```







In this example, the **static** command sets up a global address to permit outside hosts access to the 10.1.1.1 mail server host on the dmz1 interface. (The MX record for DNS needs to point to the 209.165.201.1 address so that mail is sent to this address.) The **access-list** command lets any outside users access the global address through the SMTP port (25). The **no fixup protocol** command disables the Mail Guard feature.

## flashfs

Clear, display, or downgrade filesystem information. (Configuration mode.)

| Configure with the command...              | Remove with the command...                                                                    |
|--------------------------------------------|-----------------------------------------------------------------------------------------------|
| <b>flashfs downgrade</b> {4.x   5.0   5.1} | <b>clear flashfs</b>                                                                          |
| Show command options                       | Show command output                                                                           |
| <b>show flashfs</b>                        | Displays the size in bytes of each filesystem sector and the current state of the filesystem. |

|                           |                            |                                                                                                                                    |
|---------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax Description</b> | <b>downgrade 4.x</b>       | Clear the filesystem information from Flash memory before downgrading to PIX Firewall software version 4.0, 4.1, 4.2, 4.3, or 4.4. |
|                           | <b>downgrade 5.0   5.1</b> | Write the filesystem to Flash memory before downgrading to the appropriate PIX Firewall software version 5.0 or higher.            |

### Usage Guidelines

The **clear flashfs** and the **flashfs downgrade 4.x** commands clear the filesystem part of Flash memory in the PIX Firewall. Versions 4.*n* cannot use the information in the filesystem; it needs to be cleared to let the earlier version operate correctly.

The **flashfs downgrade 5.x** command reorganizes the filesystem part of Flash memory so that information stored in the filesystem can be accessed by the earlier version. The PIX Firewall maintains a filesystem in Flash memory to store system information, IPSec private keys, certificates, and CRLs. It is crucial that you clear or reformat the filesystem before downgrading to a previous PIX Firewall version. Otherwise, your filesystem will get out of sync with the actual contents of the Flash memory and cause problems when the unit is later upgraded.

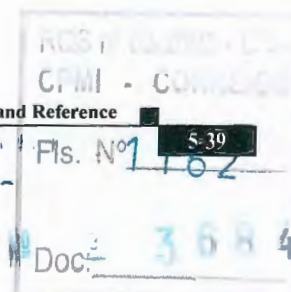


#### Note

When downgrading to PIX Firewall Versions 5.0 or 5.1, which support a maximum 4 MB of Flash memory, configuration files larger than 4 MB will be truncated and some configuration information will be lost.

You only need to use the **flashfs downgrade 5.x** command if your PIX Firewall has 16 MB of Flash memory, if you have IPSec private keys, certificates, or CRLs stored in Flash memory, and you used the **ca save all** command to save these items in Flash memory. The **flashfs downgrade 5.x** command fails if the filesystem indicates that any part of the image, configuration, or private data in the Flash memory device is unusable.

The **clear flashfs** and **flashfs downgrade** commands do not affect the configuration stored in Flash memory.





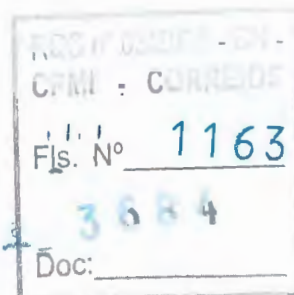
## Defining Your Network Topology

The first task that you must perform after installing CSPM is to define the basics of your network topology. This task involves identifying the network assets for which you want to define global network policies, identifying the Managed Devices that can enforce/effect the global network policies for these network assets, identifying the policy enablement hosts, and creating a network topology that represents these network objects in a manner that ensures that you can define and apply global network policies to those network objects.

The checklist below outlines what is required to understand the decision-making process and basic flow required to complete the definition of your network topology. Each step, described in the Step column, may contain several substeps and should be performed in the order presented. References to the specific procedures used to perform each step appear in the Reference column.

### Step 1 Identify the required network objects on your network

- **Internet Connection Points.** Because CSPM controls the flows into and out of your network, you must identify the connection points out of your network. Within CSPM, all such connection points must be defined within the Internet in the network topology.
- **Most Valuable Network Assets.** While your entire network is considered an asset, you can define a global security policy that addresses the enablement of most network service flows that commonly occur across your network. It is only when you want to define an exception to this global security policy that you need to be concerned with defining specific network assets within your network topology.







- **Managed Devices.** Managed Devices represent those network objects that enforce some aspect of the defined network policies. For example, an IOS Router or PIX Firewall can enforce the permitted traffic flows (defined as security policies) across your network.
- **Policy Enablement Hosts.** Policy enablement hosts represent those network objects that are required to enable network policy deployment. These hosts include CSPM servers, as well as other hosts such as certificate authority servers and Syslog servers.
- **Reachable Networks.** This list of networks identifies your internal networks that can send or receive network traffic. Many of these networks will be attached to a Managed Device. The purpose of identifying these networks is to ensure that they are defined within clouds so that the correct routing rules can be generated for those Managed Devices that act as gateway objects.

*Result:* You should have a completed Worksheet for Defining your Network Topology that identifies the required network objects, their IP addresses, and the types of network servers that run on the policy enablement hosts. This worksheet is used to complete Step 2.

For more information, see the following references:

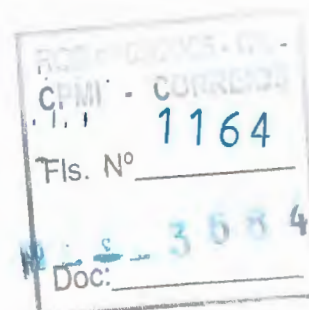
- Identifying Key Components in Your Topology, page 7-3
- Worksheet for Defining your Network Topology, page 9-4

## Step 2 Define the outermost gateway objects

When you define your network topology, you must define it from external (from the Internet) to internal (into your internal networks). The easiest method for defining gateway objects is to use the Topology Wizard. Using the Topology Wizard, you can discover the interface and device settings or specify them manually.

In addition, you can manually define any gateway object. The tasks referenced by this step are the tasks that explain how to manually define a gateway object. You must define the interface settings on the Internet before you can define any other gateway objects. If you use the Topology Wizard, the interface settings for the Internet are defined automatically based on the configuration information that you provide.

One of the most important concepts within CSPM is a cloud. A strongly suggested guideline is that unless you must define a Managed Device or a specific network on which special hosts, such as policy enablement hosts, reside, you should use a





cloud to represent all gateways and networks. You can define networks going into and out of a cloud, as well as networks contained within the cloud. For more information on clouds, refer to Step 5 in this checklist.

*Result:* The outermost networks and gateway devices are defined and the connections between those gateway devices and the Internet, which represent connections to ISPs, are defined.

For more information, see the following references:

- Adding a Cisco IOS Router to Your Topology, page 9-54
- Adding a PIX Firewall to Your Topology, page 9-34
- Adding a Cloud to Your Topology, page 9-18
- Adding a Cloud Network to Your Topology, page 9-26

**Step 3** Define network assets

Network assets represent those network objects, such as specific networks and hosts, for which you want to define exceptional network policies. These network objects are identified in Step 1, with the exception of the CSPM server, which will be defined during the next step.

*Result:* The network assets that you identified in Step 1 are defined in the network topology.

For more information, see the following references:

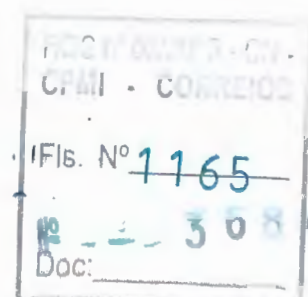
- Adding a Network to Your Topology, page 9-10
- Adding a Host to Your Topology, page 9-83
- Specifying a Client/Server Product is Running on a Host, page 9-84
- Adding an IP Range to Your Topology, page 9-80

**Step 4** Define CSPM server

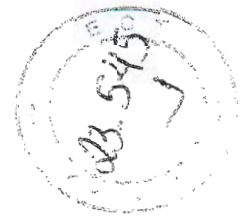
You must create the host that represents the CSPM server that you have installed on your network. To create the host, you must define the parent network on which the host resides and then create a host under that network. You can add a host based on the Windows 2000 name of the computer.

*Result:* The CSPM server is defined within your network topology.

For more information, see the “Adding a CSPM Server to Your Topology” section on page 9-77.





**Step 5** Define reachable networks

When you define the remainder of your network topology, you should use clouds. In fact, you should define clouds for as much of your network as possible. Clouds provide a logical grouping of networks and, thereby, hosts residing on those networks, that are reachable via an internal gateway.

A cloud is a special gateway object that attaches cloud networks to fully defined networks. To attach the two types of networks, the cloud identifies the IP addresses, representing default gateways, attached to those interfaces residing on the fully defined networks (which are either internal or external to the cloud). The cloud also has a special interface type called Cloud Networks, which organizes the cloud networks. In terms of the cloud, cloud networks exist within it. However, in reality, they exist inside the default gateway specified on the external interface of the cloud.

Clouds organize those settings required to identify and route to networks that reside inside of the gateway. Clouds are unique gateway objects because they do not require at least two real interfaces, as do Managed Devices. Instead, the cloud has at least one real interface (the external interface) and exactly one Cloud Networks interface (an internal interface). When you specify an IP address associated with a non-cloud interface, you are specifying the default gateway through which the cloud networks organized under the Cloud Networks interface (and therefore, within the cloud) can be reached.

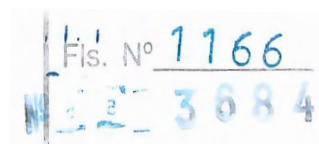
*Result:* All internal networks that are reachable from other network objects within your network are defined within one or more clouds.

For more information, see the following references:

- Adding a Cloud to Your Topology, page 9-18
- Adding a Cloud Network to Your Topology, page 9-26

## Worksheet for Defining your Network Topology

This worksheet identifies network objects and information that you must identify and define in your network topology.

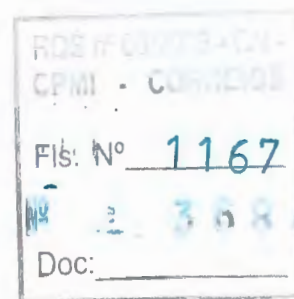




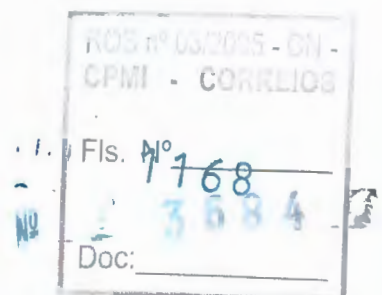
| Network Object Type | Required Information                                                    |
|---------------------|-------------------------------------------------------------------------|
| ISP Connections     | IP Address used by your outermost gateways to reach the ISP connections |

| Valuable Network Assets | asset name | IP address or network address | associated network mask (if asset is a network) |
|-------------------------|------------|-------------------------------|-------------------------------------------------|
|-------------------------|------------|-------------------------------|-------------------------------------------------|

| Managed Devices | IP addresses per interface | associated network address | associated network mask |
|-----------------|----------------------------|----------------------------|-------------------------|
|-----------------|----------------------------|----------------------------|-------------------------|









From the Interfaces panel on the Internet, you can define the networks that form the boundary between your networks and the ISPs, as well as the IP addresses of the default gateways used by your network. To do so, you must define the ISP's upstream gateway interfaces and the networks connected to those interfaces. Only one perimeter exists for the Internet—the untrusted Internet perimeter, which represents all uncontrolled networks, including those networks attached to the downstream interfaces of your outermost Managed Devices.

**Tip**

When you define your network topology, you must define it from the outside to the inside, starting with the access routers of your outermost gateway objects. These access routers often represent your ISPs' access routers. To identify different ISP connections, we recommend that you define a unique interface for each connection.

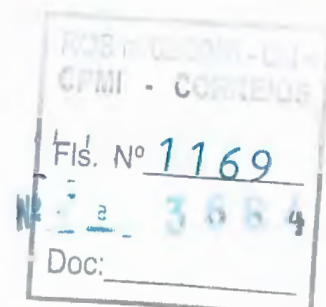
## Learn More About the Internet

The Internet is a special gateway object with one Cloud Networks interface, the interface attached to the default gateway for all unknown networks. In addition, the Internet represents the default gateway for all your trusted networks (commonly used in policy development). Trusted networks represent those networks over which you have administrative control. In other words, you control the network policies for those networks. The IP addresses associated with the Internet's interfaces specify the addresses of the default gateways used by your trusted networks, such as the IP address of your ISP's first reachable routers.

**Note**

You must attach at least one network to the Internet. Most commonly, this network identifies the network that belongs to your ISP. In addition, you must attach a gateway object—a Managed Device, such as a Cisco IOS router or PIX Firewall, or a generic router or cloud—to that network. If you add a gateway object directly to the Internet using the Topology Wizard, you will create the network that resides between that gateway object and the Internet as part of the wizard process.

Unknown networks, which the Internet represents, are those networks that you do not know about and over which you have no administrative control (you cannot control the network policies for those networks). You can use the Internet or the Internet Perimeter as a source or destination of the policy rules that make up your







network security policy. Such policy rules instruct your Managed Devices as to how they should control traffic originating from or destined to the Internet, or all unknown networks.

The *Internet Perimeter* represents all external networks shared between your outermost Managed Devices and the Internet, which represents all unknown networks. The Internet Perimeter also represents all unknown and untrusted networks—essentially, all networks that you do not control.

Untrusted networks are networks that you know about but over which you do not have administrative control. Often, you define untrusted networks so that you can specify security policy restrictions for network traffic that originates from those untrusted networks or because you want to restrict outgoing network traffic that is destined to those untrusted networks.

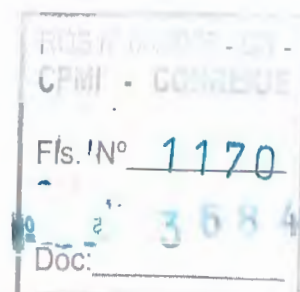
Because the Internet is a special type of Cloud, you can also specify untrusted networks as *cloud networks* that are attached to the Cloud Interface in the Interfaces panel for the Internet. These cloud networks represent untrusted networks that exist within the larger cloud of the Internet, and they identify networks to/from which you want to control the ability of users on your trusted networks to access services provided by servers residing on those networks.

After you define these cloud networks, you can reference them as a source or destination in policy rules.

## Learn More About Interfaces on the Internet

The Interfaces panel organizes settings and relationships used to derive how network security policies are enforced against your networks and the hosts residing on those networks. It organizes five key pieces of information:

- Internet perimeter
- Real and virtual network interfaces, and associated addresses or address ranges, that are connected to the existing perimeter that is inherited (Internet perimeter)
- Real networks connected to an interface
- Cloud Networks interface
- Cloud networks assigned to the Cloud Networks interface





The Internet organizes the information that represents your connections to your Internet Service Providers (ISPs). These connections are commonly high-speed serial connections (although they are not required to be serial interfaces) between your outermost routers and the external routers owned by your ISPs. Therefore, they also represent the default gateway used by the internal networks attached to your outermost routers.

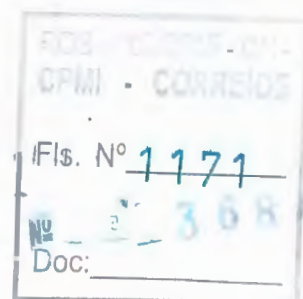
As part of your connection specifications, you must identify the networks that are shared between you and your ISP. Each interface that you define on the Internet should represent an interface on an external router owned by your ISP. Unlike other gateway objects that represent a single gateway, the Internet (and other clouds) can represent a group of gateways. Each interface defined on the Internet can represent a different connection to one or more ISPs.

In addition, the Cloud Networks interface on the Internet has a unique meaning. It represents all unknown networks residing on the Internet. An *unknown network* is one that you have not explicitly defined in the network topology, and all unknown networks are considered untrusted by all network objects that you do define in the network topology. Cloud networks enable you to represent networks that you know about and for which you want to specify special policy rules, such as not permitting traffic to a particular network. For more information on cloud networks, see the “Learn More about Cloud Networks” section on page 9-16.

## Networks

When you define a network, you are informing CSPM where to expect network packets from and where to deliver them when they are destined for objects on that network. CSPM uses networks to derive implicit routing rules for the Managed Devices over which it has control.

All networks must be attached to at least one gateway, whether it is the Internet, a Managed Device (such as a PIX Firewall or Cisco IOS router), a router, or a cloud. A network can contain other objects, such as IP ranges, hosts, and servers running some component of the CSPM system. These objects reside on the network, which means their addresses are valid addresses on that network.







## Adding a Network to Your Topology

You can connect a network to any gateway in your network topology. Gateways include the Internet, clouds, Cisco IOS routers, PIX Firewalls, and generic routers. CSPM uses networks to derive routing rules that a Managed Device needs to route traffic to hosts residing on that network. In addition, you can use networks as a source or destination when defining policy rules.

To add a network to your topology, follow these steps:

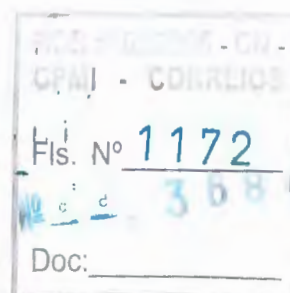
- 
- Step 1** To view your topology, click **Topology** on the CSPM taskbar.
- Step 2** Right-click the icon for the gateway on which the network resides, and then click **Add** on the shortcut menu.
- Result:* The Topology Wizard appears.
- Step 3** Select **Network** from the Select the type of network object to add list, and then click **Next**.
- Result:* The Add a Network panel appears.
- Step 4** To add a network to an existing interface, follow these steps:



**Note** You cannot add a network to an existing interface on a PIX Firewall.

- Select the interface to which you are adding the network in the Interfaces list.  
*Result:* The Network Name field, Interface IP Address field, and Network Mask field become available.
- Type the name of the network in the Network Name field, and then press **Tab**.
- Type the IP address for the interface in the Interface IP Address field, and then press **Tab**.  
*Result:* The expected network mask appears in the Network Mask field.
- To change the network mask, type that value in the Network Mask field, and then click **Next**.

*Result:* The Comment panel appears.





## Configuring Building Blocks

Building Blocks allow you to optimize your configuration. Objects such as hosts, protocols, or services can be grouped, allowing you to issue a single command to every item in the group by using the name of the group.

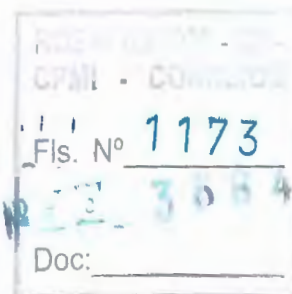
The Building Blocks feature is used to associate names that can be used in place of corresponding data values in settings and rules. This facilitates ease of maintenance.

For example, an access rule might have a source address of 1.2.3.4. As an alternative, you can use building blocks to create a network object named fred-pc with the address 1.2.3.4. You can then create an access rule with the source address as fred-pc.

Using Building Blocks, you identify objects that will be used on your network, that are configured separately. For example, you can identify the servers used for AAA authentication. The protocols used to connect to those servers, however, are configured in Settings. This design facilitates network updates, as building blocks are defined only once and in one location.

## Important Notes About Building Blocks

- You can edit only those objects defined at the current scope.
- Building blocks do not have a one-to-one association.





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- When an object is selected in the directory tree, all elements defined at the same level and above are applied.
- If you select an object by name and that name is defined at multiple scopes, the version defined nearest the current scope is selected. (See the “Configuring Network Objects” section on page 6-2 for examples using network objects.)

## Configuring Network Objects

The Network Objects feature allows you to group a set of network addresses represented by an IP network (name, IP address, IP mask). This information provides the basic identification information for that network. Firewall MC uses the name and IP address–netmask pair to resolve references to the network in the source and destination conditions of access rules and in translation rules. Firewall MC uses the interface value to apply access and translation rules that refer the network to the correct interface. The interface delivers network packets to the network, thus enforcing the rules that refer to that network.

The following examples will help you to better understand how network objects can be used. Let’s say you want to create the network object *Corp Network* at the Global scope, but different IP addresses will be used depending on the group being addressed. As a result, you can use a variable, which allows different values to be set for a building block for different devices or groups. The values are substituted into the same rule as applied to those different devices and groups (Figure 6-1).

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Figure 6-1 Example 1—Network Object "Corp Network" Defined at the Global Scope with Variable

Network Objects

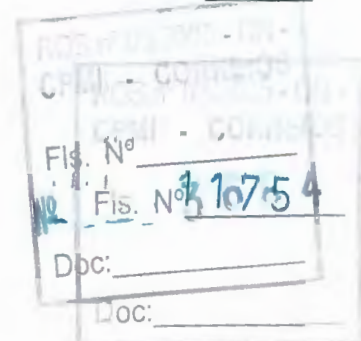
SCOPE: Global

| # | Name         | Content | Variable | Scope  |
|---|--------------|---------|----------|--------|
| 1 | any          | 0.0.0.0 | false    | Global |
| 2 | Corp Network | any     | true     | Global |

Add Edit View Delete

To access the Network Object feature, select **Configuration > Building Blocks > Network Objects**. The Network Objects table defaults to the Global scope. You complete the wizard to define the network object. When you are returned to the Network Objects table, *Corp Network* is shown in the table.

If you select the device *PIX Firewall* using the object selector, then view the Network Objects table for that scope, *Corp Network* is shown as created at the Global scope with the variable setting enabled. (The variable is set to true.) Notice that the check box is grayed-out, which means you cannot make changes at the device level (Figure 6-2).





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Figure 6-2 Example 1—Network Object "Corp Network" Shown at the Device Scope

Network Objects

SCOPE: **PIXFirewall**

| # | Name         | Content | Variable | Scope  |
|---|--------------|---------|----------|--------|
| 1 | any          | 0.0.0.0 | false    | Global |
| 2 | Corp Network | any     | true     | Global |

Add Edit View Delete

When you define *Corp Network* at the *PIX Firewall* scope, the new network object replaces the one defined at the Global scope and assigns an IP address to it (Figure 6-3). *Corp Network* can now be edited at the device scope; it is no longer shown as a variable. (The variable is set to false.)

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## CHAPTER

## 6

## Defining and Viewing Reports

You can access the reporting features that are available in Monitoring Center for Security (Security Monitor) from the Reports tab. You can generate and view reports about network activities monitored by sensors on your network. The reports include summary reports about alarms, sources, destinations, or a specific sensor on your network. By default, all events monitored by a sensor are retained by Security Monitor. Therefore, unless you delete events from the database, you can generate reports based on all recorded activities.

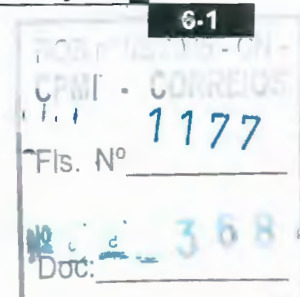
If the desired event is not being generated, verify that the sensor signature setting that corresponds to the event is enabled. Sensors generate events for only those signatures that are enabled. These events are then received by the Security Monitor server.

You can also generate the following report types:

- **Audit Reports**—Provide information about system events.
- **Firewall Reports**—Provide information about Firewall events.
- **CSA Reports**—Provide information about events generated by Management Center for Cisco Security Agents (Security Agent MC).

Refer to the following topics for more information about defining and viewing reports:

- Understanding the Types of Reports, page 6-2
- Scheduling and Generating Reports, page 6-7
- Viewing Reports, page 6-8
- Saving a Generated Report as an HTML File, page 6-9
- Deleting Generated Reports, page 6-10







- Editing Report Parameters, page 6-11
- Deleting Scheduled Report Templates, page 6-12

## Understanding the Types of Reports

You can view four categories of reports in Security Monitor: alarm reports, audit reports, CSA reports, and Firewall reports. Alarm reports provide information about the events being collected by Security Monitor. Audit reports provide information about Security Monitor system events. CSA reports provide information about Security Agent MC events. Firewall reports provide information about Firewall events.

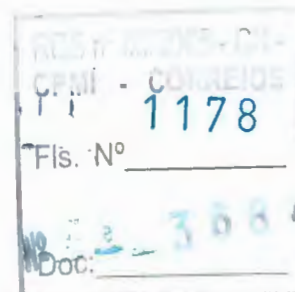
Reports can be generated on-demand or scheduled for a later date and time. You can configure scheduled reports to repeat at regular intervals.

- About Alarm Reports, page 6-2
- About Audit Reports, page 6-4
- About CSA Reports, page 6-5
- About Firewall Reports, page 6-5
- About Scheduled Reports, page 6-7

### About Alarm Reports

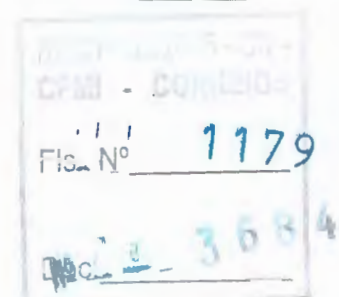
You can generate the following alarm reports in Security Monitor:

- **IDS Top Sources Report**—Reports the specified number of source IP addresses that have generated the most events during a specified time period. Filterable by Date/Time, Top  $n$ , where  $n$  is the number of sources, Destination Direction, Destination IP Address, Signature or Signature Category, Sensor, and Event Level.
- **IDS Top Source/Destination Pairs Report**—Reports the specified number of source/destination pairs (that is, connections or sessions) that have generated the most alarms during a specified time period. Filterable by Date/Time, Top  $n$ , where  $n$  is the number of source/destination pairs, Signature or Signature Category, Sensor, Event Level, Source Direction, Destination Direction, Source Address, and Destination Address.





- **IDS Top Destinations Report**—Reports the specified number of destination IP addresses that have been targeted for attack during a specified time period. Filterable by Date/Time, Top  $n$ , where  $n$  is the number of destinations, Source Direction, Source Address, Signature or Signature Category, Sensor, and Event Level.
- **IDS Top Alarms Report**—Reports the specified number of top alarms, by signature name, that have been generated during a specified time period. Filterable by Date/Time, Top  $n$ , where  $n$  is the number of alarms, Source Direction, Destination Direction, Source Address, Destination Address, Signature or Signature Category, Sensor, Event Level, and Signature or Signature Category.
- **IDS Summary Report**—Provides a summary of event information for an organization during a specified time period. Filterable by Date/Time, Organization, Source Direction, Destination Direction, Signature or Signature Category, and Event Level.
- **IDS Alarms by Sensor Report**—Reports logged alarms based on the sensor (Host ID) that detected the event. Filterable by Date/Time, Source Direction, Destination Direction, Source Address, Destination Address, Signature or Signature Category, Sensor, Event Level, and Event Count.
- **IDS Alarms by Hour Report**—Reports alarms in one-hour intervals over the time specified by the user. Filterable by Date/Time, Source Direction, Destination Direction, Source Address, Destination Address, Signature or Signature Category, Sensor, Event Level, and Event Count.
- **IDS Alarms by Day Report**—Reports alarms in one-day intervals over the time specified by the user. Filterable by Date/Time, Source Direction, Destination Direction, Source Address, Destination Address, Signature or Signature Category, Sensor, Event Level, and Event Count.
- **IDS Alarm Source/Destination Pair Report**—Reports logged alarms based on source/destination IP address pairs (that is, connections or sessions). Filterable by Date/Time, Signature or Signature Category, Sensor, Event Level, Alarm Count, Source Direction, Destination Direction, Source Address, and Destination Address.
- **IDS Alarm Source Report**—Reports alarms based on the source IP address that generated the alarm. Filterable by Date/Time, Destination Direction, Destination Address, Signature or Signature Category, Sensor, Event Level, Alarm Count, Source Direction, and Source Address.







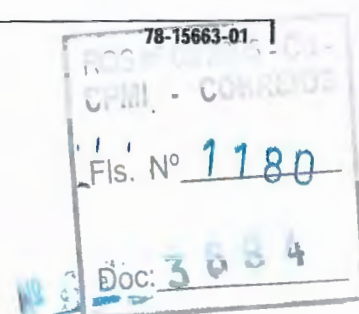
- **IDS Alarm Report**—Reports logged alarms based on signature names. Filterable by Date/Time, Source Direction, Destination Direction, Source Address, Destination Address, Sensor, Event Level, Event Count, and Signature or Signature Category.
- **IDS Alarm Destination Report**—Reports alarms based on the destination IP address that generated the alarm. Filterable by Date/Time, Source Direction, Source Address, Signature or Signature Category, Sensor, Event Level, Event Count, Destination Direction, and Destination Address.
- **Daily Metrics Report**—Reports event traffic totals, by day, from the selected date until the current date. Reporting occurs in 24-hour intervals, starting at midnight. The report shows events by platform (PIX, IOS, Sensor, RDEP) and event type (IDS or Security).
- **24 Hour Metrics Report**—Reports all alarm traffic from the most recent 24 hours in 15 minute intervals. There are no filters for this report.

## About Audit Reports

Audit reports provide information about management server events. If IDS MC and Security Monitor are installed on the same server, the generated audit reports and scheduled audit report templates are shared between the applications.

The following audit reports are available:

- **Subsystem Report**—Reports audit records ordered by the IDS subsystem, which includes systems from IDS MC and Security Monitor and systems common to each. Filterable by Event Severity, Date/Time, and Subsystem.
- **Sensor Version Import Report**—Reports the audit records that are generated when the version identifier of IDS sensor devices is imported into IDS MC. These records indicate success or failure of the import operation. Filterable by Device, Event Severity, and Date/Time.
- **Sensor Configuration Import Report**—Reports the audit records that are generated when you import IDS Sensor configurations into IDS MC. The resulting records can be used to determine success or failure in device configuration import tasks. Filterable by Device, Event Severity, and Date/Time.





- **Sensor Configuration Deployment Report**—Reports records related to IDS sensor configurations deployed to devices using IDS MC. These records indicate successful deployment or provide error messages where appropriate for deployment operations. Filterable by Device, Event Severity, and Date/Time.
- **Console Notification Report**—Reports the console notification records generated by the notification subsystem. Filterable by Event Severity and Date/Time.
- **Audit Log Report**—Reports audit records by the server and application. Unlike the other report templates, this report template provides a broad, non-task-specific view of audit records in the database. Filterable by Task Type, Event Severity, Date/Time, Subsystem, and Applications.

## About CSA Reports

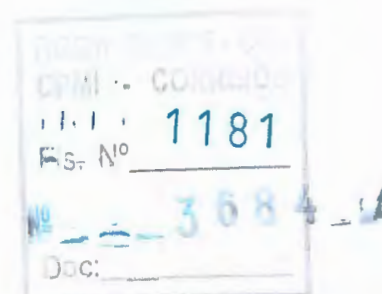
You can generate the following reports for Security Agent MC events in Security Monitor:

- **CSA Summary Report**—Filterable by Alert Level and Time/Date.
- **CSA Alerts By Severity**—Filterable by Alert Level and Time/Date.
- **CSA Alerts By Group**—Filterable by Alert Level, Time/Date and Rule.
- **CSA Administration Event Summary**—Filterable by Alert Level and Time/Date.

## About Firewall Reports

You can generate the following Firewall reports in Security Monitor:

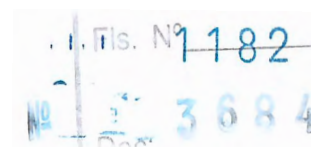
- **User Activity Summary**—Summarizes the activities of all users who have made service requests through the selected Firewall within the specified time period. Filterable by Time/Date and Firewall Address.
- **Network Traffic Summary**—Summarizes all activities based on the service requests made through the selected Firewall within the specified time period. Filterable by Time/Date and Firewall Address.







- **Most Active Users**—Lists the users who have made the most service requests through the selected Firewall within the specified time period. This report provides statistics for up to N (defaults to 20) users. Filterable by Time/Date, Firewall Address, and Top N.
- **Most Accessed Web Sites**—Lists the HTTP sites that users who request services through the selected Firewall have accessed the most within the specified time period. This report provides statistics for up to N (defaults to 20) sites. Filterable by Time/Date, Firewall Address, and Top N.
- **Event Summary Report**—Summarizes the security, warning, and informational events that the selected Firewall has experienced within the specified time period. Filterable by Time/Date and Firewall Address.
- **Detailed User Activity**—Describes the full activities of all network session transactions that a specific user has conducted through the selected Firewall within the specified time period. It presents the full list of network sessions that have occurred within the time period. Filterable by Time/Date and Firewall Address.
- **Detailed Network Traffic**—Provides transaction information about a network service's sessions that transpire during a given time interval. For example, you can generate reports about HTTP on port 80, SSL on port 443, or DNS on port 53. To generate a detailed service report, you must configure the Firewall to enable logging of statistical events for the network service. Filterable by Time/Date, Firewall Address, and Service.
- **Denied Message Activity**—Lists all syslog messages for denied connections sent out by the Firewall within the specified time period. You can filter which types of deny messages appear in the report such as VPN, Attack, and AAA and ACL. Filterable by Time/Date, Firewall Address, and Denied Events.
- **Denied Connection Activity**—Lists all TCP, UDP, and ICMP messages for denied connections sent out by the Firewall for the specified time period. Filterable by Time/Date and Firewall Address.
- **Security Alarm Source Report**—Summarizes alarms received on the syslog port by the source of the events. For example, if Security Monitor receives alarms from a PIX Firewall, use this report to view the alarm information. Filterable by Event Level, Source IP Address, and Time/Date.
- **Security Alarm Detailed Report**—Provides detailed information for each security alarm received. Filterable by Event Level, Source IP Address, and Time/Date.



## About Scheduled Reports

For each report type that you choose to generate, you can enter a report title, schedule, and notification options. Enter this information in the Schedule Report page when you select **Reports > Generate**. You can run the report immediately, or you can schedule the report to run at a later time, at regular intervals, or both.

If you choose to run the report at a later time, you must specify the date and time that you want the report to run. Additionally, you can schedule the report to run at regular intervals, such as hourly, daily, or weekly. You can edit the report parameters of a scheduled report on the Edit Scheduled Reports page, which you access by selecting **Reports > Scheduled**. You can also delete scheduled report templates from this page.

Each time a scheduled report is run, it is added to the Completed Report page.

## Scheduling and Generating Reports

On the Select Report page, you can select the type of report to generate and define the parameters for the selected report. Based on the scheduling parameters you select, the report runs immediately, at a later time, or at regular intervals.

To generate a report, follow these steps:

---

**Step 1** Select **Reports > Generate**.

The Select Report page appears.



**Tip**

In Security Monitor, you can filter which reports appear on the page. From the Report Group list, select **All** to show both alarm and audit reports, **Alarms** to show only alarm reports, or **Audit** to show only audit reports.

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**Step 2** Select the report type that you want to generate, and then click **Select**.

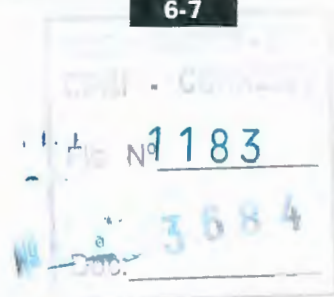
The Report Filtering page appears.

---

**Step 3** Enter the report parameters for the report type you selected. Then, click **Next**.

The Schedule Report page appears.

**Step 4** Enter a name for the report in the Report Title field.







- Step 5** To export the generated report to an HTML file, select the **Export to** check box. Then, specify the exact path to the file that is to contain the generated report. The path should include the filename and the desired extension; for example, `/<dir>/[...]/<filename>[.<ext>]`. No extension is appended to the filename if you do not specify an extension.
- Step 6** Click the **Run Now** or **Schedule for Later** radio button under Schedule Options. If you select Run Now, skip to Step 7. If you select Schedule for Later, specify the following options:
- Specify the date and time that you want the report to run in the Start Time list boxes. The date is specified by month, day, and year. The time is specified in hours and minutes. The time zone used to determine the time is to the right of the Start Time list boxes.
  - To run the report at regular intervals, select an option in the Repeat every list box. You can schedule the report to run every day, week, weekday, weekend day, hour, or minute.
- Step 7** To send an e-mail notification to someone when the report runs, select the **Email report to** check box and enter an e-mail address in the adjacent field. Use commas to separate multiple addresses. Then, click **Finish**.

If you select Run Now, the report runs and you can view the generated report by selecting Reports > View. If you select Schedule for Later, you can view the scheduled report template by selecting Reports > Scheduled.

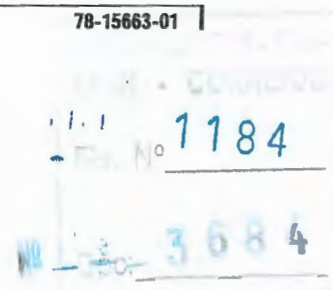
## Viewing Reports

After you generate a report, you can view it.



### Tip

To understand how data is sorted in a report, refer to the numbers that appear in the column headings of the generated report. These numbers represent the sort keys. For example, data is sorted first based on the data in the column with a (1) in it, followed by the data in the column with a (2) in it, and so on.





To view a report, follow these steps:

**Step 1** Select **Reports > View**.

The Choose Completed Report page appears.



**Tip**

In Security Monitor, you can filter which reports appear on the page. From the Report Group list, select **All** to show both alarm and audit reports, **Alarms** to show only alarm reports, or **Audit** to show only audit reports.

**Step 2** Select the check box corresponding to the title of the report you want to view.

**Step 3** To view the selected report, click **View**.

The report appears in the Report page.

**Step 4** To view the report in a new browser window, click **Open in Window...**

The report appears in a new browser window.

## Saving a Generated Report as an HTML File

After you generate a report, you can save the report as an HTML file.

To save a generated report as an HTML file, follow these steps:

**Step 1** Select **Reports > View**.

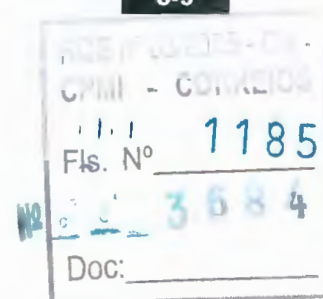
The Choose Completed Report page appears.



**Tip**

In Security Monitor, you can filter which reports appear on the page. From the Report Group list, select **All** to show both alarm and audit reports, **Alarms** to show only alarm reports, or **Audit** to show only audit reports.

**Step 2** To select the report that you want to export, select the check box corresponding to the report title.





**Step 3** Click **Open in Window**.

If you are using Internet Explorer, the report appears in a new browser window; proceed to Step 4. If you are using Netscape Navigator, the Unknown File Type dialog box appears; skip to Step 5.

**Step 4** To save the report, select **File > Save As** from the Internet Explorer menu bar. Browse to the location where you want to save the file and enter a filename. Then, click **Save**.

The report is saved using the filename and location you specified.

Skip Step 5.

**Step 5** To save the report, click **Save File**. Browse to the location where you want to save the file and enter a filename. Then, click **Save**.

The report is saved using the filename and location you specified.

## Deleting Generated Reports

You can delete generated reports. If the report was generated from a scheduled report template, deleting the report does not delete the associated scheduled report template.

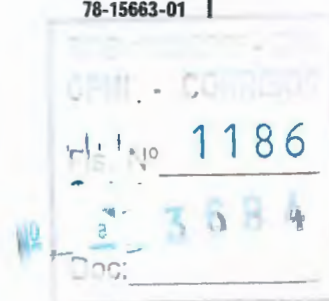
To delete a report, follow these steps:

**Step 1** Select **Reports > View**.

The Choose Completed Report page appears.

**Tip**

In Security Monitor, you can filter which reports appear on the page. From the Report Group list, select **All** to show both alarm and audit reports, **Alarms** to show only alarm reports, or **Audit** to show only audit reports.





- Step 2** Select the check box next to the title of the report you want to delete.



**Tip**

You can delete more than one report at a time. To delete more than one report, select the check boxes next to all reports that you want to delete.

A check mark appears next to each report you selected.

- Step 3** To delete the selected report, click **Delete**.

The report is deleted. The report name is removed from the list of available reports.

## Editing Report Parameters

You can edit the report parameters or the schedule for a scheduled report template.

To edit the report parameters, follow these steps:

- Step 1** Select **Reports > Scheduled**.

The Edit Scheduled Reports page appears.



**Tip**

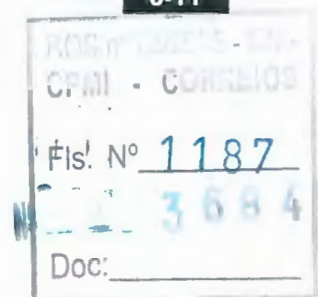
In Security Monitor, you can filter which reports appear on the page. From the Report Group list, select **All** to show both alarm and audit reports, **Alarms** to show only alarm reports, or **Audit** to show only audit reports.

- Step 2** Select the check box corresponding to the title of the report template that you want to edit.

A check mark appears next to the report you selected.

- Step 3** To open the selected report template, click **Edit**.

A new page displays the report parameters. Depending on the type of report, the parameters are different.







## Deleting Scheduled Report Templates

- Step 4** Change any report parameters that you want to. To save your changes, click **Finish**.

The changes you made are saved to the report template.

## Deleting Scheduled Report Templates

You can delete unwanted scheduled report templates. Deleting a scheduled report template also deletes all associated reports that have already been generated.

To delete a scheduled report template, follow these steps:

- Step 1** Select **Reports > Scheduled**.

The Edit Scheduled Reports page appears.

**Tip**

In Security Monitor, you can filter which reports appear on the page. From the Report Group list, select **All** to show both alarm and audit reports, **Alarms** to show only alarm reports, or **Audit** to show only audit reports.

- Step 2** Select the check box corresponding to the title of the report you want to delete.

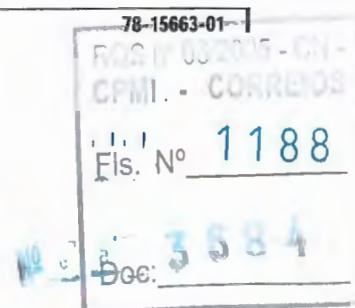
**Tip**

You can delete more than one report template at a time. To do so, select the check boxes corresponding to all the report templates that you want to delete.

A check mark appears next to each report you selected.

- Step 3** To delete the report template, click **Delete**.

The selected report template and all associated end reports are deleted.





## Configuring Application Inspection (Fixup)

This chapter describes how to use and configure application inspection, which is often called “fixup” because you use the **fixup** command to configure it. This chapter includes the following sections:

- How Application Inspection Works
- Using the fixup Command
- Basic Internet Protocols
- Voice Over IP
- Multimedia Applications
- Database and Directory Support
- Management Protocols

### How Application Inspection Works

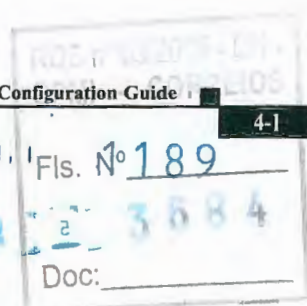
The Adaptive Security Algorithm (ASA), used by the PIX Firewall for stateful application inspection, ensures the secure use of applications and services. Some applications require special handling by the PIX Firewall application inspection function. Applications that require special application inspection functions are those that embed IP addressing information in the user data packet or open secondary channels on dynamically assigned ports.

The application inspection function works with NAT to help identify the location of embedded addressing information. This allows NAT to translate these embedded addresses and to update any checksum or other fields that are affected by the translation.

The application inspection function also monitors sessions to determine the port numbers for secondary channels. Many protocols open secondary TCP or UDP ports to improve performance. The initial session on a well-known port is used to negotiate dynamically assigned port numbers. The application inspection function monitors these sessions, identifies the dynamic port assignments, and permits data exchange on these ports for the duration of the specific session.

As illustrated in Figure 4-1, ASA uses three databases for its basic operation:

- Access control lists (ACLs)—Used for authentication and authorization of connections based on specific networks, hosts, and services (TCP/UDP port numbers).
- Inspections—Contains a static, pre-defined set of application-level inspection functions.
- Connections (XLATE and CONN tables)—Maintains state and other information about each established connection. This information is used by ASA and cut-through proxy to efficiently forward traffic within established sessions.







## Basic Internet Protocols

This section describes how the PIX Firewall supports the most common Internet protocols and how you can use the **fixup** command and other commands to solve specific problems. It includes the following topics:

- File Transfer Protocol
- Domain Name System
- Hypertext Transfer Protocol
- Simple Mail Transfer Protocol

### File Transfer Protocol

You can use the **fixup** command to change the default port assignment for the File Transfer Protocol (FTP). The command syntax is as follows:

```
[no] fixup protocol ftp [strict] [port]
```

The **port** parameter lets you configure the port at which the PIX Firewall listens for FTP traffic.

The **strict** option prevents web browsers from sending embedded commands in FTP requests. Each **ftp** command must be acknowledged before a new command is allowed. Connections sending embedded commands are dropped. The **strict** option only lets an FTP server generate the 227 command and only lets an FTP client generate the PORT command. The 227 and PORT commands are checked to ensure they do not appear in an error string.

If you disable FTP fixups with the **no fixup protocol ftp** command, outbound users can start connections only in passive mode, and all inbound FTP is disabled.

**Note**

The use of the **strict** option may break FTP clients that do not comply with the RFC standards.

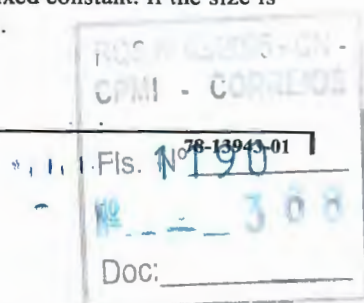
The FTP application inspection inspects the FTP sessions and performs four tasks:

- Prepares dynamic secondary data connection
- Tracks **ftp** command-response sequence
- Generates an audit trail
- NATs embedded IP address

FTP application inspection prepares secondary channels for FTP data transfer. The channels are allocated in response to a file upload, a file download, or a directory listing event and must be pre-negotiated. The port is negotiated through the PORT or PASV commands.

If the **strict** option is enabled, each **ftp** command and response sequence is tracked for the following anomalous activity:

- Truncated command—Number of commas in the PORT and PASV reply command is checked to see if it is five. If it is not five, then the PORT command is assumed to be truncated and the TCP connection is closed.
- Incorrect command—Checks the **ftp** command to see if it ends with <CR><LF> characters, as required by the RFC. If it does not, the connection is closed.
- Size of RETR and STOR commands—These are checked against a fixed constant. If the size is greater, then an error message is logged and the connection is closed.





- Command spoofing—The PORT command should always be sent from the client. The TCP connection is denied if a PORT command is sent from the server.
- Reply spoofing—PASV reply command (227) should always be sent from the server. The TCP connection is denied if a PASV reply command is sent from the client. This prevents the security hole when the user executes “227 xxxxx a1, a2, a3, a4, p1, p2.”
- TCP stream editing.
- Invalid port negotiation—The negotiated dynamic port value is checked to see if it is less than 1024. As port numbers in the range from 1 to 1024 are reserved for well known connections, if the negotiated port falls in this range then the TCP connection is freed.
- Command pipelining—The number of characters present after the port numbers in the PORT and PASV reply command is cross checked with a constant value of 8. If it is more than 8, then the TCP connection is closed.

FTP application inspection generates the following log messages:

- An Audit record 302002 is generated for each file that is retrieved or uploaded.
- The **ftp** command is checked to see if it is RETR or STOR and the retrieve and store commands are logged.
- The username is obtained by looking up a table providing the IP address.
- The username, source IP address, destination IP address, NAT address, and the file operation are logged.
- Audit record 201005 is generated if the secondary dynamic channel preparation failed due to memory shortage.

In conjunction with NAT, the FTP application inspection translates the IP address within the application payload. This is described in detail in RFC 959.

## Domain Name System

The port assignment for the Domain Name System (DNS) is not configurable. DNS requires application inspection so that DNS queries will not be subject to the generic UDP handling based on activity timeouts. Instead, the UDP connections associated with DNS queries and responses are torn down as soon as a reply to a DNS query has been received. This functionality is called DNS Guard.

DNS inspection performs two tasks:

- Monitors the message exchange to ensure that the ID of the DNS reply matches the ID of the DNS query.
- Translates the DNS A-record on behalf of the **alias** command. With PIX Firewall version 6.2, DNS inspection also supports static and dynamic NAT and Outside NAT makes the use of the **alias** command unnecessary.

Only forward lookups are NATed, so PTR records are not touched. Alarms can also be set off in the Intrusion Detection System (IDS) module for DNS zone transfers.

PIX Firewall version 6.2 introduces full support for NAT and PAT of DNS messages originating from either inside (more secure) or outside (less secure) interfaces. This means that if a client on an inside network requests DNS resolution of an inside address from a DNS server on an outside interface, the DNS A-record is translated correctly.

For example, in Figure 4-2, a client on the inside network issues an HTTP request to server 192.168.100.1, using its host name server.example.com. The address of this server is mapped through PAT to a single ISP-assigned address 209.165.200.5. The DNS server resides on the ISP network.

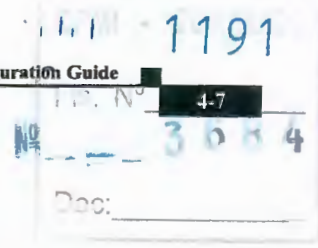
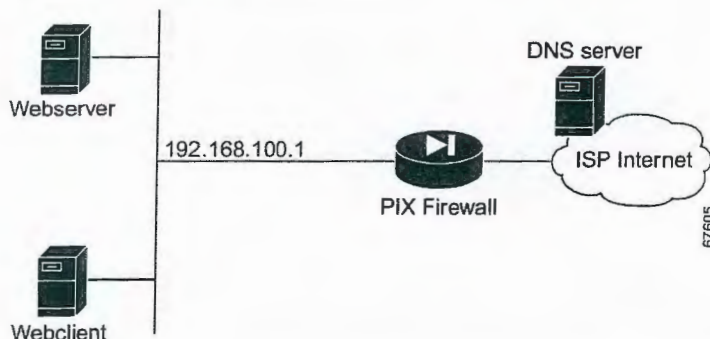




Figure 4-2 NAT/PAT of DNS Messages



When the request is made to the DNS server, the PIX Firewall translates the non-routable source address in the IP header and forwards the request to the ISP network on its outside interface. When the DNS A-record is returned, the PIX Firewall applies address translation not only to the destination address, but also to the embedded IP address of the web server. This address is contained in the user data portion of the DNS reply packet. As a result, the web client on the inside network gets the address it needs to connect to the web server on the inside network.

The transparent support for DNS in PIX Firewall version 6.2 means that the same process works if the client making the DNS request is on a DMZ (or other less secure) network and the DNS server is on an inside (or other more secure) interface.

## Hypertext Transfer Protocol

You can use the **fixup** command to change the default port assignment for the Hypertext Transfer Protocol (HTTP). The command syntax is as follows.

```
fixup protocol http [port[-port]]
```

Use the *port* option to change the default port assignments from 80. Use the *-port* option to apply HTTP application inspection to a range of port numbers.



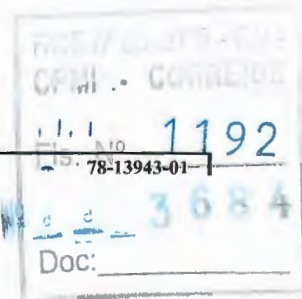
Note

The **no fixup protocol http** command statement also disables the **filter url** command.

HTTP inspection performs several functions:

- URL logging of GET messages
- URL screening via N2H2 or Websense
- Java and ActiveX filtering

The latter two features are described in “Filtering Outbound Connections” in Chapter 3, “Controlling Network Access and Use.”





## Simple Mail Transfer Protocol

This section describes how application inspection works with the Simple Mail Transfer Protocol (SMTP). It includes the following topics:

- Application Inspection
- Sample Configuration

You can use the **fixup** command to change the default port assignment for SMTP. The command syntax is as follows.

```
fixup protocol smtp [port[-port]]
```

The **fixup protocol smtp** command enables the Mail Guard feature. This restricts mail servers to receiving the seven minimal commands defined in RFC 821, section 4.5.1 (HELO, MAIL, RCPT, DATA, RSET, NOOP, and QUIT). All other commands are rejected.

Microsoft Exchange server does not strictly comply with RFC 821 section 4.5.1, using extended SMTP commands such as EHLO. PIX Firewall will convert any such commands into NOOP commands, which as specified by the RFC, forces SMTP servers to fall back to using minimal SMTP commands only. This may cause Microsoft Outlook clients and Exchange servers to function unpredictably when their connection passes through PIX Firewall.

Use the *port* option to change the default port assignments from 25. Use the *-port* option to apply SMTP application inspection to a range of port numbers.

As of version 5.1 and higher, the **fixup protocol smtp** command changes the characters in the server SMTP banner to asterisks except for the "2", "0", "0" characters. Carriage return (CR) and linefeed (LF) characters are ignored. PIX Firewall version 4.4 converts all characters in the SMTP banner to asterisks.

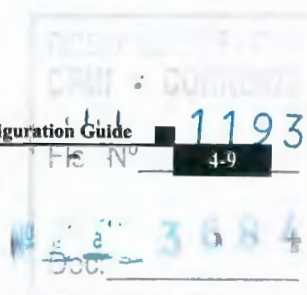
## Application Inspection

An SMTP server responds to client requests with numeric reply codes and optional human readable strings. SMTP application inspection controls and reduces the commands that the user can use as well as the messages that the server returns. SMTP inspection performs three primary tasks:

- Restricts SMTP requests to seven minimal commands (HELO, MAIL, RCPT, DATA, RSET, NOOP, and QUIT).
- Monitors the SMTP command-response sequence.
- Generates an audit trail—Audit record 108002 is generated when invalid character embedded in the mail address is replaced. For more information, see RFC 821.

SMTP inspection monitors the command and response sequence for the following anomalous signatures:

- Truncated commands.
- Incorrect command termination (not terminated with <CR><LR>).
- The MAIL and RCPT commands specify who are the sender and the receiver of the mail. Mail addresses are scanned for strange characters. The pipeline character (|) is deleted (changed to a blank space) and "<" , ">" are only allowed if they are used to define a mail address (">" must be preceded by "<").
- Unexpected transition by the SMTP server.



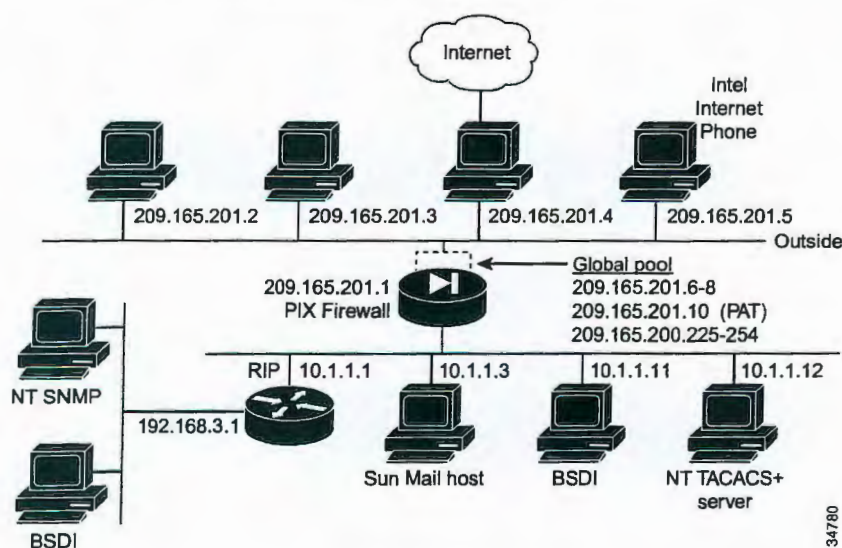


- For unknown commands, the PIX Firewall changes all the characters in the packet to X. In this case, the server will generate an error code to the client. Because of the change in the packet, the TCP checksum has to be recalculated or adjusted.
- TCP stream editing.
- Command pipelining.

## Sample Configuration

Figure 4-3 illustrates a network scenario implementing SMTP and NFS on an internal network.

Figure 4-3 Sample Configuration with SMTP and NFS (Sun RPC)



In this example, the **static** command sets up a global address to permit outside hosts access to the 10.1.1.3 Sun Mail host on the Inside interface. (The MX record for DNS must point to the 209.165.201.1 address so that mail is sent to this address.) The **access-list** command lets any outside users access the global address through the SMTP port (25). The **no fixup protocol** command disables the Mail Guard feature.

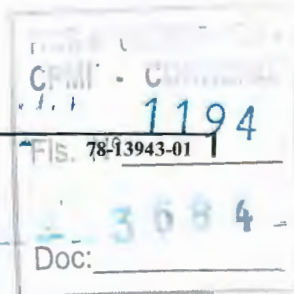
Perform the following steps to complete the configuration required for this example:

**Step 1** Provide access to the 10.1.1.3 mail server through global address 209.165.201.12:

```
static (inside, outside) 209.165.201.12 10.1.1.3 netmask 255.255.255.255 0 0
access-list acl_out permit tcp any host 209.165.201.12 eq smtp
```

The **access-list** command allows any outside host access to the static via SMTP (port 25). By default, the PIX Firewall restricts all access to mail servers to the commands DATA, HELO, MAIL, NOOP, QUIT, RCPT, and RSET, as described in RFC 821, section 4.5.1. This is implemented through the Mail Guard service, which is enabled by default (**fixup protocol smtp 25**).

Another aspect of providing access to a mail server is being sure that you have a DNS MX record for the static's global address, which outside users access when sending mail to your site.



**Step 2** Create access to port 113, the IDENT protocol:

```
access-list acl_out permit tcp any host 209.165.201.12 eq 113
access-group acl_out in interface outside
static (inside, outside) 209.165.201.12 10.1.1.3 netmask 255.255.255.0 0
access-list acl_out permit tcp any host 209.165.201.12 eq smtp
access-list acl_out permit tcp any host 209.165.201.12 eq 113
access-group acl_out in interface outside
```

If the mail server has to talk to many mail servers on the outside which connect back with the now obsolete and highly criticized IDENT protocol, use this **access-list** command statement to speed up mail transmission. The **access-group** command statement binds the **access-list** command statements to the outside interface.

Example 4-1 shows a command listing for configuring access to services for the network:

**Example 4-1** Configuring Mail Server Access

```
static (inside, outside) 209.165.201.12 10.1.1.3 netmask 255.255.255.0 0
access-list acl_out permit tcp any host 209.165.201.12 eq smtp
access-list acl_out permit tcp any host 209.165.201.12 eq 113
access-group acl_out in interface outside
static (inside, outside) 209.165.201.12 10.1.1.3 netmask 255.255.255.0 0
```

## Voice Over IP

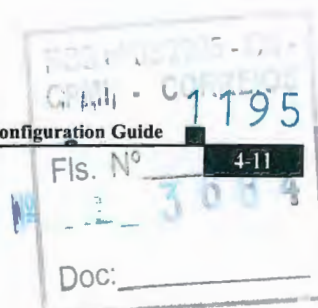
This section describes how the PIX Firewall supports Voice over IP (VoIP) applications and protocols and how you can use **fixup** and other commands to solve specific problems. It includes the following topics:

- Skinny Client Control Protocol
- H.323
- Session Initiation Protocol
- CU-SeeMe

### Skinny Client Control Protocol

Skinny (or Simple) Client Control Protocol (SCCP) is a simplified protocol used in VoIP networks. This section describes the function and limitation of application inspection when using SCCP. It includes the following topics:

- Overview
- Using SCCP with Cisco CallManager on a Higher Security Interface
- Problems Occur with Fragmented SCCP Packets







## Problems Occur with Fragmented SCCP Packets

At this time, PIX Firewall is not able to correctly handle fragmented SCCP packets. For instance, when using a voice conferencing bridge, SCCP packets may become fragmented and are then dropped by the PIX Firewall. This happens because the SCCP inspection checks each packet and drops what appear to be bad packets. When a single SCCP packet is fragmented into multiple TCP packets, the SCCP inspection function finds that the internal checksums within the SCCP packet fragments are not accurate and so it drops the packet.

## H.323

You can use the **fixup** command to change the default port assignment for the H.323 protocol. The command syntax is as follows:

```
[no] fixup protocol h323 h225 [ras port [-port]]
```

Use the *port* option to change the default control connection port assignment. The default port assignments are as follows:

- h323 h225 1720
- h323 ras 1718-1719

Use the *-port* option to apply H.323 application inspection to a range of port numbers.

The **fixup protocol h323** command provides support for Intel Internet Phone, CU-SeeMe, CU-SeeMe Pro, MeetingPoint, and MS NetMeeting. PIX Firewall version 5.3 and higher supports H.323 version 2. H.323 is a suite of protocols defined by the International Telecommunication Union (ITU) for multimedia conferences over LANs. H.323 supports VoIP gateways and VoIP gatekeepers. H.323 version 2 adds the following functionality:

- Fast Connect or Fast Start Procedure for faster call setup
- H.245 tunneling for resource conservation, call synchronization, and reduced set up time

H.323 inspection supports static NAT or dynamic NAT. H.323 RAS is configurable using the **fixup** command with PIX Firewall version 6.2 or later. With earlier versions, only H.225 & H.245 signaling can be controlled using the **fixup** command. PAT support for H.323 is introduced with PIX Firewall version 6.2.

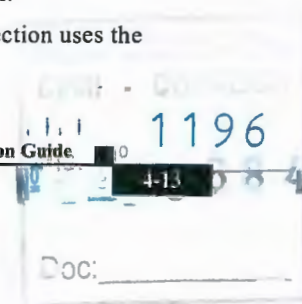
The H.323 collection of protocols collectively may use up to two TCP connection and four to six UDP connections. FastConnect uses only one TCP connection, and RAS uses a single UDP connection for registration, admissions, and status.

An H.323 client may initially establish a TCP connection to an H.323 server using TCP port 1720 to request Q.931 call setup. As part of the call setup process, the H.323 terminal supplies a port number to the client to use for an H.245 TCP connection. In environments where an H.323 gatekeeper is in use, the initial packet is transmitted using UDP, where the client sends out an ARQ.

H.323 inspection monitors the Q.931 TCP connection to determine the H.245 port number. If the H.323 terminals are not using FastConnect, the PIX Firewall dynamically allocates the H.245 connection based on the inspection of the H.225 messages.

Within each H.245 message, the H.323 end points exchange port numbers that are used for subsequent UDP data streams. H.323 inspection inspects the H.245 messages to identify these ports and dynamically creates connections for the media exchange. Real-Time Transport Protocol (RTP) uses the negotiated port number, while RTP Control Protocol (RTCP) uses the next higher port number.

The H.323 control channel handles H.225 and H.245 and H.323 RAS. H.323 inspection uses the following ports.





- 1718—Gate Keeper Discovery UDP port
- 1719—RAS UDP port
- 1720—TCP Control Port

The two major functions of H.323 inspection are as follows:

- NAT the necessary embedded IPv4 addresses in the H.225 and H.245 messages. Because H.323 messages are encoded in PER encoding format, PIX Firewall uses an ASN.1 decoder to decode the H.323 messages.
- Dynamically allocate the negotiated H.245 and RTP/RTCP connections.

The PIX Firewall administrator must open a conduit for the well-known H.323 port 1720 for the H.225 call signaling. However, the H.245 signaling ports are negotiated between the endpoints in the H.225 signaling. When an H.323 gatekeeper is used, the PIX Firewall opens an H.225 connection based on inspection of the ACF message.

The PIX Firewall dynamically allocates the H.245 channel after inspecting the H.225 messages and then “hookup” the H.245 channel to be fixed up as well. That means whatever H.245 messages pass through the PIX Firewall pass through the H.245 application inspection, NATing embedded IP addresses and opening the negotiated media channels.

The H.323 ITU standard requires that a TPKT header, defining the length of the message, precede the H.225 and H.245, before being passed on to the reliable connection. Because the TPKT header does not necessarily need to be sent in the same TCP packet as the H.225/H.245 message, PIX Firewall must remember the TPKT length to process/decode the messages properly. PIX Firewall keeps a data structure for each connection and that data structure contains the TPKT length for the next expected message.

If the PIX Firewall needs to NAT any IP addresses, then it will have to change the checksum, the UUIE (user-user information element) length, and the TPKT, if included in the TCP packet with the H.225 message. If the TPKT is sent in a separate TCP packet, then PIX Firewall will proxy ACK that TPKT and append a new TPKT to the H.245 message with the new length.



Note

PIX Firewall does not support TCP options in the Proxy ACK for the TPKT.

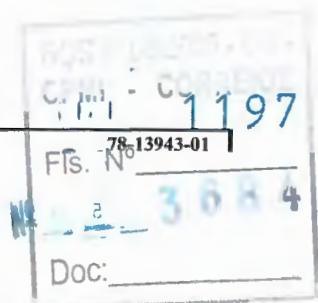
Each UDP connection with a packet going through H.323 inspection is marked as an H.323 connection and will time out with the H.323 timeout as configured by the administrator using the **timeout** command.

#### Usage Notes

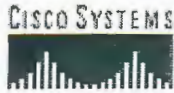
1. Static PAT may not properly translate IP addresses embedded in optional fields within H.323 messages. If you experience this kind of problem, do not use static PAT with H.323.
2. When a NetMeeting client registers with an H.323 gatekeeper and tries to call an H.323 gateway that is also registered with the H.323 gatekeeper, the connection is established but no voice is heard in either direction. This problem is unrelated to the PIX Firewall.
3. If you configure a network static where the network static is the same as a third-party netmask and address, then any outbound H.323 connection fails.

## Session Initiation Protocol

Session Initiation Protocol (SIP), as defined by the Internet Engineering Task Force (IETF), enables call handling sessions, particularly two-party audio conferences, or “calls.” This section describes how application inspection works with SIP. It includes the following topics:







ANEXO 54

[Home](#) | [Logged In](#) | [Profile](#) | [Contacts & Feed](#)[Products & Services](#)

GO

PRODUCTS & SERVICES  
CISCO SECURITY AND VPN  
DEVICES  
CISCO PIX 500 SERIES  
FIREWALLS  
ALERTS AND  
TROUBLESHOOTING  
FIELD NOTICES

Field Notice: PIX 535  
Interface  
Configuration/Performance  
Considerations

## Field Notice: PIX 535 Interface Configuration/Performance Considerations

August 2, 2001

- [More Field Notices](#)

### Products Affected

| Product | Comments                                 |
|---------|------------------------------------------|
| PIX-535 | All bundles and interface configurations |

### Problem Description

The PIX 535 platform introduced a high speed, multiple bus architecture in conjunction with a line rate Gigabit interface card. There are many possible combinations to install the available PIX interface cards into the 535 chassis. Some combinations may drastically limit the potential throughput of the firewall, as well as prevent state data from passing between a failover pair.

### Background

The PIX 535 has nine interface slots spread over three separate buses: one 32-bit/33 MHz bus with five interface slots, and two 64-bit/66 MHz buses, with two interface slots each. Use the following table and figure as references for the bus and interface slot configuration on the PIX 535:

#### PIX 535 Buses and Interface Slots

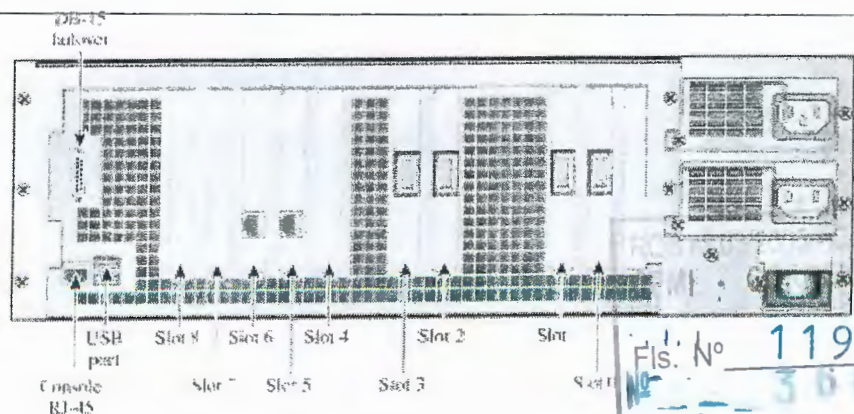
| Interface Slots | Bus | Maximum Bus Speed |
|-----------------|-----|-------------------|
|-----------------|-----|-------------------|

|               |       |               |
|---------------|-------|---------------|
| Slots 0 and 1 | Bus 0 | 64-bit/66 MHz |
|---------------|-------|---------------|

|               |       |               |
|---------------|-------|---------------|
| Slots 2 and 3 | Bus 1 | 64-bit/66 MHz |
|---------------|-------|---------------|

|              |       |               |
|--------------|-------|---------------|
| Slots 4 to 8 | Bus 2 | 32-bit/33 MHz |
|--------------|-------|---------------|

#### PIX 535 Back Panel Detail



The cards supported by the PIX 535 have different maximum bus speeds. Use the following table as a reference for the interface cards bus speed:

| Interface Card | Maximum Bus Speed |
|----------------|-------------------|
| PIX-1FE        | 32-bit/33 MHz     |
| PIX-4FE        | 32-bit/33 MHz     |
| PIX-1GE        | 64-bit/33 MHz     |
| PIX-1GE-66     | 64-bit/66 MHz     |
| PIX-VPN-ACCEL  | 32-bit/33 MHz     |

The 32-bit/33 MHz bus will always operate at 33 MHz. However, the two 64-bit/66 MHz buses will operate at the speed of the slowest interface card installed in it. If only PIX-1GE-66 cards are installed in a 64-bit/66 MHz bus, it will operate at 66 MHz. However, if any other card is installed, it will operate at 33 MHz.

#### Problem Symptoms

When a PIX-1GE-66 interface card is installed in a 32-bit/ 33MHz bus, its potential throughput will be severely limited. When a PIX-1GE-66 interface card is installed in a 64-bit/66 MHz bus in conjunction with any 33 MHz card, its potential throughput is limited, although not as severely.

Note that any throughput degradation due to the configurations described above would only be noticeable on PIX 535 systems with relatively heavy traffic.

#### Workaround/Solution

These practices must be followed in order to achieve the best possible system performance on the PIX 535:

1 - PIX-1GE-66 interface cards should be installed first in the 64-bit/66 MHz buses before they are installed in the 32-bit/33 MHz bus. If more than four PIX-1GE-66 cards are needed, they may be installed in the 32-bit/33 MHz bus, but with limited potential throughput.

2 - PIX-1GE and PIX-1FE cards should be installed first in the 32-bit/33 MHz bus before they are installed in the 64-bit/66 MHz buses. If more than five PIX-1GE and/or PIX-1FE cards are needed, they may be installed in a 64-bit/66 MHz bus, but doing so will lower that bus speed and limit the potential throughput of any PIX-1GE-66 card installed in that bus.

Use the following table to determine how to achieve the best Gigabit Ethernet performance from a PIX 535:

#### Gigabit Ethernet Interface Card Combinations

| Interface Card Combination                             | Installed In Interface Slot Numbers | Potential Throughput |
|--------------------------------------------------------|-------------------------------------|----------------------|
| Two to four PIX-1GE-66                                 | 0 through 3                         | Best                 |
| PIX-1GE-66 combined with PIX-1GE or just PIX-1GE cards | 0 through 3                         | Degraded             |
| Any PIX-1GE-66 or PIX-1GE                              | 4 through 8                         | Severely degraded    |

These caveats must be followed:

3 - The PIX-4FE and PIX-VPN-ACCEL cards can only be installed in the 32-



bit/33 MHz bus and must never be installed in a 64-bit/66 MHz bus. Installation of these cards in a 64-bit/66 MHz bus may cause the system to hang at boot time.

4 - If stateful failover is enabled, the interface card and bus used for the stateful failover LAN port must be equal to or faster than the fastest card used for the network interface ports. For example, if your inside and outside interfaces are PIX-1GE-66 cards installed in bus 0, your stateful failover interface must be a PIX-1GE-66 card installed in bus 1. A PIX-1GE or PIX-1FE card cannot be used in this case, nor can a PIX-1GE-66 card installed in bus 2 or sharing bus 1 with a slower card.

Although using the PIX-1GE card in the PIX 535 is supported, this practice is strongly discouraged since potential system performance is much lower than that afforded by the PIX-1GE-66 card.

#### How To Identify Hardware Levels

To determine what interface cards you have installed, perform the following command from the command line:

```
PIX535# show interface interface ethernet0 "outside" is up, line protocol is up
Hardware is i82559 ethernet, address is 0002.b304.0eab
```

The type of interface card installed is identified by the hardware type. Reference the following table to determine their mapping:

#### PIX 535 Supported Interface Cards

| Interface Card | Hardware Type |
|----------------|---------------|
|----------------|---------------|

|            |                |
|------------|----------------|
| PIX-1GE-66 | i82543         |
| PIX-1GE    | i82542         |
| PIX-4FE    | i82558         |
| PIX-1FE    | i82558, i82559 |

#### Notes:

1 - The PIX-1FE card with hardware type i82557 is not supported by the PIX 535.

2 - To differentiate between the PIX-1FE card and PIX-4FE card with hardware type i82558, you may check for four sequential MAC addresses or visually inspect whether one or four RJ-45 ports are present on the card.

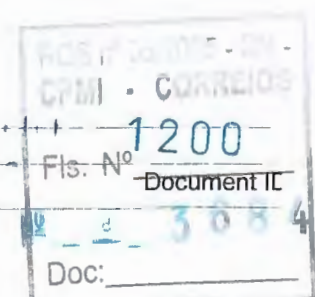
3 - To physically differentiate between the PIX-1GE and PIX-1GE-66 cards visually inspect their primary ASIC. The PIX-1GE is labeled "LSI L2A1157" and the PIX-1GE-66 is labeled "INTEL TL82543GC".

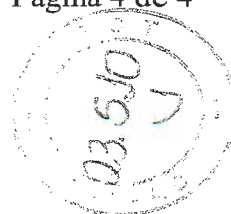
#### For More Information

If you require further assistance, or if you have any further questions regarding this field notice, please contact the Cisco Systems Technical Assistance Center (TAC) by one of the following methods:

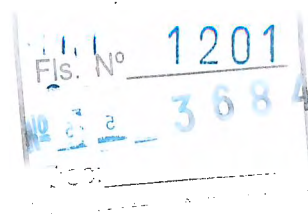
- Open a case on Cisco.Com
- By email
- By telephone

Updated: Feb 11, 2003





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## End-of-Sale and End-of-Life Announcement for the Cisco PIX 32-bit/33-MHz Four-port Fast Ethernet Interface Card

Cisco Systems® announces the end of life of the Cisco PIX® 32-bit/33-MHz Four-port Fast Ethernet Interface Card. The last day to order the Cisco PIX 32-bit/33-MHz Four-port Fast Ethernet Interface Card is July 7, 2003. Customers will continue to receive support from the Cisco Technical Assistance Center (TAC) until July 7, 2008. Table 1 describes the end-of-life milestones, definitions, and dates.

Cisco Systems introduced a new Fast Ethernet 100BASE-TX interface card for the Cisco PIX Security Appliances based on the higher performance 64-bit/66-MHz PCI bus. The new card provides four 100BASE-TX ports, increased performance, and deployment flexibility on modular Cisco PIX Security Appliances. It is supported by the latest maintenance releases of all current Cisco PIX OS trains, namely versions 5.2(9), 6.0(4), 6.1(4), 6.2(2) and 6.3(1) or later. With these benefits and extensive OS support, customers are encouraged to migrate to the new Cisco PIX 64-bit/66-MHz Four-port Fast Ethernet Interface Card.

Table 2 provides relevant information for migrating from the end of life Cisco PIX 32-bit/33-MHz Four-port Fast Ethernet Interface Card to the new Cisco PIX 64-bit/66-MHz Four-port Fast Ethernet Interface Card.

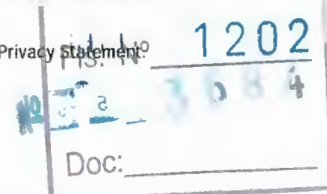
**Table 1** End-of-Life Milestones and Dates

| Milestone                                 | Definition                                                                                                                                                                                                                            | Date                                                                                                                                                                                                |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| End-of-life announcement date             | The date the end-of-sale and end-of-life announcement is distributed to the general public.                                                                                                                                           | May 27, 2003                                                                                                                                                                                        |
| End of sale date                          | The last date to order the product through Cisco point-of-sale mechanisms. The product is no longer for sale.                                                                                                                         | July 7, 2003                                                                                                                                                                                        |
| Last shipment date                        | The last-possible ship date that can be requested of Cisco and/or its contract manufacturers. Actual ship date is dependent on lead-time.                                                                                             | July 21, 2003                                                                                                                                                                                       |
| End of software maintenance releases date | The last date that Cisco Engineering may release any final software maintenance releases or bug fixes. After this date, Cisco Engineering will no longer develop, repair, maintain, or test the product software.                     | July 7, 2004                                                                                                                                                                                        |
| End of Routine failure analysis date      | The last possible date a routine failure analysis may be performed to determine the cause of product failure or defect.                                                                                                               | July 7, 2004                                                                                                                                                                                        |
| End of new service attachment date        | For equipment and software that is not covered by a service-and-support contract, this is the last date to order a new service-and-support contract or add the equipment and/or software to an existing service-and-support contract. | Not Applicable (Standard services-and-support contract is attached to the Cisco PIX Security Appliance and not to this end-of-life Cisco PIX 32-bit/33-MHz Four-port Fast Ethernet Interface Card.) |
| End of service contract renewal date      | The last date to extend or renew a service contract for the product. The extension or renewal period cannot extend beyond the last date of support.                                                                                   |                                                                                                                                                                                                     |
| Last date of support                      | The last date to receive service and support for the product. After this date, all support services for the product are unavailable, and the product becomes obsolete.                                                                | July 7, 2008                                                                                                                                                                                        |

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03.505

**Table 2** Product Part Numbers Affected by This Announcement

| End-of-Sale Product |                                                                | Product Migration Option |                                                                |
|---------------------|----------------------------------------------------------------|--------------------------|----------------------------------------------------------------|
| Part Number         | Description                                                    | Part Number              | Description                                                    |
| PIX-4FE             | Cisco PIX 32-bit/33-MHz Four-port Fast Ethernet Interface Card | PIX-4FE-66               | Cisco PIX 64-bit/66-MHz Four-port Fast Ethernet Interface Card |
| PIX-4FE=            | Cisco PIX 32-bit/33-MHz Four-port Fast Ethernet Interface Card | PIX-4FE-66=              | Cisco PIX 64-bit/66-MHz Four-port Fast Ethernet Interface Card |

Customers can use the Cisco Technology Migration Plan (TMP) to trade in products and receive credit toward the purchase of new Cisco equipment. For more information about Cisco TMP, go to:

<http://www.cisco.com/go/tradein/>

To use the Cisco TMP application, you must have a Cisco.com user ID.

#### Additional Information

For more information about the Cisco PIX 64-bit/66-MHz Four-port Fast Ethernet Interface card, go to:

[http://www.cisco.com/en/US/products/hw/vpndevc/ps2030/products\\_data\\_sheets\\_list.html](http://www.cisco.com/en/US/products/hw/vpndevc/ps2030/products_data_sheets_list.html)

For more information about Cisco products, contact your Cisco account manager and/or Cisco Channel Partner.

For more information about the Cisco End-of-Life Policy, go to:

[http://www.cisco.com/en/US/products/prod\\_end\\_of\\_life.html](http://www.cisco.com/en/US/products/prod_end_of_life.html)

FIG. NO. 1203  
NO. 3684



103 3027

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No. 3684



## About This Guide

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This preface describes:

- Document Objectives
- Audience
- Document Organization
- Document Conventions
- Cisco Connection Online
- CD-ROM Documentation

### Document Objectives

Cisco PIX (Private Internet Exchange) Firewall provides full firewall protection that completely conceals the architecture of an internal network from the outside world.

### Audience

This guide is for network managers who perform any of the following tasks:

- Managing network security
- Installing and configuring firewalls
- Managing default and static routes, and TCP and UDP services

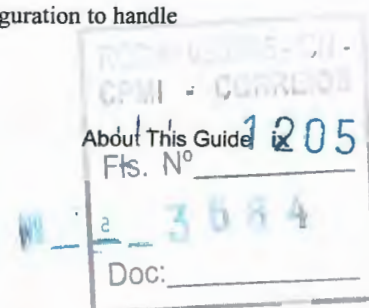
Use this guide with the installation guide supplied with your PIX Firewall unit.

### Document Organization

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This guide describes:

- Chapter 1, "Introduction," describes the PIX Firewall, its Adaptive Security feature, concepts, and new features for this release.
- Chapter 2, "Configuring the PIX Firewall," describes how to initially configure the PIX Firewall to participate on the network, how to test the new configuration, and how to improve the configuration to access each feature.
- Chapter 3, "Advanced Configurations," describes how to improve the configuration to handle optional features available for the PIX Firewall.
- Chapter 4, "Configuration Examples," provides example configurations.







## Document Conventions

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- Chapter 5, "Command Reference," describes each PIX Firewall command and provides command syntax, usage guidelines, and an example.
- Appendix A, "Configuration Forms," provides forms you can use to plan a configuration before starting to create a configuration.
- Appendix B, "Acronyms and Abbreviations," lists the acronyms and abbreviations used in this guide.
- Appendix C, "Installing the PIX Firewall Setup Wizard," describes how to install the PIX Firewall Setup Wizard.
- Appendix D, "Configuring for MS-Exchange Use," describes how to configure PIX Firewall to handle mail transfers across the firewall from Windows NT Servers on the protected and unprotected networks.
- Appendix E, "Subnet Masking and Addressing," lists the IP addresses associated with each subnet mask value.

## Document Conventions

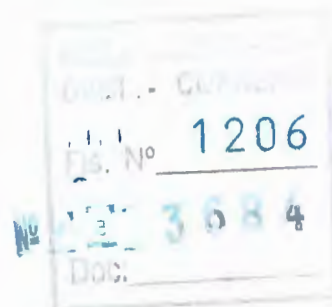
This guide uses the following conventions:

- Filenames, directory names, and arguments for which you supply values are in *italics*.
- The symbol ^ represents the key labeled Ctrl (control). To enter a control key; for example, ^z, hold down the Ctrl key while you press the z key.
- Command names, buttons, and keywords in text are shown in **boldface**. The PIX Firewall commands are described in Chapter 5, "Command Reference."
- Command statements in the default configuration section in Chapter 4, "Configuration Examples" that PIX Firewall provides are shown in **boldface** and *italic screen* font.
- Variables in command syntax descriptions are shown in *italics*. Command options in square brackets [ ] can be optionally entered, and parameters separated by a vertical bar (|) require you to enter one parameter, but not the other(s).
- Examples depict screen displays and the command line in *screen* font.
- Information you need to enter in examples is shown in **boldface screen** font.
- Variables for which you must supply a value are shown in *italic screen* font.
- Selecting a menu item (or screen) is indicated by the following convention:  
Select **screen1>screen2>screen3**.

---

**Note** Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

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## Cisco Connection Online

Cisco Connection Online (CCO) is Cisco Systems' primary, real-time support channel. Maintenance customers and partners can self-register on CCO to obtain additional information and services.

Available 24 hours a day, 7 days a week, CCO provides a wealth of standard and value-added services to Cisco's customers and business partners. CCO services include product information, product documentation, software updates, release notes, technical tips, the Bug Navigator, configuration notes, brochures, descriptions of service offerings, and download access to public and authorized files.

CCO serves a wide variety of users through two interfaces that are updated and enhanced simultaneously: a character-based version and a multimedia version that resides on the World Wide Web (WWW). The character-based CCO supports Zmodem, Kermit, Xmodem, FTP, and Internet e-mail, and it is excellent for quick access to information over lower bandwidths. The WWW version of CCO provides richly formatted documents with photographs, figures, graphics, and video, as well as hyperlinks to related information.

You can access CCO in the following ways:

- WWW: <http://www.cisco.com>
- WWW: <http://www-europe.cisco.com>
- WWW: <http://www-china.cisco.com>
- Telnet: [cco.cisco.com](http://cco.cisco.com)
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and connection rates up to 28.8 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact [cco-help@cisco.com](mailto:cco-help@cisco.com). For additional information, contact [cco-team@cisco.com](mailto:cco-team@cisco.com).

---

**Note** If you are a network administrator and need personal technical assistance with a Cisco product that is under warranty or covered by a maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or [tac@cisco.com](mailto:tac@cisco.com). To obtain general information about Cisco Systems, Cisco products, or upgrades, contact 800 553-6387, 408 526-7208, or [cs-rep@cisco.com](mailto:cs-rep@cisco.com).

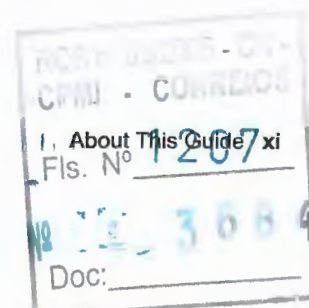
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## CD-ROM Documentation

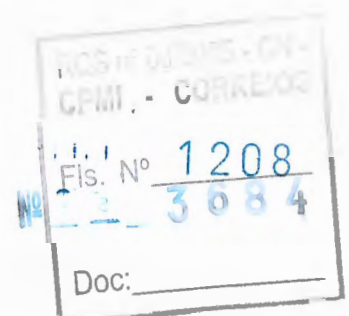
Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more current than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service.

The CD-ROM package is available as a single package or as an annual subscription. You can also access Cisco documentation on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <http://www-europe.cisco.com>.

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## CISCO AVVID PARTNER PROGRAM

### Perimeter Security Design Guide: Websense Enterprise v4.3

#### Design Guide

#### Websense Enterprise v4.3— Cisco PIX Firewall Edition

**Websense Enterprise v4.3 provides integrated Internet filtering for the Cisco PIX® Firewall, helping network administrators effectively monitor and control network traffic. As a plug-in for the Cisco PIX Firewall, Websense tells the firewall to block or permit Internet traffic. Websense is compatible with Netscape Navigator, Microsoft Internet Explorer, and other common Internet browsers and programs.**

**Websense Enterprise v4.3 (Windows 2000, Solaris 8, and Linux RedHat 7 platforms) was verified interoperable with Cisco PIX Firewall Software Version 6.1(2).**

#### Description of Product

Websense Enterprise v4.3, Cisco PIX Firewall Edition is an employee Internet management system that enables organizations to monitor, manage, and report on Internet access internal network.

Network administrators assign policies that restrict Internet use within organizations. Websense Enterprise then filters network activity according to the preestablished policy monitoring, and reporting on the activity. Websense Enterprise integrates with the Cisco Firewall, providing the engine by which content filtering is enforced. Using the Websense Master Database of URLs in conjunction with Cisco PIX Firewall, flexible, high-performance content-filtering policies can be created.

Websense can be installed on a Windows NT, Windows 2000, Solaris, or Red Hat Linux machine connected to the network. Websense can run on systems with other applications well, as long as they are not too processor or memory intensive.

Internet requests are sent to the Cisco PIX Firewall, which then queries Websense to determine whether the request should be permitted or blocked. At the same time, the PIX Firewall sends the original request to the Internet.

By sending the request to the Internet before receiving confirmation from Websense, the Cisco PIX Firewall does not slow down authorized business access. Requiring Websense confirmation before returning the site to the requesting user prevents unauthorized access.

When Websense receives a request, it checks the source to find out if the workstation requesting the URL is to be blocked completely from the Internet. If it is not, Websense determines whether a custom setting has been established for the requested URL. If Websense consults its URL database to see if the site is in a blocked category.

Because Websense runs on a single-server computer, it provides filtering for an entire network. Websense provides transparent content filtering to the network environment, client configuration needed.

#### Philosophy of Protection

##### Assumptions

Rapid advances in communications technology have combined to create a connectivity explosion that has businesses, schools, and local service providers increasing their Internet access. New users are accessing the Internet at a staggering pace, and new Web sites added as quickly.

This global connectivity lets commerce and information flow across time zones and national boundaries.

Corporate networks, once isolated from the outside world, have suddenly opened up,



potential security risks. Internally, Web-enabled users may gain access to enormous quantities of material, deemed inappropriate or undesirable in the workplace by security administrators. Websense provides advanced network-to-Internet monitoring, reporting management. These powerful features help organizations identify and limit unproductive surfing, control access to content such as illegal or pornographic materials, and reduce unnecessary bandwidth consumption.

### Threats

This wide-open access also provides unregulated access to large amounts of frivolous, offensive, and controversial material, as well as material that is not job related. As a result, many organizations must determine how to permit unhindered access to the vast amount of information on the Internet while restricting access to undesirable content.

Websense Enterprise, an "intelligent" software product, offers organizations and individuals greater flexibility and security while preventing access to objectionable or inappropriate materials on the Internet. Rather than attempting to block access at each local computer, Websense is server based, high performance, and capable of filtering information through a set of policies.

### Organizational Security Policies

Inside organizations, initial security measures usually include a written Internet access policy (IAP) and basic monitoring tools that let the network administrator observe network traffic patterns and bandwidth consumption levels.

Websense Enterprise enables organizations to better control their network resources and enforce a variety of IAPs throughout the enterprise.

Organizations are also implementing measures that help reduce unproductive employee "surfing" (and thereby save costs) through the use of Internet management tools and filtering applications that enforce IAPs by limiting access to sites deemed undesirable.

With Websense, network managers enforce organizational IAPs by configuring policies that limit or prohibit access to certain sites. Policy enforcement controls may also be established based on date and time.

### Standards References

Websense Enterprise complies with basic protocol standards and has received ICSA certification. See [www.icsa.net](http://www.icsa.net) for further information.

### Typical Implementation

Websense Enterprise v4.3, Cisco PIX Firewall Edition should be deployed within a network behind the Cisco PIX Firewall. All Hypertext Transfer Protocol (HTTP) requests should pass through the Cisco PIX Firewall connected to the server running Websense, to ensure proper filtering.

Customers should be familiar with configuring the Cisco PIX Firewall. The installation configuration of Websense Enterprise is thoroughly explained in the documentation provided with the product. No extra training is needed to install or set up Websense.

Typical implementation, which includes installation, configuration of the Cisco PIX Firewall and definition of filtering policies, takes about one hour. Minimum requirements are detailed in the following section.

### Secure Installation and Deployment

The Websense Manager lets you configure Websense Enterprise locally or from any Windows NT, Windows 2000, or Solaris workstation behind the firewall that meets or exceeds the system requirements.

Before installing Websense, you need to have the following:

- Websense Enterprise v4.3, Cisco PIX Firewall Edition
- A valid Websense license or evaluation key
- Cisco PIX Firewall Software Version 4.4 or greater
- Windows NT 4.0 (Server version recommended because its networking capabilities are faster than Windows Workstation) with at least SP5, Windows 2000 with at least SP2, Solaris 2.6 (with Recommended Patch Cluster), Solaris 2.7 (with Recommended Patch Cluster), Red Hat Linux 6.2, or Red Hat Linux 7.1
- Customer address and contact information

For Windows and Linux installations, Websense recommends at minimum a Pentium III



processor with 256 MB of RAM. For Solaris installations, Websense recommends a SPARC II with 256 MB of RAM.

The Websense installation program is a single executable program that installs the W Manager and the Websense Server. Before installing any Websense components, be sure your system time is set correctly. Websense uses the system clock to determine the time for downloading the database and enforcing time-based filtering policies.

To enable Websense filtering, enter a valid registration key. This key allows you to do the Websense Master Database of Web sites.

Internet access through Websense depends on the license level purchased. Each Websense license key may be used on only one computer, which filters the number of workstations authorized by your license level. License levels do not refer to simultaneous users, but refer to the total number of computers accessing the Internet during each 24-hour period.

Websense works by consulting a growing database of Internet sites, organized into predefined categories. The database resides locally on the same machine as Websense.

Every day, during a configurable time period, Websense downloads the latest update to the Master Database. The connection is established via the HTTP protocol over the Internet. The customer site must allow outbound HTTP access. The Websense machine is programmed to go to one of three national or international database servers to download the Master Database, which is transferred in a special, proprietary format. During installation, use whichever of these database servers is used.

When Websense requests a database update, it transmits the customer's registration information to the Websense download site for verification. This registration information informs Websense customers about new versions of the product.

The database has both site names and full URL path names to specifically control what material is blocked. Although Websense Enterprise filters only HTTP sites, the database contains sites accessed via File Transfer Protocol (FTP), Gopher, Telnet, Internet Relay Chat (IRC), USENET News, and RealAudio sites.

Websense, Inc. continually updates its Master Database. Using automated tools, a team of Web analysts scans the Internet looking for new sites to add to the database. A Web analyst personally verifies each site before it is added to the database. In addition, supervisors conduct quality checks on all sites to ensure accuracy and consistency of categorization. Finally, the Master Database is rechecked regularly and obsolete sites are removed.

Using the Websense Master Database of URLs in conjunction with the Cisco PIX Firewall, you can enforce powerful, high-performance, content filtering policies by choosing from Websense Enterprise's preconfigured policies or creating or modifying custom policies. While access to sites in unblocked categories is permitted, Websense can observe and log activity to permitted sites based on your configuration.

**Figure 1**  
**Websense Running on a Server Separate from the Cisco PIX Firewall**

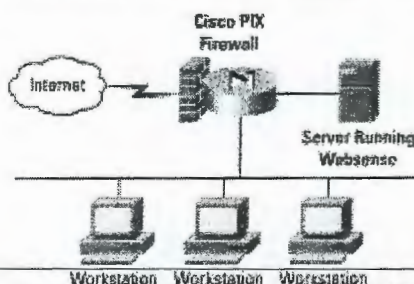


Figure 1 shows Websense running on a server separate from the Cisco PIX Firewall. The firewall can be configured to deny session attempts, protecting Websense and the other functions of the server from malicious internal attacks and from any external Internet attack. The server is not accessible to any internal or external networks.

The Websense server must be given physical protection, allowing only authorized network security administrators physical access to the Websense server.

#### Assets Protected

The Websense Enterprise architecture, in concert with the Cisco PIX Firewall, provides security features and access management. Through development and implementation of policies that are enforced by Websense, companies can preserve bandwidth by limiting Internet access to appropriate and authorized activities. Websense also protects and enhances corporate productivity by limiting unauthorized "surfing." In addition, corporate liability is reduced because Websense can exclude offensive and illegal material from being brought into the company network via the Internet.



### Self-Protection

The server running Websense relies on the mechanisms of the Windows NT, Window Solaris, or Red Hat Linux operating systems for protection against malicious attacks.

The database download is protected because the customer must enter a valid license can be used on only one computer. Each time the Websense server contacts the Mas Database server, it automatically sends the customers key and contact information, v the key with each download request.

Websense can be configured via the graphical Websense Manager. Access to the ma limited to authorized administrators with correct usernames and passwords.

### Assurance

The Websense Master Database can be tested by browsing sites to see if they are bl monitored. You can also verify enforcement of your security policy by using Websens Reporter as described in the next section.

### Reporting

Websense Enterprise features a separate program called Websense Reporter, which detailed log entries for each request it processes. Using the Reporter function, you ca generate tabular reports and bar charts that show Internet access activity by your em

Websense Reporter prepares reports of three different types. *Detailed reports* provide information on requested sites and the clients who requested them. Information is pre for every site or category for each client and protocol selected. Dates and times are in to provide a complete picture of Internet access. *Summary reports* give an overview o Internet usage for selected clients and sites. Totals reveal hits and bytes transferred, depending upon the report format selected. *Charts* show usage trends by presenting overview in the form of a bar graph.

Reporter comes equipped with more than 50 different formats to choose from. Report can be customized to suit your individual needs; these formats can then be saved for later time. You can also schedule reports to be generated at specific times (such as o when network traffic is low). Reports can be saved to a specified directory or sent to a with a valid e-mail address.

In addition to selecting the type of report and sites included, you can also choose date clients (users, groups, and workstations), and protocols to be reported (note that trans and bytes do not show up when using Websense Enterprise, Cisco PIX Firewall Editio These options let network administrators pinpoint the information of interest and gene meaningful reports.

When running on Windows NT or Windows 2000, Websense Enterprise logs status m in the Windows NT Application Event Log, which can be viewed with the Windows NT Viewer.

**Note** For performance reasons, Cisco PIX Firewall has the option to cache some Web responses so that it can permit or block those sites without contacting Websense. We logs sites that are permitted or blocked directly by the Cisco PIX Firewall only when u Cisco PIX Firmware 5.2(1) or later.

### Management

Websense is managed via a Java application that runs on any Windows NT, Windows or Solaris machine on the network behind the Cisco PIX Firewall.

The Websense installation program is a single executable program run via the Windo Windows 2000 graphical user interface (GUI), or the Solaris or Red Hat Linux comma It installs Websense Enterprise v4.3, Cisco PIX Firewall Edition, which includes the W Manager. When installed, you can use Websense Manager to configure and manage program: register, define filtering policies, define database download periods, and defi logging requirements.

Websense Manager also ensures that the database has been downloaded during the period. The Download Database dialog box shows the day when the database was la downloaded. It also lets you manage logging and reporting via the Logging Tab and th license expiration date via the Download Tab.

### Scope of Scale

Websense Enterprise, Cisco PIX Firewall Edition can scale to 1000 HTTP requests p second, assuming proper configuration of the Cisco PIX Firewall.

### Continuous Protection

The redundancy of Websense is provided through the Cisco PIX Firewall itself. Users configure the firewall to allow Websense to fail open or fail closed. Fail open means th



Websense shuts down, all users will be able to access the Internet without filtering. If closed means that if Websense shuts down, all access to the Internet will be prohibited.

Websense automatically downloads an update to the Master Database by choosing a period during the time interval specified by the customer. If Websense is unable to connect to the Master Database site at that time, it retries every 10 minutes, up to a total of ten tries. If the specified timeframe, until it successfully downloads a new update to the database. If the download cannot be completed, Websense continues filtering with the last database that was successfully downloaded.

If the download is unsuccessful, the Date field in the Download Database dialog box (in Websense Manager) is not updated and the Last Download Result field reports the error. Administrators can be notified via e-mail if the download fails, by checking a box Email Tab of the Server Configuration dialog box in Websense Manager.

### Protection Testing

#### Testbed

The machines used in the testbed conformed to the following specifications:

- Intel Pentium III
- 256 MB of RAM
- 100 MB free disk space
- Windows NT 4.0 (server version) Service Pack 5

The machines were placed on an Ethernet network, they included a T1 line to the Internet and there was no other traffic to the Internet.

The functionality of the product was tested thoroughly. A load generator tool was used to generate HTTP requests based on an input data file of thousands of URLs. The tool reports a message indicating whether a site is blocked or not blocked. The number of threads (100, 250) and the time to wait to launch subsequent requests (0, 10, 20, 30 milliseconds) can be specified.

#### Protection testing environments:

- Ran HTTP requests in blocked category; all categories blocked; non-demo database; expected result is 100-percent blocked
- Ran HTTP requests in blocked category; all categories "not" blocked; non-demo database; expected result is 100-percent blocked.
- Ran HTTP requests in customer URL and sites blocked in customer URL; expected result is 100-percent blocked

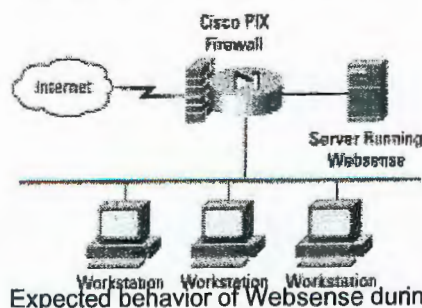
### Configurations

There are no configuration requirements for the user's workstation or for routers in a private network.

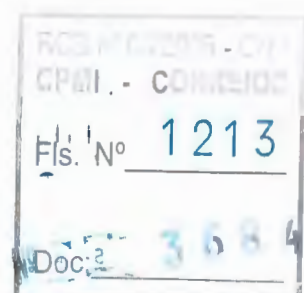
It is recommended that Websense Enterprise be put on its own interface for performance reasons (as reflected in Figure 2). Websense can share the demilitarized zone (DMZ) interface or the internal interface. Your performance impact depends on how much traffic you have on your internal and DMZ networks. With Websense on its own interface, there is no chance of the network adding latency.

Websense recommends that only administrators access the Websense machine.

**Figure 2**  
**Websense Running on a Dedicated Interface**



Expected behavior of Websense during testing:





Follow these steps to modify the *Global* policy.

**Step 1.** Open Websense Manager. If you have not already entered a valid registration and downloaded the Master Database, please do so. Refer to your *Setup Guide* for instructions.

**Step 2.** Right-click the icon of the appropriate Websense server (if you have added than one) and select Connect to Server. Enter the password established when you ad server.

**Step 3.** Open the *Policies* topic in the navigation pane and select Global. The Global is set to enforce the Default Settings category set from 08:00 to 17:00 (8:00 a.m. to 5: seven days a week. The Basic Filtering category set is in effect at all other times.

To change enforcement times or category sets enforced by the Global policy, click Edi to open the Edit Policy dialog box. After you make changes, click OK to exit the Edit P dialog box.

**Step 4.** Open the Category Set topic in the navigation pane and then select Default The Default Settings category set is configured to block some categories, permit other provide the option to defer viewing for other categories. Modify these settings to suit y needs. Websense enforces your settings when the Default Settings category set is ac

To edit the Default Settings category set, click Edit Category Set and then change the option for any category you want to modify. After you make changes, click OK to exit t Category dialog box.

**Step 5.** Configure Websense Server options by right-clicking the Websense Server i then selecting Configure Server. Open the tabs on the Server Configuration dialog bo configure the settings as appropriate.

**Step 6.** Click the Save All button to update the Websense Server with any changes make. When you click the Save All button, you must click Done after the save is finish exit the Saving Data dialog box.

### Installation

Typically, Websense Server (the filtering engine) and Websense Manager (the user in are installed together. However, you can also install them on separate machines. Bot components must be installed in order to filter Internet requests.

Additionally, you can install Websense Manager on multiple machines in the network t enable remote configuration of the Websense Server. You can install Websense Serv Websense Manager on different operating systems. For example, you can use the W Manager on a Windows machine to configure a Websense Server running on a Solari machine. Simply install each component on the appropriate machine according to the installation instructions for that operating system.

Detailed installation instructions for both Windows and Solaris are included in the *We Enterprise v4.3, Cisco PIX FireWall Edition Setup Guide*. Following is a summary of th installation instructions.

### Windows NT Installation

1. Run the wseXXX.exe setup program, where XXX is the version number. This i exacting ZIP file that extracts the README file, the setup guide, and the install pr into a temporary directory.

2. Run the installation program, Setup.exe.

3. Follow on-screen instructions provided by the InstallShield installation program installation creates a Websense Enterprise program group that contains:

- Websense program files
- Documentation in Adobe Acrobat format
- An online HELP system
- README text file

### Installing Websense on Solaris or Red Hat Linux

1. Log in to the installation machine as the *root* user.

2. Copy the wse###.tgz file (### is the version number) to the installation director



3. Enter the following command to unzip the file:

```
>>gunzip wse###.tgz<<
```

4. Expand the file into its components with the following command:

```
>>tar -xvf wse###.tar<<
```

This places the following files into the installation directory:

install.sh—The installation program

websense.tar—An archive file containing all the Websense components, including the Websense Administrator's Guide (wse.pdf) and the uninstall program (uninstall.sh)

license.txt—The Websense license agreement

5. Run the installation program:

```
./install.sh
```

6. Follow the on-screen instructions provided.

### Websense Configuration

Run Websense Manager, found in the Websense Enterprise program group (Window the start\_manager script found in the Manager subdirectory (Solaris). Enter the Websense license key to begin downloading the Websense Master Database.

1. Click Server in the Websense Manager menu; then select Configure to bring up Server Configuration dialog box.
2. Select the Download tab and enter the registration key. Your Internet connection contact the Websense Database server; the license is validated; expiration and limits are checked; and a database download is initiated.
3. Modify other configuration settings by opening the appropriate tab and changing settings.
4. Configure the Cisco PIX Firewall to send Internet requests to Websense. For i

**enable**

**configure terminal**

```
url-server host 10.1.1.1. timeout 5
```

The Websense server accesses and downloads the Master Database on each day specified by the customer via outbound HTTP access that is configured to be allowed by the Cisco Firewall.

### Configuring the Cisco PIX Firewall

Before Websense can filter Internet requests, the Cisco PIX Firewall must be configured to use Websense as a URL filter.

1. Access the Cisco PIX Firewall, either from a console or from a remote terminal, Telnet.
2. Enter your login password.
3. Put the Cisco PIX Firewall into enabled mode by entering **>>enable<<** and your password.
4. Place the Cisco PIX Firewall into configure mode by entering **>>configure terminal<<**
5. Tell the Cisco PIX Firewall that the Websense Server exists by entering: **url-server host <IP> [timeout <#>]**

```
>>url-server host <IP> [timeout <#>]<<
```

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where:

<IP> is the IP address of the Websense machine

<#> is an optional number of seconds

The Cisco PIX Firewall waits for a response from the URL server before timing out (the default is 5 seconds).

6. Tell the Cisco PIX Firewall how to filter URL requests by entering:

```
>>filter url http <local_ip> <netmask> <foreign_ip> <netmask><<
```

where:

<local\_ip> is the address of local/internal host/network, which is the source for connections to be filtered

<foreign\_ip> is the address of the foreign/external host/network, which is the destination for connections to be filtered

<netmask> is the netmask to apply

Typically, the last two entries should be zeroes to filter access to all Web sites through Websense. For example:

```
filter url http 10.5.0.0 255.255.0.0 0 0 filters the 10.5 network going to any destination
```

7. Save changes by entering >>write memory<<.

You can view the current URL server rules by entering >>show url-server<<. To review the filter rules, enter >>show filter<<. For help on individual commands, enter >>help followed by the command. For example, >>help filter<< shows the complete syntax for the filter command and explains each of the arguments.

**Note** If you need to discontinue filtering for any reason, enter each original filter command preceded by the word **no**. For example:

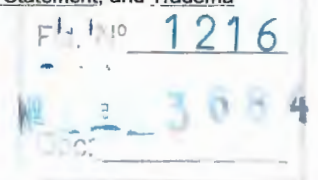
```
>>no filter url http 10.5.0.0 255.255.0.0 0 0<<
```

### Customer Expectations—Risks, Exposures, and Consequences

Designed for the Cisco PIX Firewall, Websense provides filtering, monitoring, and reporting capabilities. With its flexibility, Websense Enterprise saves organizations money and bandwidth and provides protection against legal liability.

Users who do not read the documentation or configure the product improperly may experience the following consequences:

- No Master Database download
- Database download during a busy period instead of a quiet period
- Cisco PIX Firewall not configured to use Websense as a URL filter
- Open, unfiltered access to the Internet because license limit is exceeded
- Not all URL requests logged and reported because of Cisco PIX Firewall caching





## Cisco PIX Firewall Version 6.2

The world-leading Cisco PIX® Firewall Series of purpose-built security appliances provides robust, enterprise-class security services, including stateful inspection firewalling, virtual private networking (VPN), intrusion protection, and much more—in cost-effective, easy-to-deploy solutions. Ranging from compact, plug-and-play desktop firewalls for small/home offices to carrier-class gigabit firewalls for the most demanding enterprise and service-provider environments, Cisco PIX Firewalls provide robust security, performance, and reliability for network environments of all sizes.

### Advanced Firewall Technologies Provide Enterprise-Class Network Security

Cisco PIX Firewalls deliver a broad range of advanced firewall services that protect enterprise networks from the threats lurking on the Internet and in today's network environments. The state-of-the-art Cisco Adaptive Security Algorithm (ASA) provides rich stateful inspection firewall services, tracking the state of all authorized network communications and preventing unauthorized network access. Cisco PIX Firewalls deliver an additional layer of security through intelligent, "application-aware" security services that examine packet streams at Layers 4 through 7, using inspection engines specialized for many of today's popular applications. Administrators can easily create custom security policies that will be enforced on network traffic traversing the firewall by leveraging more than 100 pre-defined applications, services, and protocols within Cisco PIX Firewalls, and the flexible access control capabilities that Cisco PIX Firewalls provide. Access to network resources can also be strongly authenticated via the Cisco PIX Firewall's seamless integration with enterprise databases, either directly using

TACACS+/RADIUS or indirectly via Cisco Secure Access Control Server (ACS). In addition to these services, Cisco PIX Firewalls provide extensive logging, URL filtering, content filtering, and more in concert with Cisco AVVID (Architecture for Voice, Video and Integrated Data) partner solutions.

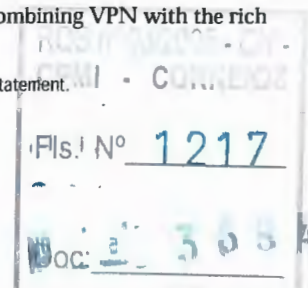
### Market-Leading Voice-over-IP Security Services Protect Next-Generation Converged Networks

Cisco PIX Firewalls continue to provide market-leading protection for numerous voice-over-IP (VoIP) standards and other multimedia standards, including H.323, Session Initiation Protocol (SIP), Skinny, Real-Time Transport Protocol (RTP), Real-Time Streaming Protocol (RTSP), and Real-Time Transport Control Protocol (RTCP). This allows businesses to securely take advantage of the many benefits that converged data and voice networks provide, such as significant total cost of ownership (TCO) savings and the competitive advantages and improved productivity gained through the power of fully integrated voice, video, and data networks. By combining VPN with the rich

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stateful inspection firewall services that Cisco PIX Firewalls provide for these converged networking standards, businesses can easily extend voice and multimedia services to remote/satellite offices for additional bandwidth and cost savings.

#### **Site-to-Site VPNs Extend Networks Economically to Remote Sites and Business Partners**

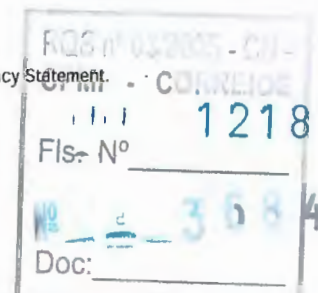
Using the standards-based site-to-site VPN capabilities within Cisco PIX Firewalls, businesses can securely extend their network across low-cost Internet connections to business partners and remote/satellite offices worldwide. Built upon the Internet Key Exchange (IKE) and IP Security (IPSec) VPN standards, Cisco PIX Firewalls encrypt data using 56-bit Data Encryption Standard (DES) or advanced 168-bit Triple DES (3DES) encryption, ensuring that malicious individuals cannot see sensitive business data as it safely travels across the Internet. Cisco PIX Firewalls can also participate in X.509-based Public Key Infrastructures (PKI) and provide easy, automated certificate enrollment by taking advantage of the Simplified Certificate Enrollment Protocol (SCEP)—another Internet standard Cisco helped to pioneer. Certain Cisco PIX Firewall models also provide integrated hardware VPN acceleration, providing up to 100 Mbps of 3DES throughput and support for up to 2000 IKE security associations.

#### **Easy VPN Enables Highly Scalable, Easy-to-Manage VPN Deployments**

The innovative Easy VPN capabilities found in Cisco PIX Firewalls and other Cisco solutions—such as Cisco IOS® Software-based routers and Cisco VPN 3000 Series Concentrators—deliver a uniquely scalable, cost-effective, and easy-to-manage remote-access VPN architecture. Built upon the foundation of dynamic policy distribution and effortless provisioning, Easy VPN eliminates the operational costs associated with maintaining remote-device configurations typically required by traditional VPN solutions. Easy VPN enables Cisco customers to enjoy the numerous benefits that VPNs provide—increased employee productivity by taking advantage of high-speed broadband connectivity, and significantly reduced operational costs by eliminating expenses associated with legacy dialup architectures—without the problems commonly found with other remote-access VPN solutions.

Cisco PIX Firewalls provide robust, remote-access VPN concentrator services that enable enterprises to securely extend their network to traveling employees, teleworkers, and remote offices for “anytime, anywhere access” to vital corporate network resources. Acting as an Easy VPN Server, Cisco PIX Firewalls support the wide range of Cisco software- and hardware-based Easy VPN Remote products. By dynamically pushing VPN security policies to Easy VPN-enabled users as they connect, Cisco PIX Firewalls ensure that the latest VPN security policy is consistently enforced for all remote-access users.

Certain models of Cisco PIX Firewalls can also act as “hardware VPN clients” using the new Easy VPN Remote features in Cisco PIX Firewall OS, transparently providing secure access to a corporate network for all devices protected by a Cisco PIX Firewall in a remote network. This dramatically simplifies the initial deployment and ongoing management of VPNs deployed to remote offices and teleworker environments by eliminating the need to install and maintain VPN client software on the individual devices protected by a remote Cisco PIX Firewall. Advanced client-side resiliency features ensure maximum VPN uptime by providing automatic failover to backup Easy VPN Servers in the event of a network or service failure.





### **Integrated Intrusion Protection Guards from Popular Internet Threats**

The integrated intrusion-protection capabilities in Cisco PIX Firewalls protect today's networks from many popular forms of attacks, including Denial-of-Service (DoS) attacks and malformed packet attacks. Using a wealth of advanced intrusion-protection features, including DNSGuard, FloodGuard, FragGuard, MailGuard, and TCP intercept, in addition to looking for more than 55 different attack "signatures," Cisco PIX Firewalls keep a vigilant watch for attacks, can optionally block them, and can notify administrators about them in real time. Additionally, Cisco PIX Firewalls support virtual packet reassembly, searching for attacks that are hidden over a series of fragmented packets. Strong integration with Cisco Intrusion Detection Systems (IDS) sensors enables Cisco PIX Firewalls to automatically shun (block) network nodes identified as being hostile by Cisco IDS sensors.

### **Enterprise-Class Resiliency Provides Maximum Business Uptime**

Cisco PIX Firewalls provide award-winning stateful failover capabilities (on select models) that ensure resilient network protection for enterprise network environments. Employing a cost-effective, active-standby high-availability architecture, Cisco PIX Firewalls configured as a failover pair continuously synchronize connection state information and device configuration data between one another. Performing this synchronization over a high-speed LAN connection provides the added benefit of being able to geographically separate failover pair members, thus providing a further layer of protection. In the rare event of a system or network failure, network sessions are automatically transitioned between firewalls seamlessly, and with complete transparency to network users.

### **Robust Remote-Management Solutions Lower Total Cost of Ownership**

Cisco PIX Firewalls deliver a wealth of remote-management methods for configuration, monitoring, and troubleshooting. Management solutions range from an integrated, Web-based management application to highly scalable multi-firewall management tools to support for remote-monitoring protocols such as Simple Network Management Protocol (SNMP) and syslog. Cisco PIX Firewalls additionally provide up to 16 levels of customizable administrative roles, so that enterprises can grant administrators and operations personnel the appropriate level of permissions they need for each firewall they manage (for example, monitoring only, read-only access to the configuration, VPN configuration only, firewall configuration only, etc.). Cisco PIX Firewalls now also support Auto Update, a revolutionary secure remote-management capability that ensures firewall configurations and software images are kept up-to-date.

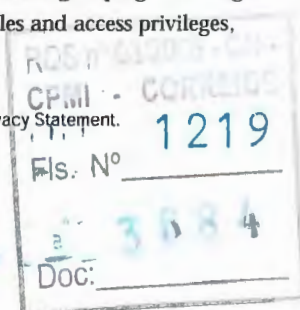
Cisco PIX Device Manager (PDM), integrated with Cisco PIX Firewalls, provides administrators an intuitive, Web-based management interface for remotely configuring and monitoring a single Cisco PIX Firewall, without requiring any software (other than a standard Web browser) to be installed on an administrator's computer. Administrators can also remotely configure, monitor, and troubleshoot Cisco PIX Firewalls using a command-line interface (CLI) through various methods, including Telnet and Secure Shell (SSH) Protocol, or out-of-band via a console port.

Administrators can easily manage a large number of remote Cisco PIX Firewalls using either the new combination of the CiscoWorks Management Center for Cisco PIX Firewalls and Auto Update Server, or Cisco Secure Policy Manager (CSPM)—all available within the Cisco VPN Security Management Solution (VMS) network management suite. The CiscoWorks Management Center for Cisco PIX Firewalls is a highly scalable, next-generation, three-tier management solution for Cisco PIX Firewalls that includes features such as hierarchical grouping of managed firewalls, "Smart Rules" configuration inheritance, customizable administrative roles and access privileges,

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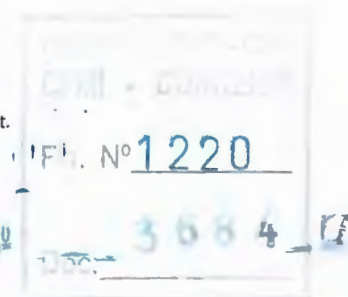
workflow-based enterprise change management, comprehensive support for Cisco PIX Firewall's new Auto Update capabilities, and support for dynamically addressed firewalls. Cisco Secure Policy Manager Release 3.0 is a policy-based centralized management solution for Cisco PIX Firewalls that includes a task-based interface, an interactive network topology map, policy wizards, and policy import capabilities. Additional integrated event management and inventory solutions are also available as part of the Cisco VMS network management suite.

### New Features Found in Cisco PIX Firewall Release 6.2

Cisco PIX Firewall Release 6.2 provides a wealth of new innovative features, which are detailed below:

**Table 1** New Features and Benefits

| New Features                                    | Benefits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Enterprise-Class Security</b>                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| LAN-based failover                              | <ul style="list-style-type: none"><li>• Extends failover functionality and enables geographic separation of Cisco PIX Firewalls in a failover pair by allowing failover information to be shared over a dedicated LAN connection (instead of a serial cable) between failover pairs</li></ul>                                                                                                                                                                                                                                                                                                                                                                                               |
| Bidirectional Network Address Translation (NAT) | <ul style="list-style-type: none"><li>• Enhances rich NAT functionality in Cisco PIX Firewalls to support environments with overlapping private address ranges</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Turbo access control lists (ACLs)               | <ul style="list-style-type: none"><li>• Provides significantly enhanced performance and deterministic search times for ACL processing; especially useful in environments where extensive ACLs are deployed</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| N2H2 URL filtering                              | <ul style="list-style-type: none"><li>• Integrates with N2H2 Sentian™ products—leading Internet filtering solutions—to provide robust employee Web access control and monitoring</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Enhanced small-packet performance               | <ul style="list-style-type: none"><li>• Delivers up to 48 percent more firewall performance for 64- to 512-byte packets than previous Cisco PIX Firewall OS releases, due to further optimization of small-packet processing</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Management</b>                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Auto Update                                     | <ul style="list-style-type: none"><li>• Provides highly scalable, secure remote management of PIX Firewalls with a unique push/pull management model</li><li>• Next-generation secure XML/HTTPS interface can be leveraged by Cisco and third-party management applications for remote firewall configuration management, inventory, software image management/deployment and monitoring</li><li>• Supports dynamically addressed firewalls in addition to firewalls with static IP addresses</li><li>• Integrates seamlessly with CiscoWorks Management Center for Cisco PIX Firewalls and Auto Update Server for robust, scalable remote management of up to 1000 PIX Firewalls</li></ul> |
| Object grouping                                 | <ul style="list-style-type: none"><li>• Enables administrators to group network objects (such as devices, networks, and services) into logical groups to greatly simplify access control rule definition and maintenance</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



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**Table 1** New Features and Benefits

| New Features                                          | Benefits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command-level authorization                           | <ul style="list-style-type: none"> <li>Enables businesses to create up to 16 customizable administrative roles and profiles for accessing Cisco PIX Firewalls (for example, monitoring only, read-only access to configuration, VPN administrator, firewall administrator, etc.)</li> <li>Uses either the internal Cisco PIX Firewall administrator database or outside sources via TACACS+, such as Cisco Secure ACS</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Dynamic ACLs via Cisco Secure ACS                     | <ul style="list-style-type: none"> <li>Supports dynamic downloading and enforcement of ACLs on a per-user basis, upon user authentication with the firewall</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Network Time Protocol (NTP) v3 client                 | <ul style="list-style-type: none"> <li>Provides convenient method for synchronizing the clock on Cisco PIX Firewalls with other devices on a network</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| CPU monitoring via SNMP v2                            | <ul style="list-style-type: none"> <li>Extends SNMP-based remote firewall health monitoring to include the ability to monitor CPU utilization</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Software and configuration updates via HTTP and HTTPS | <ul style="list-style-type: none"> <li>Adds support for downloading Cisco PIX Firewall OS and Cisco PIX Device Manager software, as well as configuration updates via HTTP or HTTPS</li> <li>Provides ability to deliver configuration and software updates over authenticated, encrypted network connection</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| HTTPS-based CLI access                                | <ul style="list-style-type: none"> <li>Delivers flexible, secure interface for interactive and easily scriptable access to Cisco PIX Firewall CLI via standard HTTPS requests</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Packet capture                                        | <ul style="list-style-type: none"> <li>Gives administrators new, powerful troubleshooting capabilities by providing robust packet-capturing facilities on each interface of the firewall</li> <li>Supports several methods of accessing captured packets, including via the console, secure Web access or a file exported to a Trivial File Transfer Protocol (TFTP) server</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Small Office/Home Office</b>                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Easy VPN Remote (hardware VPN client)                 | <ul style="list-style-type: none"> <li>Enables dramatically simplified VPN rollouts to small office, teleworker, and remote/branch-office environments, allowing Cisco PIX 501, 506, and 506E Firewalls to act as hardware VPN clients, and eliminating the provisioning complexities of traditional site-to-site VPN deployments</li> <li>Downloads VPN policy dynamically from an Easy VPN Server upon connection, ensuring the latest corporate security policies are enforced</li> <li>Provides robust client-side VPN resiliency with support for up to ten Easy VPN servers with automatic failover, in addition to Dead Peer Detection (DPD) support</li> <li>Enables the network behind a Cisco PIX Firewall to appear as a single user to the VPN headend when using Easy VPN Remote Client Mode</li> <li>Provides site-to-site VPN-like functionality without requiring any additional provisioning when using Easy VPN Remote Network Extension Mode</li> <li>Supports both split and non-split tunneling environments</li> <li>Provides intelligent, transparent Domain Name System (DNS) proxy capabilities for access to both corporate and public DNS servers</li> </ul> |
| PPP over Ethernet (PPPoE) support                     | <ul style="list-style-type: none"> <li>Ensures compatibility with networks that require PPPoE support, such as xDSL and cable modem broadband environments</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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**Table 1** New Features and Benefits

| New Features                            | Benefits                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Voice-over-IP (VoIP)/Multimedia</b>  |                                                                                                                                                                                                                                                                                                                          |
| Multicast support                       | <ul style="list-style-type: none"><li>• Supports wide range of multicast applications by introducing support for Internet Group Management Protocol (IGMP) v2 and stub multicast routing, including NAT and Port Address Translation (PAT) and the ability to build access control lists for multicast traffic</li></ul> |
| PAT for H.323 and SIP                   | <ul style="list-style-type: none"><li>• Extends market-leading VoIP support and enables SIP and H.323 to work in PAT environments, typically found in home offices and remote offices</li></ul>                                                                                                                          |
| DHCP server support for Cisco IP phones | <ul style="list-style-type: none"><li>• Simplifies remote Cisco IP Phone deployments by providing Cisco CallManager contact information via DHCP options 66 and 150 to Cisco IP phones for automated bootstrapping</li></ul>                                                                                             |
| Internet Locator Service (ILS) Fixup    | <ul style="list-style-type: none"><li>• Adds support for ILS, a popular directory service used by applications such as Microsoft NetMeeting, SiteServer and Active Directory, for registration and location of network entities/endpoints</li></ul>                                                                      |

### Technical Specifications

#### VPN Client Compatibility

Cisco PIX Firewalls support a wide variety of software- and hardware-based VPN clients, including:

|                                                             |                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Software IPSec VPN clients</b>                           | Cisco Secure VPN Client Release 1.1<br>Cisco VPN 3000 Concentrator Client, Release 2.5 and higher<br>Cisco VPN Client for Microsoft Windows, Release 3.0 and higher<br>Cisco VPN Client for Linux, Release 3.5 and higher<br>Cisco VPN Client for Solaris, Release 3.5 and higher<br>Cisco VPN Client for Mac OS X, Release 3.5 and higher |
| <b>Hardware IPSec VPN clients</b>                           | Cisco VPN 3002 Hardware Client, Release 3.0 and higher<br>Cisco IOS Software Easy VPN Remote, Release 12.2(8)YJ<br>Cisco PIX Firewall Easy VPN Remote, Release 6.2 and higher                                                                                                                                                              |
| <b>Layer 2 Tunneling Protocol (L2TP)/IPSec VPN clients</b>  | Microsoft Windows 2000                                                                                                                                                                                                                                                                                                                     |
| <b>Point-to-Point Tunneling Protocol (PPTP) VPN clients</b> | Microsoft Windows 95<br>Microsoft Windows 98<br>Microsoft Windows NT 4.0<br>Microsoft Windows 2000                                                                                                                                                                                                                                         |





### Easy VPN Server Compatibility

Cisco PIX Firewalls can now act as hardware-based VPN clients, taking advantage of the new Easy VPN Remote capabilities in Cisco PIX Firewall OS. The following Easy VPN Server platforms are supported for this deployment scenario:

|                              |                             |
|------------------------------|-----------------------------|
| Cisco IOS Routers            | Release 12.2(8)T and higher |
| Cisco PIX Firewalls          | Release 6.0(1) and higher   |
| Cisco VPN 3000 Concentrators | Release 3.1 and higher      |

### Cisco Site-to-Site VPN Compatibility

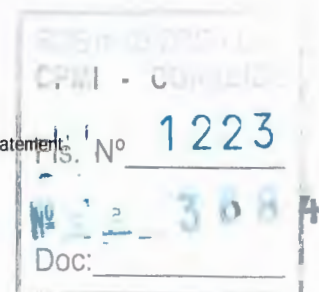
In addition to supporting interoperability with many third-party VPN products, Cisco PIX Firewalls interoperate with the following Cisco VPN products for site-to-site VPN connectivity:

|                              |                             |
|------------------------------|-----------------------------|
| Cisco IOS Routers            | Release 12.1(6)T and higher |
| Cisco PIX Firewalls          | Release 5.1(1) and higher   |
| Cisco VPN 3000 Concentrators | Release 2.5.2 and higher    |

### Cryptographic Standards Supported

Cisco PIX Firewalls support numerous cryptographic standards and related third-party products and services, including the following:

|                                                          |                                                                                                          |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Asymmetric (public key) encryption algorithms            | RSA (Rivest, Shamir, Adelman) public/private key pairs, 512 bits to 2048 bits                            |
| Symmetric encryption algorithms                          | DES: 56 bits<br>3DES: 168 bits<br>RC4: 40, 56, 64, and 128 bits                                          |
| Perfect Forward Secrecy (Diffie-Hellman key negotiation) | Group 1: 768-bits<br>Group 2: 1024-bits                                                                  |
| Hash algorithms                                          | MD5: 128-bits<br>SHA-1: 160-bits                                                                         |
| X.509 certificate authorities                            | Baltimore UniCERT<br>Entrust Authority<br>Microsoft Windows 2000 Certificate Services<br>VeriSign OnSite |
| X.509 certificate enrollment protocols                   | SCEP                                                                                                     |







|                                  |                                                                                                                                                                                                                |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Platforms supported</b>       | Cisco PIX 501 Firewall<br>Cisco PIX 506 Firewall<br>Cisco PIX 506E Firewall<br>Cisco PIX 515 Firewall<br>Cisco PIX 515E Firewall<br>Cisco PIX 520 Firewall<br>Cisco PIX 525 Firewall<br>Cisco PIX 535 Firewall |
| <b>RAM, minimum</b>              | 32 MB, except Cisco PIX 501 which requires 16 MB                                                                                                                                                               |
| <b>Flash memory, minimum</b>     | 16 MB, except Cisco PIX 501/506/506E which require 8 MB                                                                                                                                                        |
| <b>Expansion cards supported</b> | Single-port 10/100 Fast Ethernet card<br>Four-port 10/100 Fast Ethernet card<br>Single-port Gigabit Ethernet, multimode (SX) SC, card<br>VPN Acceleration Card (VAC)                                           |

|                        |                                                                                                |
|------------------------|------------------------------------------------------------------------------------------------|
| <b>PIX-SW-UPGRADE=</b> | Cisco PIX software one-time upgrade for customers without a current SMARTnet™ support contract |
|------------------------|------------------------------------------------------------------------------------------------|

Support services are available from Cisco partners as well as from Cisco. The Cisco SMARTnet service augments customer support resources. It provides 24x7x 365 access to technical resources (both online and via telephone), the ability to download updated system software, and hardware advance replacement.



### Additional Information

For more information, please visit the following links:

Cisco PIX Firewall:

<http://www.cisco.com/go/pix>

Cisco PIX Device Manager:

[http://www.cisco.com/warp/public/cc/pd/fw/sqfw500/prodlit/pixdm\\_ds.pdf](http://www.cisco.com/warp/public/cc/pd/fw/sqfw500/prodlit/pixdm_ds.pdf)

Cisco Secure ACS:

<http://www.cisco.com/go/acs>

Cisco Secure Policy Manager:

<http://www.cisco.com/go/policymanager>

Cisco VPN Security Management Solution (VMS), CiscoWorks Management Center for Cisco PIX Firewalls and Auto Update Server:

<http://www.cisco.com/go/vms>

Cisco SAFE Blueprint:

<http://www.cisco.com/go/safe>

To download the latest Cisco PIX Firewall OS and Cisco PIX Device Manager software (with a valid Cisco.com login), visit:

<http://www.cisco.com/cgi-bin/tablebuild.pl/pix>

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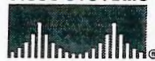
Page 9 of 10

|            |      |
|------------|------|
| FILE NO    | 1225 |
| CPM - CONF |      |
| NO         | 3684 |
| Doc:       |      |





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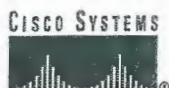
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# Cisco PIX<sup>®</sup> Device Manager



## Overview

Cisco PIX Device Manager (PDM) offers enterprise and service provider users the features they need to easily manage Cisco PIX Firewalls. It features an intuitive graphical user interface (GUI) to help you set up and configure your PIX Firewall. In addition, a wide range of informative, real-time, and historical reports provide critical insight into usage trends, performance baselines, and security events. Secure communication allows efficient management of local or remote Cisco PIX Firewalls. In short, PDM simplifies Internet security, making it a cost-effective tool that enhances productivity and network security saving both time and money.

## Intuitive User Interface

Many security vulnerabilities are caused by poor configuration. Consequently, implementing security policy must be as straightforward as possible. PDM includes wizards, point-and-click configuration, and online help to simplify administration. Security professionals can focus on enforcing security and defining policy, rather than on mastering the tools required to get the job done.

## Wizard

PIX Device Manager offers a helpful wizard for setting up a new PIX deployment. With just a few steps, the PDM Setup Wizard enables you to efficiently create a basic configuration that allows packets to flow through the PIX Firewall from the inside network to the outside network securely.

You can also perform optional tasks such as configuring rules to allow outside access to your Web or mail server. After you complete initial setup, intuitive pull-down menus and icons enable you to easily add and delete services and rules, as well as access other feature settings.

## Graphical User Interface

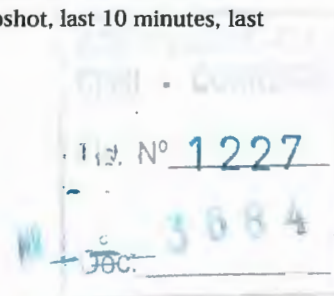
Using Cisco PIX Device Manager, you can easily configure, manage, and monitor security policies across your network. PDM's Graphical User Interface (GUI) provides a familiar tabbed layout with one-click access to common tasks. The point-and-click design is simple for even novice users, reducing ramp-up time. The result is cost savings through significant reductions in management time and maximum efficiency in network security management.

## Monitoring and Reporting

PDM offers robust reporting and monitoring tools that provide you with real-time and historical insights. At a glance, administrators can view graphical reports summarizing network activity, resource utilization, and event logs, allowing performance and trend analysis. PDM's logging and notification features allow security staff to detect and interrupt suspicious activity.

## Graphing Tools

Cisco PDM monitoring tools create graphical summary reports showing real-time usage, security events, and network activity. Data from each graph can be displayed in increments you select (10 second snapshot, last 10 minutes, last







60 minutes, last 12 hours, last 5 days) and refreshed at user-defined intervals. The ability to view multiple graphs simultaneously allows you to do side-by-side analysis.

*System graphs:* Provide detailed status information on the PIX Firewall, including blocks used and free, current memory utilization, and CPU utilization.

*Connection graphs:* Track real-time session and performance monitoring data for connections, address translations, authentication, authorization, and accounting (AAA) transactions, URL filtering requests, and more on a per-second basis. Stay fully informed of your network connections and activities, without being overwhelmed.

*Intrusion Detection System (IDS):* 16 different graphs are available to display potentially malicious activity. IDS-based signature information displays activity such as IP attacks, Internet Control Message Protocol (ICMP) requests, and Portmap requests.

*Interface graphs:* Provide real-time monitoring of your bandwidth usage for each interface. Bandwidth usage is displayed for incoming and outgoing communications. You can view packet rates, counts, and errors, as well as bit, byte, and collision counts, and more.

#### **Syslog Viewer**

Cisco PDM's integrated syslog viewer allows you to view specific syslog message types by selecting the desired logging level.

#### **Embedded Architecture**

The embedded design of PDM allows customers to manage their Cisco PIX firewalls from almost any computer, regardless of their operating system, - which is a critical requirement for many of today's e-businesses. Similarly, PDM provides a consistent experience by working with most of today's popular browsers, including Microsoft Internet Explorer and Netscape Navigator. With PDM, there is no application to install and no plug-in required. An authorized network administrator can securely manage and monitor their PIX firewalls from a Web browser.

#### **Secure Communication**

Cisco PDM supports the Secure Socket Layer (SSL) protocol to provide high-grade encryption from the PIX Firewall to a browser. Your PIX Firewall, combined with 56-bit Data Encryption Standard (DES) or the more secure 168-bit Triple DES (3DES), ensures that communication with remote PIX Firewalls is secure.

Similar to Telnet usage, PDM enables you to protect access with a valid username and password. This can either be on the PIX Firewall or through an authentication server.

#### **Licensing**

Cisco PIX Device Manager is included as part of Cisco PIX operating systems version 6.0 and higher. A separate license for PDM is not required. A DES or 3DES license is required, as PDM only supports encrypted communication. If your PIX is not currently encryption enabled you can request a free DES activation key by completing the following form:

<http://www.cisco.com/cgi-bin/Software/FormManager/formgenerator.pl?pid=221&fid=324>

3DES keys are available as part of a feature license upgrade.

#### **Technical Specifications**

##### **PIX Firewall System Requirements**

###### **Hardware**

*Platform:* Cisco PIX Firewall 506, 515, 520, 525, or 535

*Random Access Memory:* 32 MB

*Flash Memory:* 16 MB (PIX Firewall 506 requires 8 MB)

###### **Software**

*PIX Firewall operating system:* Version 6.0 or higher

*Encryption:* DES or 3DES-enabled

##### **User System Requirements**

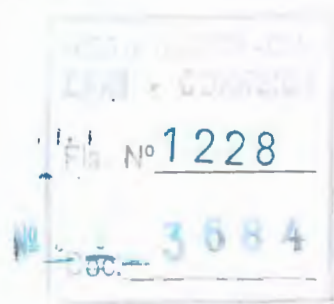
###### **Hardware**

*Processor:* 300 MHz, 500 MHz recommended

*Random Access Memory:* 128 MB, 192 MB recommended

*Display Resolution:* 800 x 600 pixels, 1024 x 768 pixels recommended

*Display Colors:* 256, 256 color recommended





## Software

| Operating Systems                                                                                         | Browsers                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Windows 2000 (Service Pack 1)<br>Windows NT 4.0 (Service Pack 6a)<br>Windows 98 (original or 2nd edition) | MS Internet Explorer 5.01 (Service Pack1) or higher (5.5 recommended)<br>Netscape Communicator 4.51 or higher (4.76 recommended) |
| Windows NT 4.0 (Service Pack 6a)                                                                          | Windows 98 (original or 2nd edition)                                                                                             |
| Sun Solaris 2.6 or 2.8 running CDE or Open Windows window manager                                         | Redhat Linux 6.2 or 7.0 running GNOME or KDE 2.0 desktop environment                                                             |
| Redhat Linux 6.2 or 7.0 running GNOME or KDE 2.0 desktop environment                                      | Netscape Communicator 4.76                                                                                                       |

## Network Connection

Connection speed: 56 Kbps, 128 Kbps recommended

## Additional Information

For more information about Cisco PIX Firewall, go to <http://www.cisco.com/go/pix>



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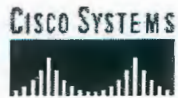
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## PRODUCTS &amp; SERVICES

CISCO NETWORK  
MANAGEMENT CISCOWORKSCiscoWorks VPN/Security  
Management Solution

Versions and Options

Product Literature

Technical Documentation

Alerts and Troubleshooting

Software Center

Relevant Services

CISCOWORKS VPN/SECURITY MANAGEMENT  
SOLUTION

## Introduction

CiscoWorks VPN/Security Management Solution (VMS) is an integral part of the Cisco SAFE Blueprint for Enterprise network security and protects the productivity of organizations by combining web-based tools for configuring, monitoring, and trouble-shooting VPNs, firewalls, and network- and host-based intrusion detection systems (IDSs). CiscoWorks VMS also delivers network device inventory, change audit and software distribution features.

CiscoWorks VMS is organized into several functional areas:

- Firewall Management
- IDS Management, network and host-based
- VPN Router Management
- Security Monitoring
- VPN Monitoring
- Operational Management

To configure and manage PIX for smaller environments, on a device-by-device basis, refer to [Cisco PIX Device Manager](#)

Applications included in CiscoWorks VMS 2.2:

[CiscoWorks Management Center for Firewalls](#)

[CiscoWorks Auto Update Server Software](#)

[CiscoWorks Management Center for IDS Host Sensors](#)

[CiscoWorks Management Center for Cisco Security Agents](#)

[CiscoWorks Management Center for VPN Routers](#)

[CiscoWorks Monitoring for Security](#)

[CiscoWorks VPN Monitor](#)

[CiscoWorks Resource Manager Essentials](#)

[CiscoWorks Common Services Software](#)

## Versions and Options (3)

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[CiscoWorks VPN/Security Management Solution 2.1](#)

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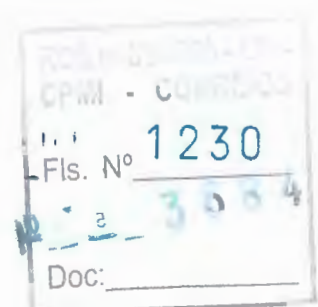
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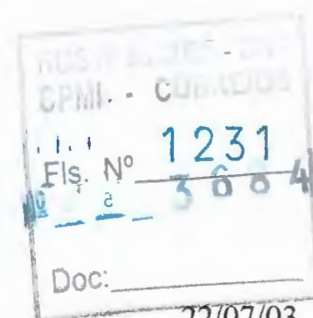
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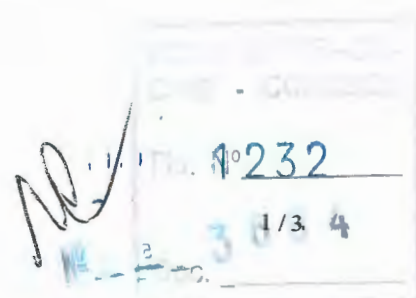


## ANEXO SERVIDOR RISC TIPO 01



# HARDWARE HP 9000 SUPERDOME

## DOCUMENTAÇÃO TÉCNICA





## SUMÁRIO

- **SPECjbb2000**
- **HP SUPERDOME SERVIDORES UNIX**
- **SUPERDOME SITE PREPARATION GUIDE**
- **HP-UX ADVANCES THE STATE OF THE ART IN ENTERPRISE UNIX**
- **HP JFS 3.3 AND HP ONLINEJFS 3.3 VERITAS FILE SYSTEM 3.3 SYSTEM ADMINISTRATOR GUIDE**
- **A4902A- HP RACK SYSTEM/E, 41U**
- **HP-UX 11i OPERATING ENVIRONMENTS ENTERPRISE RELEASE**
- **SINGLE-SYSTEM HIGH AVAILABILITY AT THE FOREFRONT IN HEWLETT-PACKARD'S SERVER LINE**
- **HP STORAGEWORKS DISK SYSTEM 2100**
- **HP SERVER CONECTIVITY ULTRA 160 SCSI ADAPTER**
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- **HP-UX VIRTUAL PARTITIONS**
- **HP-UX ADMINISTRATION GUIDE**
- **HP SYSTEM PARTITIONS GUIDE**
- **HP RACK-OPTIMIZED RP5430 AND RP5470 SERVERS ENTRY-LEVEL UNIX SERVERS**
- **USER GUIDE RP5400 FAMILY OF SERVERS**
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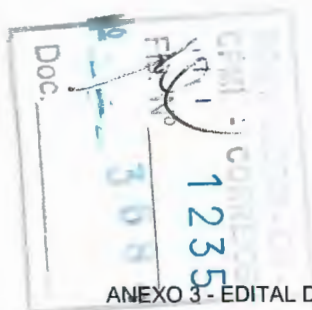
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## COMPROVAÇÃO DAS ESPECIFICAÇÕES EXIGIDAS NO EDITAL

### 2.1. ASPECTOS GERAIS

| REQUISITO | ATRIBUTOS OFERTADOS | ATRIBUTOS OFERTADOS ADICIONALMENTE | CONFIRMA ATENDIMENTO (SIM / NÃO) | PÁGINA DA DOCUMENTAÇÃO TÉCNICA |
|-----------|---------------------|------------------------------------|----------------------------------|--------------------------------|
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**CORREIOS**

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|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------|----------------------------------------------|
| <p>2.1 – Comprovação de Performance para os Equipamentos da plataforma RISC</p> | <p>Os equipamentos RISC para os quais foram solicitados valores de performance baseado em SPECjbb2000 (Servidores RISC Tipo 1), apresentam a comprovação por documentação adequada do valor de SPECjbb2000 auditado pelo Standard Performance Evaluation Corporation – SPEC (<a href="http://www.spec.org">www.spec.org</a>) para o equipamento cotado. O equipamento cotado não foi auditado com o número de processadores proposto, para isso estamos informando o cálculo estimado. O valor utilizado para estimativa de SPECjbb2000 foi obtido em equipamento auditado, com o mesmo tipo/série e tipo de CPU (modelo, clock e cache), do equipamento cotado O servidor cotado é o “Hewlett-Packard HP Superdome Server” com processadores PA-RISC 8700+, de 875 MHz, 2,25 MB de memória cache L1 e com o sistema operacional HP-UX 11i. Assim:</p> <p>SPECjbb2000 estimado = SPECjbb2000 auditado * (nº de CPU ofertadas / nº CPU auditada), assim:</p> <p>SPECjbb2000 auditado = 346.862</p> <p>nº de CPU ofertadas = 24 CPUs</p> <p>nº CPU auditada = 32 CPUs</p> <p>Specjbb2000 estimado = 346.862 * (24/32)= 260.146,50</p> <p>A estimativa de SPECjbb2000 foi feita utilizando modelo de equipamentos com benchmark superior ao valor máximo especificado.</p> | <p>Capacidade de expansão de 346.862 SPECjbb2000 auditado.</p> | <p>SIM</p> | <p>PÁG. 1 DO ANEXO SERVIDOR RISC TIPO-01</p> |
|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------|----------------------------------------------|



**CORREIOS**

ADMINISTRAÇÃO CENTRAL

**2.3 – Requisitos Gerais**

Os equipamentos “Servidores RISC Tipo 01” ofertados são novos de fábrica e entregues acondicionados adequadamente em caixas fechadas, de forma a permitir completa segurança durante o transporte;

Estão sendo entregues com os equipamentos “Servidores RISC Tipo 01” os cabos, acessórios, manuais e documentações completas, que são necessários ao pleno funcionamento dos equipamentos, softwares e periféricos;

Não estão sendo consideradas para efeitos de somatório das quantidades mínimas exigidas, controladoras Fibre Channel e de Rede integradas na placa de sistema, nos “Servidores RISC Tipo 01”

Está sendo considerado para efeito de somatório, placa de rede Ethernet com até 2 (duas) interfaces por placa, na montagem da configuração dos “Servidores RISC Tipo 1”.

Estamos ofertando o remanejamento de módulos de switch, interfaces de rede ou fibre channel entre os servidores fornecidos, a qualquer momento da vigência do Contrato, sem ônus adicionais.

SIM

Vide seção 13 , pág 22 da Proposta Técnica .

SIM

Vide seção 13 , pág 22 da Proposta Técnica .

SIM

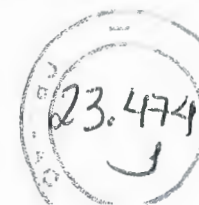
Vide seção 13 , pág 22 da Proposta Técnica .

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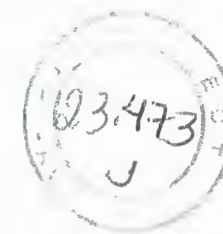
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Vide seção 13 , pág 22 da Proposta Técnica .





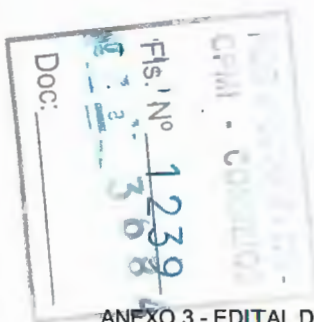
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|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|-------------------------------------------------|
| 2.4 – Garantia             | 48 (quarenta e oito) meses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  | SIM | Vide seção 13 , pág 22 da Proposta Técnica .    |
| 2.5 – Alimentação Elétrica | <p>Todos os “Servidores RISC Tipo 01” destinados ao CCD de Brasília operarão em 220VAC (duzentos e vinte Volts) através da utilização de PDCA (Power Distribution Controller Assembly A5800A option 007) a 5 (cinco) fios, sendo 3 (três) para as fases de 220 VAC, 1 (um) para neutro e 1 (um) para o condutor de proteção (fio terra).</p> <p>OBS.: A tensão de linha de 220 VAC para o CCD de Brasília é obtida entre fase e neutro, caracterizando um circuito de entrada AC do tipo Star (estrela).</p> |  | SIM | PÁGS. 19,20 E 22 DO ANEXO SERVIDOR RISC TIPO-01 |
|                            | <p>Todos os “Servidores RISC Tipo 01” destinados ao CCD de São Paulo operarão em 110 (cento e dez Volts) através da utilização de PDCA (Power Distribution Controller Assembly A5800A option 006) apropriado, a 4 (quatro) fios, sendo 3 para as fases de 110/(127) VAC e 1 (um) para o condutor de proteção (fio terra).</p> <p>OBS.: A tensão de linha de 220 VAC para o CCD de São Paulo é obtida entre fases, caracterizando um circuito de entrada AC do tipo Delta (triângulo).</p>                    |  | SIM | PÁGS. 19,20 E 22 DO ANEXO SERVIDOR RISC TIPO-01 |



**CORREIOS**

ADMINISTRAÇÃO CENTRAL

|                           |                                                                                                                                                                                                                                                                                                                                                                                  |  |     |                                              |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------------------------------------------|
| 2.6 – Assistência técnica | A <b>CONTRATADA</b> prestará os serviços assistência técnica nos locais de instalação dos equipamentos, nas cidades de Brasília/DF e São Paulo/SP;<br>Os serviços prestados irão englobar a substituição de peças e componentes defeituosos dos equipamentos, bem como a depuração e resolução de problemas relacionados ao <b>AMBIENTE OPERACIONAL</b> fornecido pelo Correios. |  | SIM | Vide seção 13 , pág 23 da Proposta Técnica . |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------------------------------------------|





**CORREIOS**

ADMINISTRAÇÃO CENTRAL

### 2.7 – Recursos Mínimos de Particionamento para os Servidores RISC

Os equipamentos RISC Tipo 01 serão fornecidos com 8 (oito) partições lógicas (vPar) e sendo expansível a, no mínimo, 16 (dezesesseis) partições lógicas (vPar).

O número especificado de partições é alcançado com a simples configuração de software fornecido para este fim, sem a necessidade de adição de nenhum hardware ou software adicionais. Estão sendo entregues 2 (duas) consoles rp2470 em Brasília e 2 (duas) consoles rp2470 em São Paulo para gerenciamento de todos os equipamentos em cada localidade e criação/gerenciamento das partições.

As partições funcionarão de modo que cada uma execute sua própria imagem de sistema operacional e que a falha do sistema operacional de uma partição não interfierirá, em hipótese alguma, no funcionamento das demais partições.

Os equipamentos "RISC Tipo 01" permitirão o remanejamento de recursos de CPU, Memória e I/O entre as partições;

Os equipamentos "RISC Tipo 01" serão fornecidos com todos os recursos de hardware e software necessários à criação do número mínimo de partições especificadas para cada equipamento.

A Cobra Tecnologia fornecerá 4 notebooks para o CCD de Brasília e 1 notebook para o CCD de São Paulo do modelo EVO N1020v com as seguintes configuração:

Processador Pentium IV 2.4GHz

256MB de memória RAM do tipo DDR (PC2100)

Disco rígido de 30GB

DVD-ROM

Unidade de disquete 1.44MB

Interface de Fax-Modem

Interface de rede 10/100

Tela de 15"

SIM

Vide seção 11.4 , pág 18 da Proposta Técnica E PÁG. 16 DO ANEXO SERVIDOR RISC TIPO-01

SIM

Vide seção 11.4 , pág 18 da Proposta Técnica

SIM

PÁG 104 DO ANEXO SERVIDOR RISC TIPO-01

SIM

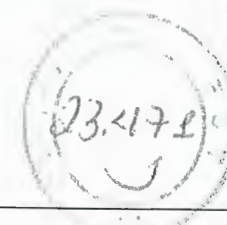
PÁGS. 104 E 110 ANEXO SERVIDOR RISC TIPO-01

SIM

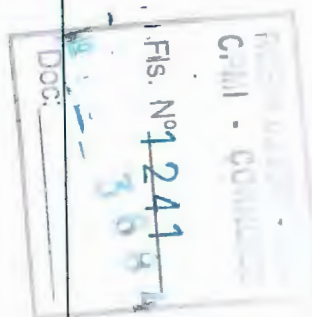
Vide seção 11.4 , pág 18 da Proposta Técnica

SIM

Vide seção 13 , pág 23 da Proposta Técnica .



**2.10 – Recursos  
Mínimos de hardware  
e software para os  
servidores RISC  
adicionais**



Todos os servidores RISC fornecidos adicionalmente serão montados em RACKS de 19" do fabricante, conforme o subitem 7, a serem fornecidos pela Cobra Tecnologia.

A Cobra Tecnologia fornecerá, instalará e configurará, para todos os servidores RISC cotados adicionalmente os seguintes softwares:

Sistema operacional HP HP-UX 64 bits, instalado e configurado para Rede dos Correios, com número ilimitado de usuários simultâneos;

Sistema de Arquivos JFS (Journaled File System);

Ferramenta que permita o backup e restore do sistema operacional (IMAGE BACKUP) pela rede TCP/IP

1 (uma) licença do agente 'Concord SystemEdge', devidamente instalado e configurado conforme orientação da equipe técnica dos Correios;

Está sendo ofertado licenças de software agente de backup (HP Openview Data Protector) compatível com o gerenciador de fitoteca especificado no subitem 5.13, devidamente instalado e configurado conforme orientação da equipe técnica dos Correios.

A Cobra Tecnologia fornecerá e instalará, para todos os servidores RISC cotados adicionalmente, os seguintes componentes de hardware:

Fontes instaladas na configuração máxima do equipamento, com recurso de troca sem interrupção (HOT-SWAPPABLE/HOT-PLUGGABLE) e alimentação elétrica de acordo com a localidade onde serão instalados os equipamentos, conforme subitem 2.5, frequência de 60 Hertz;

SIM

PÁG. 33 DO ANEXO SERVIDORES RISC TIPO-01

SIM

PÁGS. 28 E 41 DO ANEXO SERVIDORES RISC TIPO-01

SIM

PÁG. 32 DO ANEXO SERVIDORES RISC TIPO-01

SIM

PÁGS. 107 E 108 DO ANEXO SERVIDORES RISC TIPO-01

SIM

Vide seção 13 págs. 22, 23, 24 e 25 da Proposta Técnica .

SIM

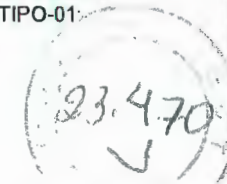
Vide seção 13 págs. 22, 23, 24 e 25 da Proposta Técnica .

SIM

Vide seção 11.4 , pág 18 da Proposta Técnica

SIM

PÁGS .116 E 117 DO ANEXO SERVIDOR RISC TIPO-01





**2.10 – Recursos**  
Mínimos de hardware  
e software para os  
servidores RISC  
adicionais  
(continuação)

As fontes de alimentação dos servidores RISC adicionais são redundantes por fontes internas independentes, com alimentação redundante, de tal forma que, em caso de falha de uma das fontes por defeito ou por falta de alimentação elétrica em um dos 2 (dois) circuitos, o equipamento continua a funcionar sem prejuízo das aplicações.

As interfaces de rede padrão Ethernet PCI 10/100/1000 Base-T ofertadas estão em conformidade com os padrões IEEE 802.3ab e 802.3u, com possibilidade de gerenciamento SNMP. As interfaces de rede conectarão os servidores a Rede do CCD utilizando cabeamento UTP CAT-6 e conectores RJ-45.

Os servidores RISC adicionais estarão sendo fornecidos com 1 (uma) unidade interna de fita DDS 3. No fornecimento está previsto a entrega de 10 (dez) fitas DDS 3 novas e 2 (duas) fitas para limpeza para cada servidor RISC fornecido adicionalmente.

SIM

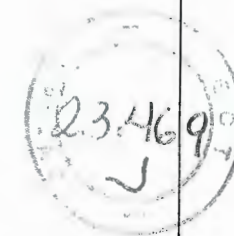
PÁGS. 113, 116 E 117 DO  
ANEXO SERVIDOR RISC TIPO-01

SIM

PÁGS. 96 E 97 DO ANEXO  
SERVIDOR RISC TIPO-01

SIM

Vide seção 13 , pág 23 da  
Proposta Técnica .



Doc: \_\_\_\_\_

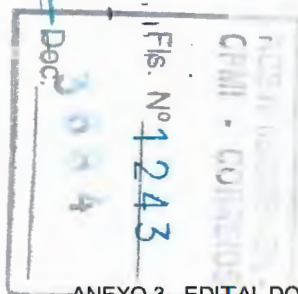
Fila, Nº \_\_\_\_\_

CPM - CPM - CPM

3 6 8 4

1 2 4 2

|                                                   |                                                                                                                                                                                                                                                                                |  |            |                                                                 |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------|-----------------------------------------------------------------|
| <b>2.11 – Comprovação dos Requisitos Técnicos</b> | <p>Documentação fornecida na língua inglesa, com identificação do fabricante, marca e modelo do produto</p> <p>Documentos extraídos dos originais em PDF ou HTML do fabricante, disponíveis na Internet.</p>                                                                   |  | <b>SIM</b> | <b>CONFORME ANEXOS DOS EQUIPAMENTOS E PRODUTOS APRESENTADOS</b> |
| <b>2.12 – Organização da Documentação Técnica</b> | <p>Toda a documentação será fornecida e catalogada conforme o exigido.</p>                                                                                                                                                                                                     |  |            | Vide seção 13 , pág 23 da Proposta Técnica .                    |
| <b>2.13 – Suporte Remoto</b>                      | <p>A Cobra Tecnologia disponibilizará todos os PRODUTOS necessários à implementação de uma estrutura de acesso remoto que permita a Cobra Tecnologia acesso a rede corporativa do Correios, utilizando o Switch Tipo 5 a ser fornecido de acordo com o subitem 3.5.;</p>       |  | <b>SIM</b> | Vide seção 13 , pág 23 da Proposta Técnica .                    |
|                                                   | <p>Esta estrutura de acesso remoto será utilizada para que a Cobra Tecnologia possa prestar serviço de suporte remoto nas situações em que o Correios julgue necessária. A estrutura de acesso remoto seguirá estritamente as Normas de Segurança definidas pelo Correios.</p> |  | <b>SIM</b> | Vide seção 13 , pág 23 da Proposta Técnica .                    |





**2.14 – Configuração  
das Ferramentas de  
Gerenciamento**

Durante o Treinamento de Gerenciamento, descrito no Subitem 1.9.2.3. do ANEXO 1-A, a Cobra Tecnologia instalará e configurará os novos agentes 'Concord SystemEdge', integrando conforme os padrões da plataforma de Gerência já existente do Correios;

A Cobra Tecnologia configurará os agentes 'Concord SystemEdge' para, entre outras coisas, medir o tempo de resposta dos serviços de infra-estrutura, não se limitando a: DNS, HTTP, HTTPS, SMTP, POP3, FTP e TCP;

A Cobra Tecnologia configurará os agentes 'Concord SystemEdge' para que monitore o desempenho e falhas das aplicações Exchange, Oracle, MS SQL, APACHE e IIS;

A CONTRATADA habilitará o agente SNMP dos Roteadores, Switches e servidores fornecidos, conforme os padrões do Correios;

A Cobra Tecnologia configurará as ferramentas de gerenciamento existentes no Correios, não se limitando a: Integração de eventos no HP OpenView Operations;

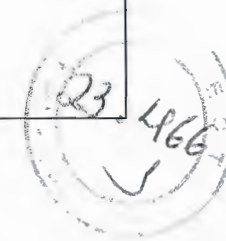
Criação e integração de regras inteligentes do Concord Live Health para envio de eventos ao HP OpenView Operations;

Criação e geração de relatórios do Concord eHealth.

**SIM****Vide seção 13 , págs. 22 e 23  
da Proposta Técnica .**

**4.2. SERVIDORES RISC****4.2.1 SERVIDORES RISC TIPO 1**

| ATRIBUTO                 | ATRIBUTOS OFERTADOS                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ATRIBUTOS OFERTADOS<br>ADICIONALMENTE | CONFIRMA ATENDIMENTO<br>(SIM / NÃO) | PÁGINA DA<br>DOCUMENTAÇÃO TÉCNICA                                                                       |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------|
| 1 – CPU e<br>Performance | <p>Os servidores “RISC Tipo 01” ofertados são compostos, cada um, por 24 processadores RISC de 64 bits PA8700+, com cache L1 de 2,25 MB e, apresentam performance estimada de 260.146,50 SPECjbb2000, conforme especificado neste documento, no subitem 2.1, com possibilidade de expansão para 346.862 SPECjbb2000 auditada, cada um, com a simples adição de placas , CPUs e memória.</p> <p>Não está sendo utilizada a formação de CLUSTER para o atendimento à capacidade solicitada.</p> |                                       | <p>SIM</p> <p>SIM</p>               | <p>PÁGS. 1 E 3 DO ANEXO<br/>SERVIDOR RISC TIPO-01</p> <p>PÁG. 16 DO ANEXO<br/>SERVIDOR RISC TIPO-01</p> |





**CORREIOS**

ADMINISTRAÇÃO CENTRAL

|                           |                                                                                                                                                                                                                                  |  |     |                                                                                             |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|---------------------------------------------------------------------------------------------|
| 2 – Memória RAM           | O servidor “RISC Tipo 01” será fornecido com 64 Gbytes de memória RAM , instaladas, com possibilidade de expansão de no mínimo 128 Gbytes de memória RAM, e com disponibilidade de recursos para verificação e correção de erro. |  | SIM | Vide seção 11.4 , pág 18 da Proposta Técnica E PÁGS. 16 E 53 DO ANEXO SERVIDOR RISC TIPO-01 |
| 3 – Suporte à Arquitetura | O servidor “RISC Tipo 01” fornecido suporta arquitetura SMP – Symetric Multi Processing.                                                                                                                                         |  | SIM | PÁG. 17 DO ANEXO SERVIDOR RISC TIPO-01                                                      |

Doc: \_\_\_\_\_

Fls. Nº 1246



**CORREIOS**

ADMINISTRAÇÃO CENTRAL

**4 – Fonte de Alimentação**

O servidor "RISC Tipo 01" terá número de fontes instaladas suficiente para suportar a operação do equipamento na configuração máxima especificada.

As fontes ofertadas possuem recurso de troca sem interrupção (HOT-SWAPPABLE).

O servidor "RISC Tipo 01" irá possuir alimentação elétrica de acordo com a localidade onde serão instalados os equipamentos, conforme subitem 2.5., frequência de 60 (sessenta) Hertz. Todos os "Servidores RISC Tipo 01" destinados ao CCD de Brasília operarão em 220VAC (duzentos e vinte Volts) através da utilização de PDCA (Power Distribution Controller Assembly A5800A option 007) a 5 (cinco) fios, sendo 3 (três) para as fases de 220 VAC, 1 (um) para neutro e 1 (um) para o condutor de proteção (fio terra).

OBS.: A tensão de linha de 220 VAC para o CCD de Brasília é obtida entre fase e neutro, caracterizando um circuito de entrada AC do tipo Star (estrela).

Todos os "Servidores RISC Tipo 01" destinados ao CCD de São Paulo operarão em 110 (cento e dez Volts) através da utilização de PDCA (Power Distribution Controller Assembly A5800A option 006) apropriado, a 4 (quatro) fios, sendo 3 para as fases de 110/(127) VAC e 1 (um) para o condutor de proteção (fio terra).

OBS.: A tensão de linha de 220 VAC é obtida entre fases, caracterizando um circuito de entrada AC do tipo Delta

SIM

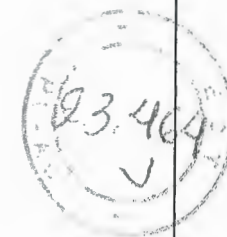
Vide seção 11.4 , pág 18 da Proposta Técnica

SIM

PÁG. 17 DO ANEXO SERVIDOR RISC TIPO-01

SIM

PÁGS. 19, 20 E 22 DO ANEXO SERVIDOR RISC TIPO-01

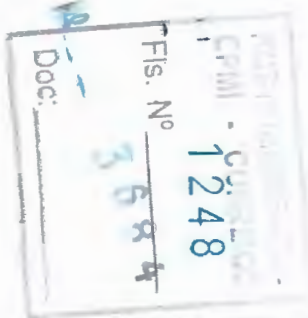




**CORREIOS**

ADMINISTRAÇÃO CENTRAL

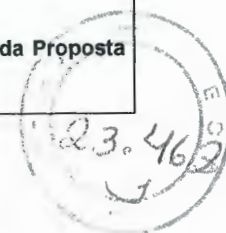
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |     |                                                                                      |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|--------------------------------------------------------------------------------------|
| 4 – Fonte de Alimentação (Continuação) | As fontes de alimentação serão redundantes por fontes internas independentes, com alimentação redundante, de tal forma que, em caso de falha de uma das fontes por defeito ou por falta de alimentação elétrica em um dos 2 (dois) circuitos, o equipamento continue a funcionar sem prejuízo das aplicações. Os servidores "RISC Tipo 01" estão sendo oferecidos com 2 (duas) PDCAs (Power Distribution Controller Assembly) que devem ser alimentadas por circuitos elétricos independentes. |  | SIM | PÁGS. 23, 24, 25 E 26 DO ANEXO SERVIDOR RISC TIPO-01                                 |
| 5 – Controladoras e Disco Rígido       | - Serão fornecidos com os servidores "RISC Tipo 01" 16 (dezesesseis) discos de 36GB, com funcionalidade de troca sem interrupção, com tempo médio de acesso de 5,2 ms com velocidade de rotação de 10.000 RPM.                                                                                                                                                                                                                                                                                 |  | SIM | Vide seção 11.4, pág 18 da Proposta Técnica E PÁG. 82 DO ANEXO SERVIDOR RISC TIPO-01 |
|                                        | - Serão fornecidos com os servidores "RISC Tipo 01" 8 (oito) controladoras de discos Ultra 2 SCSI ou superior, não incorporadas na placa de sistema.                                                                                                                                                                                                                                                                                                                                           |  | SIM | Vide seção 11.4, pág 18 da Proposta Técnica E PÁG. 88 DO ANEXO SERVIDOR RISC TIPO-01 |



**CORREIOS**

ADMINISTRAÇÃO CENTRAL

|                                    |                                                                                                                                                                                                                                                                                        |                                                              |     |                                                                                             |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------|
| 6 – Controladora de I/O            | Serão fornecidas com os servidores "RISC Tipo 01" 16 (dezesseis) controladoras FIBER CHANNEL, operando a 2Gb/s.                                                                                                                                                                        |                                                              | SIM | Vide seção 11.4 , pág 18 da Proposta Técnica E PÁG. 91 DO ANEXO SERVIDOR RISC TIPO-01       |
|                                    | Serão fornecidas com os servidores "RISC Tipo 01" 16 (dezesseis) interfaces de rede padrão Ethernet PCI 10/100/1000 Base-T em conformidade com os padrões IEEE 802.3ab e 802.3u, com possibilidade de gerenciamento SNMP                                                               |                                                              | SIM | Vide seção 11.4 , pág 18 da Proposta Técnica E PÁGS. 96 E 97 DO ANEXO SERVIDOR RISC TIPO-01 |
|                                    | Interfaces de rede que irão conectar os servidores a Rede do CCD utilizando cabeamento UTP CAT-6 e conectores RJ-45.                                                                                                                                                                   |                                                              |     |                                                                                             |
| 7 – Unidade de CD/DVD-ROM e Backup | Serão fornecidos com os servidores "RISC Tipo 01" 4 (quatro) unidades de DVD-ROM e 4 (quatro) unidades leitora/gravadora de fitas DDS-3 por equipamento, totalizando 1 (uma) unidade de DVD-ROM e 1 (uma) unidade leitora/gravadora de fitas para cada conjunto de 2 (duas) partições. |                                                              | SIM | Vide seção 11.4 , pág 18 da Proposta Técnica                                                |
|                                    | As unidades de DVD-ROM possuem velocidade de 40X CD-ROM ou 10X DVD-ROM.                                                                                                                                                                                                                | As unidades ofertadas têm desempenho superior ao solicitado. | SIM | PÁG. 99 DO ANEXO SERVIDOR RISC TIPO-01                                                      |
|                                    | As unidades leitora/gravadora de fitas atendem o padrão DDS-3 ou superior.                                                                                                                                                                                                             |                                                              | SIM | PÁG. 101 DO ANEXO SERVIDOR RISC TIPO-01                                                     |
|                                    | No fornecimento está previsto a entrega de 10 (dez) fitas novas, padrão DDS-3 e 2 (duas) fitas para limpeza para cada unidade leitora/gravadora de fitas.                                                                                                                              |                                                              | SIM | Vide seção 11.4 , pág 18 da Proposta Técnica                                                |

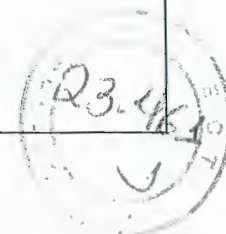




**CORREIOS**

ADMINISTRAÇÃO CENTRAL

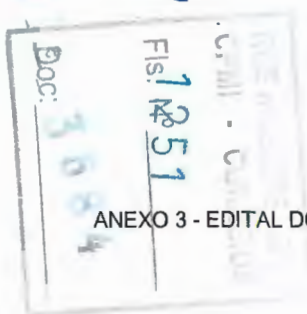
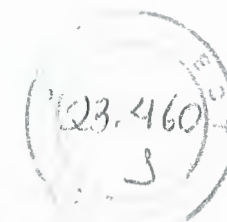
|                          |                                                                                                                                                                                                                                                                                                 |  |     |                                                                                             |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|---------------------------------------------------------------------------------------------|
| 8 – Ambiente Operacional | Os servidores "RISC Tipo 01" serão fornecidos com o ambiente operacional HP-UX 64 bits, instalado e configurado para Rede dos Correios, com número ilimitado de usuários simultâneos, licenciado para cada uma das 8 (oito) partições do equipamento, contendo:                                 |  | SIM | Vide seção 11.4 , pág 18 da Proposta Técnica E PÁGS. 28 E 41 DO ANEXO SERVIDOR RISC TIPO-01 |
|                          | Sistema de Arquivos JFS (Journaled File System);                                                                                                                                                                                                                                                |  | SIM | PÁG. 32 DO ANEXO SERVIDOR RISC TIPO-01                                                      |
|                          | Ferramenta que permita o backup e restore do sistema operacional (IMAGE BACKUP) pela rede TCP/IP                                                                                                                                                                                                |  | SIM | PÁGS. 107 E 108 DO ANEXO SERVIDOR RISC TIPO-01                                              |
|                          | 1 (uma) licença do agente 'Concord SystemEdge', devidamente instalado e configurado conforme orientação da equipe técnica dos Correios;                                                                                                                                                         |  | SIM | Vide seção 13 págs. 22, 23, 24 e 25 da Proposta Técnica .                                   |
|                          | 1 (uma) licença de software agente de backup compatível com o gerenciador de fitoteca especificado no subitem 5.13, devidamente instalado e configurado conforme orientação da equipe técnica dos Correios                                                                                      |  | SIM | Vide seção 13 págs. 22, 23, 24 e 25 da Proposta Técnica .                                   |
|                          | O Sistema Operacional (HP-UX) e o Hardware dos servidores "RISC Tipo 01" são produzidos pela HP.                                                                                                                                                                                                |  | SIM | PÁG. 145 DO ANEXO SERVIDOR RISC TIPO-01                                                     |
|                          | Serão fornecidas e instaladas as ferramentas, agentes e demais softwares que permitam a criação de ambientes clusterizados entre os equipamentos fornecidos. Para todos os servidores "RISC Tipo 01" foram incluídos os software MC/ServiceGuard extension for RAC, MirrorDisk UX e Online JFS. |  | SIM | Vide seção 13 págs. 22, 23, 24 e 25 da Proposta Técnica .                                   |



**CORREIOS**

ADMINISTRAÇÃO CENTRAL

|                          |                                                                                                                                                                                                                                                                                                                                                                   |  |     |                                                                                        |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------------------------------------------------------------------------------------|
| 8 – Ambiente Operacional | <p>Serão fornecidas licenças do compilador C para 6 (seis) servidores "RISC TIPO 01". A versão fornecida do compilador C está homologada para a versão do sistema operacional HP-UX 11i. As licenças estão dimensionadas considerando-se o número de processadores fornecidos em cada equipamento. O Compilador C fornecido é compatível com o padrão ANSI C.</p> |  | SIM | PÁG. 103 DO ANEXO SERVIDOR RISC TIPO-01 E Vide seção 11.4 , pág 18 da Proposta Técnica |
|                          | <p>O número de licenças está dimensionado de forma a ser possível a implementação de 20 (vinte) clusters com 2 (dois) nós cada, sendo: 14 (quatorze) clusters com 2 (dois) nós para o CCD de Brasília/DF; 6 (seis) clusters com 2 (dois) nós para o CCD de São Paulo/SP.</p>                                                                                      |  | SIM | Vide seção 11.4 , pág 18 da Proposta Técnica                                           |





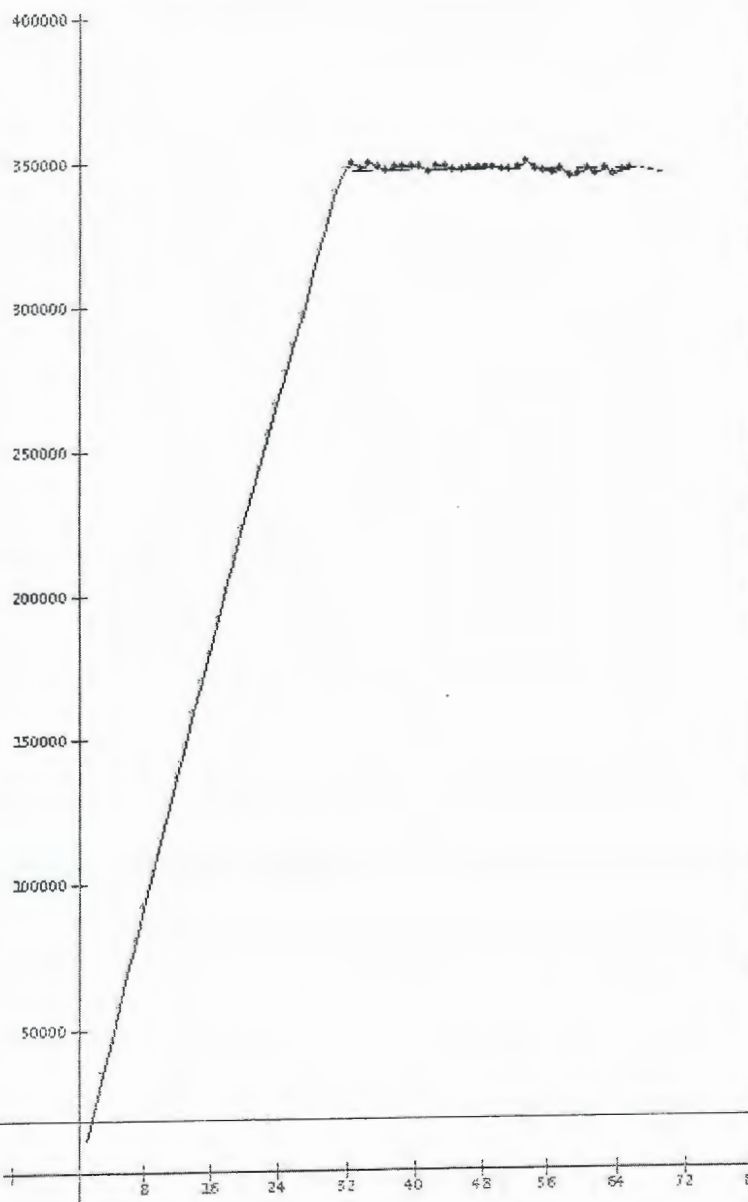
## SPECjbb2000

SPECjbb2000 = 346862 ops/s

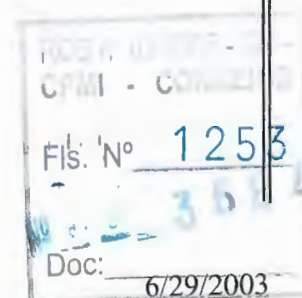
Hewlett-Packard HP Superdome Server

Hewlett-Packard Hotspot 1.4.1.02 64-bit VM on HP-UX 11i for PA-RISC 8700+

| Warehouses | Ops/s  | Incl. in metric |
|------------|--------|-----------------|
| 1          | 11373  |                 |
| 2          | 23410  |                 |
| 3          | 35111  |                 |
| 4          | 46510  |                 |
| 5          | 58126  |                 |
| 6          | 69583  |                 |
| 7          | 80849  |                 |
| 8          | 92122  |                 |
| 9          | 103517 |                 |
| 10         | 114673 |                 |
| 11         | 125960 |                 |
| 12         | 136898 |                 |
| 13         | 148008 |                 |
| 14         | 159330 |                 |
| 15         | 169946 |                 |
| 16         | 180066 |                 |
| 17         | 191437 |                 |
| 18         | 202294 |                 |
| 19         | 213113 |                 |
| 20         | 223679 |                 |
| 21         | 234384 |                 |
| 22         | 244313 |                 |
| 23         | 255572 |                 |
| 24         | 265863 |                 |
| 25         | 276975 |                 |
| 26         | 286413 |                 |
| 27         | 296516 |                 |
| 28         | 308404 |                 |
| 29         | 318573 |                 |
| 30         | 329198 |                 |
| 31         | 339563 |                 |
| 32         | 346954 |                 |



|    |        |   |
|----|--------|---|
| 33 | 349338 | * |
| 34 | 347126 | * |
| 35 | 348893 | * |
| 36 | 348069 | * |
| 37 | 346529 | * |
| 38 | 347827 | * |
| 39 | 348003 | * |
| 40 | 348043 | * |
| 41 | 347853 | * |
| 42 | 346035 | * |
| 43 | 347616 | * |
| 44 | 347922 | * |
| 45 | 346819 | * |
| 46 | 346469 | * |
| 47 | 347201 | * |
| 48 | 347219 | * |
| 49 | 347320 | * |
| 50 | 347209 | * |
| 51 | 346854 | * |
| 52 | 346850 | * |
| 53 | 346987 | * |
| 54 | 349036 | * |
| 55 | 346474 | * |
| 56 | 346251 | * |
| 57 | 345192 | * |
| 58 | 346883 | * |
| 59 | 344254 | * |
| 60 | 344663 | * |
| 61 | 346493 | * |
| 62 | 344528 | * |
| 63 | 346373 | * |
| 64 | 344509 | * |
| 65 | 346130 | * |
| 66 | 346354 | * |
| 67 | 346525 |   |
| 68 | 346134 |   |
| 69 | 345452 |   |
| 70 | 345704 |   |





|             |                       |                 |
|-------------|-----------------------|-----------------|
| SPECjbb2000 | (from<br>33 to<br>66) | 346862<br>ops/s |
|-------------|-----------------------|-----------------|

|                  |                            |                        |
|------------------|----------------------------|------------------------|
| SPEC license # 3 | Tested by: Hewlett-Packard | Test date: Feb 4, 2003 |
|------------------|----------------------------|------------------------|

| Hardware        |                                                   | Software                                  |                                                                                                                                                                                                                                                           |
|-----------------|---------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hardware Vendor | Hewlett-Packard                                   | Software Vendor                           | Hewlett-Packard                                                                                                                                                                                                                                           |
| Vendor URL      | <a href="http://www.hp.com">http://www.hp.com</a> | Vendor URL                                | <a href="http://www.hp.com">http://www.hp.com</a>                                                                                                                                                                                                         |
| Model           | HP Superdome Server                               | Java Precompiler Version                  | none                                                                                                                                                                                                                                                      |
| Processor       | PA-RISC 8700+                                     | Java Precompiler Command Line             |                                                                                                                                                                                                                                                           |
| MHz             | 875                                               | Java Precompiler Way Of Excluding Classes | none                                                                                                                                                                                                                                                      |
| # of Procs      | 32                                                | JVM Version                               | Hotspot 1.4.1.02 64-bit VM on HP-UX 11i for PA-RISC 8700+                                                                                                                                                                                                 |
| Memory (MB)     | 128 GB                                            | JVM Command Line                          | java -XX:+ServerApp -XX:+AggressiveHeap -Xmn80g -ms82g -mx82g spec.jbb.JBBmain -propfile Test1                                                                                                                                                            |
| Primary cache   | 786KBI+1536KBD                                    | JVM Initial Heap Memory (MB)              | 82 GB                                                                                                                                                                                                                                                     |
| Secondary cache | none                                              | JVM Maximum Heap Memory (MB)              | 82 GB                                                                                                                                                                                                                                                     |
| Other cache     | none                                              | JVM CLASSPATH                             | ./jbb.jar:<br>./jbb_no_precompile.jar:<br>./check.jar:<br>./reporter.jar:                                                                                                                                                                                 |
| Filesystem      | VxFS                                              | JVM BOOTCLASSPATH                         | /opt/java1.4.1/jre/lib/rt.jar:<br>/opt/java1.4.1/jre/lib/i18n.jar:<br>/opt/java1.4.1/jre/lib/sunrsasign.jar:<br>/opt/java1.4.1/jre/lib/jsse.jar:<br>/opt/java1.4.1/jre/lib/jce.jar:<br>/opt/java1.4.1/jre/lib/charsets.jar:<br>/opt/java1.4.1/jre/classes |
| Disks           | 5 x 16 GB SCSI                                    | OS Version                                | HP-UX 11i v1.0                                                                                                                                                                                                                                            |
| Other hardware  | none                                              | System state                              | normal                                                                                                                                                                                                                                                    |
|                 |                                                   | Other software                            | none                                                                                                                                                                                                                                                      |

| Test Information |                 |
|------------------|-----------------|
| Tested by        | Hewlett-Packard |
| SPEC license #   | 3               |
| Test location    | Cupertino, CA   |

| Tuning                                                                                                                                                                                                   |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                                                                                                                                                                                          |  |
| Notes                                                                                                                                                                                                    |  |
| +AggressiveHeap instructs the JVM to push memory use to the limit and sets the memory management policy to defer collection as much as possible. If you want to use different heap values, you can do so |  |



|                     |             |
|---------------------|-------------|
| Test date           | Feb 4, 2003 |
| H/w available       | Jun-2002    |
| JVM available       | Jun-2003    |
| OS available        | Dec-2000    |
| Other s/w available |             |

by setting the -Xmn, -ms, -mx options after specifying AggressiveHeap on the command line.

### Details of Runs

| Warehouses | Thrput | Total heap (MB) |      | Thread spread % | % > 120s | transaction type | Count   | Time (in seconds) |      |
|------------|--------|-----------------|------|-----------------|----------|------------------|---------|-------------------|------|
|            |        | Size            | Used |                 |          |                  |         | total             | max  |
| 1          | 11373  | 83429           | 35.0 | <0.01%          | .017     | new_order        | 593496  | 68.9              | .020 |
|            |        |                 |      |                 |          | payment          | 593499  | 22.7              | .020 |
|            |        |                 |      |                 |          | order_status     | 59350   | 2.68              | .020 |
|            |        |                 |      |                 |          | delivery         | 59350   | 8.90              | .020 |
|            |        |                 |      |                 |          | stock_level      | 59349   | 9.42              | .020 |
| 2          | 23410  | 83429           | 57.6 | .523%           | .025     | new_order        | 1221685 | 143               | .029 |
|            |        |                 |      |                 |          | payment          | 1221682 | 47.5              | .029 |
|            |        |                 |      |                 |          | order_status     | 122169  | 5.38              | .020 |
|            |        |                 |      |                 |          | delivery         | 122168  | 17.3              | .021 |
|            |        |                 |      |                 |          | stock_level      | 122169  | 19.8              | .020 |
| 3          | 35111  | 83429           | 78.9 | .150%           | .017     | new_order        | 1832167 | 217               | .020 |
|            |        |                 |      |                 |          | payment          | 1832163 | 70.9              | .020 |
|            |        |                 |      |                 |          | order_status     | 183216  | 7.42              | .020 |
|            |        |                 |      |                 |          | delivery         | 183217  | 27.9              | .020 |
|            |        |                 |      |                 |          | stock_level      | 183218  | 26.9              | .020 |
| 4          | 46510  | 83429           | 104  | .776%           | .017     | new_order        | 2427042 | 288               | .020 |
|            |        |                 |      |                 |          | payment          | 2427033 | 94.8              | .020 |
|            |        |                 |      |                 |          | order_status     | 242701  | 10.1              | .020 |
|            |        |                 |      |                 |          | delivery         | 242705  | 36.2              | .020 |
|            |        |                 |      |                 |          | stock_level      | 242705  | 37.0              | .020 |
| 5          | 58126  | 83429           | 125  | .946%           | .017     | new_order        | 3033181 | 360               | .020 |
|            |        |                 |      |                 |          | payment          | 3033179 | 122               | .020 |
|            |        |                 |      |                 |          | order_status     | 303318  | 13.6              | .020 |
|            |        |                 |      |                 |          | delivery         | 303318  | 42.8              | .020 |
|            |        |                 |      |                 |          | stock_level      | 303320  | 45.5              | .020 |
| 6          | 69583  | 83429           | 147  | 1.38%           | .017     | new_order        | 3631040 | 427               | .020 |
|            |        |                 |      |                 |          | payment          | 3631044 | 147               | .020 |



|    |        |       |     |       |       |              |         |      |      |
|----|--------|-------|-----|-------|-------|--------------|---------|------|------|
|    |        |       |     |       |       | order_status | 363104  | 16.2 | .020 |
|    |        |       |     |       |       | delivery     | 363106  | 54.9 | .020 |
|    |        |       |     |       |       | stock_level  | 363104  | 54.6 | .020 |
| 7  | 80849  | 83429 | 169 | 1.19% | <0.01 | new_order    | 4218584 | 497  | .029 |
|    |        |       |     |       |       | payment      | 4218572 | 168  | .029 |
|    |        |       |     |       |       | order_status | 421860  | 19.1 | .029 |
|    |        |       |     |       |       | delivery     | 421857  | 63.2 | .029 |
|    |        |       |     |       |       | stock_level  | 421857  | 68.1 | .029 |
| 8  | 92122  | 83429 | 192 | .665% | .017  | new_order    | 4807166 | 573  | .020 |
|    |        |       |     |       |       | payment      | 4807155 | 194  | .020 |
|    |        |       |     |       |       | order_status | 480715  | 20.8 | .020 |
|    |        |       |     |       |       | delivery     | 480714  | 72.3 | .020 |
|    |        |       |     |       |       | stock_level  | 480717  | 74.9 | .020 |
| 9  | 103517 | 83429 | 218 | 1.16% | .025  | new_order    | 5402214 | 641  | .029 |
|    |        |       |     |       |       | payment      | 5402220 | 216  | .029 |
|    |        |       |     |       |       | order_status | 540221  | 24.0 | .029 |
|    |        |       |     |       |       | delivery     | 540222  | 84.0 | .029 |
|    |        |       |     |       |       | stock_level  | 540221  | 85.0 | .020 |
| 10 | 114673 | 83429 | 236 | 1.43% | .025  | new_order    | 5984421 | 712  | .030 |
|    |        |       |     |       |       | payment      | 5984432 | 244  | .028 |
|    |        |       |     |       |       | order_status | 598442  | 26.8 | .030 |
|    |        |       |     |       |       | delivery     | 598443  | 90.6 | .030 |
|    |        |       |     |       |       | stock_level  | 598441  | 93.1 | .030 |
| 11 | 125960 | 83429 | 260 | 1.44% | .017  | new_order    | 6572931 | 787  | .028 |
|    |        |       |     |       |       | payment      | 6572953 | 269  | .028 |
|    |        |       |     |       |       | order_status | 657296  | 29.2 | .028 |
|    |        |       |     |       |       | delivery     | 657293  | 99.0 | .028 |
|    |        |       |     |       |       | stock_level  | 657297  | 101  | .028 |
| 12 | 136898 | 83429 | 283 | 1.46% | .017  | new_order    | 7143684 | 850  | .030 |
|    |        |       |     |       |       | payment      | 7143682 | 292  | .030 |
|    |        |       |     |       |       | order_status | 714364  | 33.9 | .020 |
|    |        |       |     |       |       | delivery     | 714367  | 110  | .020 |
|    |        |       |     |       |       | stock_level  | 714367  | 116  | .030 |
| 13 | 148008 | 83429 | 306 | 1.44% | .017  | new_order    | 7723468 | 924  | .029 |
|    |        |       |     |       |       | payment      | 7723460 | 314  | .029 |
|    |        |       |     |       |       | order_status | 772346  | 33.7 | .021 |
|    |        |       |     |       |       | delivery     | 772347  | 123  | .029 |
|    |        |       |     |       |       | stock_level  | 772348  | 123  | .029 |



|    |        |       |     |       |       |              |          |      |      |
|----|--------|-------|-----|-------|-------|--------------|----------|------|------|
| 14 | 159330 | 83429 | 330 | 1.37% | .017  | new_order    | 8314229  | 996  | .029 |
|    |        |       |     |       |       | payment      | 8314235  | 341  | .029 |
|    |        |       |     |       |       | order_status | 831423   | 36.7 | .029 |
|    |        |       |     |       |       | delivery     | 831421   | 129  | .029 |
|    |        |       |     |       |       | stock_level  | 831422   | 131  | .029 |
| 15 | 169946 | 83429 | 351 | 1.35% | .033  | new_order    | 8869726  | 1066 | .030 |
|    |        |       |     |       |       | payment      | 8869721  | 362  | .030 |
|    |        |       |     |       |       | order_status | 886969   | 41.1 | .020 |
|    |        |       |     |       |       | delivery     | 886974   | 140  | .030 |
|    |        |       |     |       |       | stock_level  | 886972   | 141  | .030 |
| 16 | 180066 | 83429 | 370 | 1.02% | <0.01 | new_order    | 9395518  | 1129 | .029 |
|    |        |       |     |       |       | payment      | 9395497  | 387  | .260 |
|    |        |       |     |       |       | order_status | 939553   | 42.1 | .028 |
|    |        |       |     |       |       | delivery     | 939548   | 154  | .260 |
|    |        |       |     |       |       | stock_level  | 939552   | 152  | .260 |
| 17 | 191437 | 83429 | 392 | 1.06% | .017  | new_order    | 9989675  | 1203 | .260 |
|    |        |       |     |       |       | payment      | 9989679  | 414  | .260 |
|    |        |       |     |       |       | order_status | 998962   | 47.2 | .020 |
|    |        |       |     |       |       | delivery     | 998969   | 158  | .260 |
|    |        |       |     |       |       | stock_level  | 998963   | 159  | .020 |
| 18 | 202294 | 83429 | 418 | 1.30% | .017  | new_order    | 10556241 | 1275 | .260 |
|    |        |       |     |       |       | payment      | 10556251 | 439  | .260 |
|    |        |       |     |       |       | order_status | 1055632  | 48.2 | .260 |
|    |        |       |     |       |       | delivery     | 1055624  | 169  | .030 |
|    |        |       |     |       |       | stock_level  | 1055627  | 165  | .030 |
| 19 | 213113 | 83429 | 436 | 1.04% | <0.01 | new_order    | 11119841 | 1353 | .240 |
|    |        |       |     |       |       | payment      | 11119855 | 453  | .240 |
|    |        |       |     |       |       | order_status | 1111981  | 51.9 | .029 |
|    |        |       |     |       |       | delivery     | 1111984  | 179  | .240 |
|    |        |       |     |       |       | stock_level  | 1111984  | 176  | .240 |
| 20 | 223679 | 83429 | 456 | 1.46% | <0.01 | new_order    | 11671187 | 1422 | .260 |
|    |        |       |     |       |       | payment      | 11671174 | 483  | .028 |
|    |        |       |     |       |       | order_status | 1167116  | 54.8 | .028 |
|    |        |       |     |       |       | delivery     | 1167115  | 184  | .260 |
|    |        |       |     |       |       | stock_level  | 1167122  | 185  | .260 |
| 21 | 234384 | 83429 | 487 | 1.49% | .025  | new_order    | 12231795 | 1485 | .290 |
|    |        |       |     |       |       | payment      | 12231794 | 515  | .290 |
|    |        |       |     |       |       | order_status | 1223177  | 56.5 | .029 |



|    |        |       |     |       |       |              |          |      |      |
|----|--------|-------|-----|-------|-------|--------------|----------|------|------|
|    |        |       |     |       |       | delivery     | 1223183  | 192  | .290 |
|    |        |       |     |       |       | stock_level  | 1223177  | 199  | .030 |
| 22 | 244313 | 83429 | 505 | 1.53% | .042  | new_order    | 12752064 | 1550 | .280 |
|    |        |       |     |       |       | payment      | 12752062 | 534  | .260 |
|    |        |       |     |       |       | order_status | 1275203  | 59.9 | .028 |
|    |        |       |     |       |       | delivery     | 1275199  | 207  | .260 |
|    |        |       |     |       |       | stock_level  | 1275205  | 209  | .030 |
| 23 | 255572 | 83429 | 533 | 2.33% | .025  | new_order    | 13337542 | 1625 | .300 |
|    |        |       |     |       |       | payment      | 13337517 | 560  | .300 |
|    |        |       |     |       |       | order_status | 1333759  | 64.2 | .300 |
|    |        |       |     |       |       | delivery     | 1333749  | 214  | .300 |
|    |        |       |     |       |       | stock_level  | 1333753  | 214  | .030 |
| 24 | 265863 | 83429 | 549 | 1.90% | .042  | new_order    | 13876891 | 1699 | .300 |
|    |        |       |     |       |       | payment      | 13876888 | 578  | .300 |
|    |        |       |     |       |       | order_status | 1387686  | 64.7 | .022 |
|    |        |       |     |       |       | delivery     | 1387686  | 225  | .300 |
|    |        |       |     |       |       | stock_level  | 1387694  | 226  | .300 |
| 25 | 276975 | 83429 | 572 | 1.26% | <0.01 | new_order    | 14452078 | 1763 | .300 |
|    |        |       |     |       |       | payment      | 14452096 | 611  | .300 |
|    |        |       |     |       |       | order_status | 1445215  | 69.4 | .300 |
|    |        |       |     |       |       | delivery     | 1445213  | 231  | .300 |
|    |        |       |     |       |       | stock_level  | 1445206  | 234  | .300 |
| 26 | 286413 | 83429 | 595 | 1.50% | .017  | new_order    | 14945793 | 1839 | .280 |
|    |        |       |     |       |       | payment      | 14945790 | 635  | .300 |
|    |        |       |     |       |       | order_status | 1494578  | 69.9 | .021 |
|    |        |       |     |       |       | delivery     | 1494579  | 238  | .300 |
|    |        |       |     |       |       | stock_level  | 1494585  | 243  | .022 |
| 27 | 296516 | 83429 | 620 | 1.51% | .025  | new_order    | 15474268 | 1898 | .300 |
|    |        |       |     |       |       | payment      | 15474262 | 656  | .300 |
|    |        |       |     |       |       | order_status | 1547422  | 74.2 | .300 |
|    |        |       |     |       |       | delivery     | 1547428  | 253  | .300 |
|    |        |       |     |       |       | stock_level  | 1547429  | 258  | .029 |
| 28 | 308404 | 83429 | 639 | 1.93% | .025  | new_order    | 16094681 | 1986 | .320 |
|    |        |       |     |       |       | payment      | 16094662 | 678  | .320 |
|    |        |       |     |       |       | order_status | 1609472  | 76.2 | .030 |
|    |        |       |     |       |       | delivery     | 1609464  | 262  | .320 |
|    |        |       |     |       |       | stock_level  | 1609471  | 255  | .030 |
| 29 | 318573 | 83429 | 666 | 1.41% | .017  | new_order    | 16623970 | 2047 | .320 |



|    |        |       |     |       |      |              |          |      |      |
|----|--------|-------|-----|-------|------|--------------|----------|------|------|
|    |        |       |     |       |      | payment      | 16623981 | 705  | .320 |
|    |        |       |     |       |      | order_status | 1662396  | 80.4 | .030 |
|    |        |       |     |       |      | delivery     | 1662391  | 269  | .320 |
|    |        |       |     |       |      | stock_level  | 1662399  | 271  | .320 |
| 30 | 329198 | 83429 | 688 | 2.15% | .025 | new_order    | 17179807 | 2119 | .320 |
|    |        |       |     |       |      | payment      | 17179837 | 728  | .320 |
|    |        |       |     |       |      | order_status | 1717985  | 81.7 | .320 |
|    |        |       |     |       |      | delivery     | 1717982  | 283  | .030 |
|    |        |       |     |       |      | stock_level  | 1717978  | 276  | .030 |
| 31 | 339563 | 83429 | 711 | 1.57% | .025 | new_order    | 17720745 | 2197 | .340 |
|    |        |       |     |       |      | payment      | 17720723 | 751  | .340 |
|    |        |       |     |       |      | order_status | 1772081  | 81.9 | .030 |
|    |        |       |     |       |      | delivery     | 1772075  | 288  | .340 |
|    |        |       |     |       |      | stock_level  | 1772071  | 286  | .030 |
| 32 | 346954 | 83429 | 737 | 2.23% | .042 | new_order    | 18109505 | 2251 | .860 |
|    |        |       |     |       |      | payment      | 18109478 | 774  | .860 |
|    |        |       |     |       |      | order_status | 1810953  | 88.7 | .610 |
|    |        |       |     |       |      | delivery     | 1810945  | 305  | .860 |
|    |        |       |     |       |      | stock_level  | 1810954  | 299  | .860 |
| 33 | 349338 | 83429 | 748 | 13.6% | .025 | new_order    | 18230885 | 2312 | 1.01 |
|    |        |       |     |       |      | payment      | 18230878 | 806  | 1.08 |
|    |        |       |     |       |      | order_status | 1823087  | 90.3 | .800 |
|    |        |       |     |       |      | delivery     | 1823087  | 313  | 1.01 |
|    |        |       |     |       |      | stock_level  | 1823081  | 309  | 1.01 |
| 34 | 347126 | 83429 | 762 | 51.2% | .042 | new_order    | 18118452 | 2379 | 1.13 |
|    |        |       |     |       |      | payment      | 18118464 | 831  | .990 |
|    |        |       |     |       |      | order_status | 1811848  | 93.9 | .590 |
|    |        |       |     |       |      | delivery     | 1811848  | 321  | .970 |
|    |        |       |     |       |      | stock_level  | 1811845  | 326  | .890 |
| 35 | 348893 | 83429 | 789 | 51.8% | .025 | new_order    | 18207687 | 2462 | .940 |
|    |        |       |     |       |      | payment      | 18207679 | 844  | 1.37 |
|    |        |       |     |       |      | order_status | 1820770  | 96.4 | .600 |
|    |        |       |     |       |      | delivery     | 1820768  | 330  | .700 |
|    |        |       |     |       |      | stock_level  | 1820768  | 331  | .360 |
| 36 | 348069 | 83429 | 813 | 39.5% | .042 | new_order    | 18167687 | 2513 | 1.08 |
|    |        |       |     |       |      | payment      | 18167680 | 885  | .900 |
|    |        |       |     |       |      | order_status | 1816771  | 99.9 | .500 |
|    |        |       |     |       |      | delivery     | 1816768  | 346  | 1.00 |



|    |        |       |     |       |      |              |          |      |      |
|----|--------|-------|-----|-------|------|--------------|----------|------|------|
|    |        |       |     |       |      | stock_level  | 1816771  | 335  | .900 |
| 37 | 346529 | 83429 | 831 | 44.0% | .033 | new_order    | 18085817 | 2590 | 1.09 |
|    |        |       |     |       |      | payment      | 18085836 | 909  | 1.02 |
|    |        |       |     |       |      | order_status | 1808585  | 99.0 | .760 |
|    |        |       |     |       |      | delivery     | 1808577  | 346  | .960 |
|    |        |       |     |       |      | stock_level  | 1808583  | 353  | .890 |
| 38 | 347827 | 83429 | 847 | 36.0% | .025 | new_order    | 18152071 | 2673 | 1.00 |
|    |        |       |     |       |      | payment      | 18152049 | 923  | .900 |
|    |        |       |     |       |      | order_status | 1815206  | 104  | .300 |
|    |        |       |     |       |      | delivery     | 1815201  | 359  | .770 |
|    |        |       |     |       |      | stock_level  | 1815206  | 354  | .800 |
| 39 | 348003 | 83429 | 877 | 41.9% | .017 | new_order    | 18159697 | 2720 | 1.00 |
|    |        |       |     |       |      | payment      | 18159691 | 958  | 1.35 |
|    |        |       |     |       |      | order_status | 1815975  | 107  | .880 |
|    |        |       |     |       |      | delivery     | 1815972  | 378  | .980 |
|    |        |       |     |       |      | stock_level  | 1815970  | 369  | 1.00 |
| 40 | 348043 | 83429 | 892 | 50.0% | .042 | new_order    | 18166317 | 2800 | 1.08 |
|    |        |       |     |       |      | payment      | 18166360 | 973  | 1.00 |
|    |        |       |     |       |      | order_status | 1816636  | 112  | .900 |
|    |        |       |     |       |      | delivery     | 1816636  | 380  | 1.02 |
|    |        |       |     |       |      | stock_level  | 1816628  | 379  | 1.18 |
| 41 | 347853 | 83429 | 911 | 48.7% | .033 | new_order    | 18154889 | 2861 | 1.40 |
|    |        |       |     |       |      | payment      | 18154877 | 1007 | 1.00 |
|    |        |       |     |       |      | order_status | 1815488  | 112  | .660 |
|    |        |       |     |       |      | delivery     | 1815484  | 395  | .880 |
|    |        |       |     |       |      | stock_level  | 1815490  | 387  | 1.02 |
| 42 | 346035 | 83429 | 925 | 49.3% | .025 | new_order    | 18058530 | 2919 | 1.09 |
|    |        |       |     |       |      | payment      | 18058521 | 1031 | 1.01 |
|    |        |       |     |       |      | order_status | 1805850  | 116  | .990 |
|    |        |       |     |       |      | delivery     | 1805845  | 407  | 1.04 |
|    |        |       |     |       |      | stock_level  | 1805851  | 408  | 1.04 |
| 43 | 347616 | 83429 | 941 | 51.3% | .033 | new_order    | 18142511 | 3017 | 1.08 |
|    |        |       |     |       |      | payment      | 18142537 | 1059 | 1.00 |
|    |        |       |     |       |      | order_status | 1814251  | 119  | .500 |
|    |        |       |     |       |      | delivery     | 1814250  | 403  | .800 |
|    |        |       |     |       |      | stock_level  | 1814255  | 405  | 1.00 |
| 44 | 347922 | 83429 | 966 | 47.5% | .058 | new_order    | 18163045 | 3075 | 1.21 |
|    |        |       |     |       |      | payment      | 18163054 | 1071 | 1.08 |

|    |        |       |      |       |      |              |          |      |       |
|----|--------|-------|------|-------|------|--------------|----------|------|-------|
|    |        |       |      |       |      | order_status | 1816310  | 123  | 1.00  |
|    |        |       |      |       |      | delivery     | 1816309  | 428  | 1.11  |
|    |        |       |      |       |      | stock_level  | 1816305  | 416  | 1.01  |
| 45 | 346819 | 83429 | 987  | 42.4% | .042 | new_order    | 18102457 | 3157 | 1.13  |
|    |        |       |      |       |      | payment      | 18102462 | 1105 | 1.01  |
|    |        |       |      |       |      | order_status | 1810241  | 126  | 1.11  |
|    |        |       |      |       |      | delivery     | 1810240  | 430  | 1.11  |
|    |        |       |      |       |      | stock_level  | 1810245  | 415  | 1.07  |
| 46 | 346469 | 83429 | 1010 | 46.4% | .042 | new_order    | 18084153 | 3222 | 1.02  |
|    |        |       |      |       |      | payment      | 18084153 | 1117 | 1.07  |
|    |        |       |      |       |      | order_status | 1808416  | 130  | .900  |
|    |        |       |      |       |      | delivery     | 1808412  | 444  | 1.04  |
|    |        |       |      |       |      | stock_level  | 1808415  | 429  | 1.02  |
| 47 | 347201 | 83429 | 1025 | 47.8% | .033 | new_order    | 18120893 | 3269 | 1.99  |
|    |        |       |      |       |      | payment      | 18120906 | 1154 | 1.99  |
|    |        |       |      |       |      | order_status | 1812090  | 124  | .820  |
|    |        |       |      |       |      | delivery     | 1812091  | 464  | 1.10  |
|    |        |       |      |       |      | stock_level  | 1812084  | 455  | 1.99  |
| 48 | 347219 | 83429 | 1048 | 45.8% | .033 | new_order    | 18121791 | 3345 | 1.09  |
|    |        |       |      |       |      | payment      | 18121822 | 1163 | 1.09  |
|    |        |       |      |       |      | order_status | 1812179  | 135  | 1.03  |
|    |        |       |      |       |      | delivery     | 1812187  | 466  | 1.13  |
|    |        |       |      |       |      | stock_level  | 1812186  | 455  | 1.09  |
| 49 | 347320 | 83429 | 1070 | 44.9% | .033 | new_order    | 18127083 | 3420 | 1.60  |
|    |        |       |      |       |      | payment      | 18127094 | 1195 | 1.10  |
|    |        |       |      |       |      | order_status | 1812711  | 131  | -.311 |
|    |        |       |      |       |      | delivery     | 1812705  | 481  | 2.50  |
|    |        |       |      |       |      | stock_level  | 1812702  | 464  | 1.02  |
| 50 | 347209 | 83429 | 1084 | 42.5% | .042 | new_order    | 18122815 | 3493 | 1.77  |
|    |        |       |      |       |      | payment      | 18122775 | 1213 | 1.69  |
|    |        |       |      |       |      | order_status | 1812275  | 143  | 1.11  |
|    |        |       |      |       |      | delivery     | 1812283  | 489  | 1.69  |
|    |        |       |      |       |      | stock_level  | 1812283  | 476  | 1.69  |
| 51 | 346854 | 83429 | 1105 | 40.6% | .025 | new_order    | 18101260 | 3587 | 2.85  |
|    |        |       |      |       |      | payment      | 18101278 | 1220 | 1.91  |
|    |        |       |      |       |      | order_status | 1810129  | 144  | .900  |
|    |        |       |      |       |      | delivery     | 1810123  | 499  | 1.99  |
|    |        |       |      |       |      | stock_level  | 1810123  | 472  | 1.40  |



|    |        |       |      |       |       |              |          |      |      |
|----|--------|-------|------|-------|-------|--------------|----------|------|------|
| 52 | 346850 | 83429 | 1127 | 44.7% | .033  | new_order    | 18102561 | 3626 | 1.71 |
|    |        |       |      |       |       | payment      | 18102567 | 1254 | 1.81 |
|    |        |       |      |       |       | order_status | 1810253  | 145  | 1.08 |
|    |        |       |      |       |       | delivery     | 1810256  | 526  | 1.71 |
|    |        |       |      |       |       | stock_level  | 1810257  | 485  | .999 |
| 53 | 346987 | 83429 | 1150 | 39.7% | .042  | new_order    | 18111240 | 3690 | 2.00 |
|    |        |       |      |       |       | payment      | 18111218 | 1286 | 2.00 |
|    |        |       |      |       |       | order_status | 1811125  | 140  | 1.10 |
|    |        |       |      |       |       | delivery     | 1811117  | 542  | 1.90 |
|    |        |       |      |       |       | stock_level  | 1811117  | 501  | 1.91 |
| 54 | 349036 | 83429 | 1161 | 36.8% | <0.01 | new_order    | 18119506 | 3730 | 2.00 |
|    |        |       |      |       |       | payment      | 18119528 | 1293 | 1.90 |
|    |        |       |      |       |       | order_status | 1811948  | 143  | 1.20 |
|    |        |       |      |       |       | delivery     | 1811943  | 549  | 1.96 |
|    |        |       |      |       |       | stock_level  | 1811954  | 518  | 1.90 |
| 55 | 346474 | 83429 | 1186 | 40.5% | .150  | new_order    | 18104033 | 3840 | 2.08 |
|    |        |       |      |       |       | payment      | 18104001 | 1340 | 1.49 |
|    |        |       |      |       |       | order_status | 1810402  | 151  | 1.10 |
|    |        |       |      |       |       | delivery     | 1810400  | 543  | 1.89 |
|    |        |       |      |       |       | stock_level  | 1810401  | 522  | 1.49 |
| 56 | 346251 | 83429 | 1206 | 40.9% | .025  | new_order    | 18069769 | 3883 | 2.29 |
|    |        |       |      |       |       | payment      | 18069759 | 1359 | 1.99 |
|    |        |       |      |       |       | order_status | 1806978  | 159  | 1.49 |
|    |        |       |      |       |       | delivery     | 1806975  | 567  | 2.09 |
|    |        |       |      |       |       | stock_level  | 1806972  | 529  | 1.99 |
| 57 | 345192 | 83429 | 1217 | 30.2% | .033  | new_order    | 18016031 | 3953 | 2.10 |
|    |        |       |      |       |       | payment      | 18016032 | 1381 | 1.99 |
|    |        |       |      |       |       | order_status | 1801600  | 164  | 1.70 |
|    |        |       |      |       |       | delivery     | 1801600  | 587  | 2.33 |
|    |        |       |      |       |       | stock_level  | 1801597  | 533  | 2.10 |
| 58 | 346883 | 83429 | 1238 | 43.1% | .033  | new_order    | 18104299 | 4006 | 2.00 |
|    |        |       |      |       |       | payment      | 18104294 | 1422 | 2.99 |
|    |        |       |      |       |       | order_status | 1810427  | 162  | 2.95 |
|    |        |       |      |       |       | delivery     | 1810434  | 584  | 2.00 |
|    |        |       |      |       |       | stock_level  | 1810427  | 535  | 1.33 |
| 59 | 344254 | 83429 | 1259 | 35.5% | .042  | new_order    | 17968548 | 4092 | 1.80 |
|    |        |       |      |       |       | payment      | 17968553 | 1443 | 1.80 |
|    |        |       |      |       |       | order_status | 1796853  | 164  | 1.78 |



|    |        |       |      |       |      |              |          |      |      |
|----|--------|-------|------|-------|------|--------------|----------|------|------|
|    |        |       |      |       |      | delivery     | 1796856  | 593  | 2.84 |
|    |        |       |      |       |      | stock_level  | 1796859  | 555  | 1.50 |
| 60 | 344663 | 83429 | 1275 | 38.6% | .033 | new_order    | 17988404 | 4151 | 2.01 |
|    |        |       |      |       |      | payment      | 17988433 | 1442 | 2.00 |
|    |        |       |      |       |      | order_status | 1798839  | 162  | 1.90 |
|    |        |       |      |       |      | delivery     | 1798839  | 645  | 2.00 |
|    |        |       |      |       |      | stock_level  | 1798848  | 573  | 2.00 |
| 61 | 346493 | 83429 | 1299 | 33.8% | .033 | new_order    | 18083923 | 4169 | 2.00 |
|    |        |       |      |       |      | payment      | 18083901 | 1496 | 2.00 |
|    |        |       |      |       |      | order_status | 1808392  | 169  | 1.60 |
|    |        |       |      |       |      | delivery     | 1808388  | 679  | 2.30 |
|    |        |       |      |       |      | stock_level  | 1808388  | 574  | 1.98 |
| 62 | 344528 | 83429 | 1313 | 37.1% | .025 | new_order    | 17979884 | 4247 | 2.20 |
|    |        |       |      |       |      | payment      | 17979862 | 1505 | 2.41 |
|    |        |       |      |       |      | order_status | 1797987  | 170  | 1.98 |
|    |        |       |      |       |      | delivery     | 1797982  | 652  | 2.00 |
|    |        |       |      |       |      | stock_level  | 1797976  | 609  | 2.10 |
| 63 | 346373 | 83429 | 1340 | 25.9% | .033 | new_order    | 18077670 | 4338 | 2.05 |
|    |        |       |      |       |      | payment      | 18077652 | 1517 | 1.99 |
|    |        |       |      |       |      | order_status | 1807756  | 169  | 1.69 |
|    |        |       |      |       |      | delivery     | 1807771  | 681  | 2.09 |
|    |        |       |      |       |      | stock_level  | 1807760  | 613  | 1.89 |
| 64 | 344509 | 83429 | 1354 | 39.1% | .025 | new_order    | 17978875 | 4420 | 2.23 |
|    |        |       |      |       |      | payment      | 17978881 | 1560 | 2.58 |
|    |        |       |      |       |      | order_status | 1797889  | 185  | 1.90 |
|    |        |       |      |       |      | delivery     | 1797882  | 663  | 2.08 |
|    |        |       |      |       |      | stock_level  | 1797887  | 618  | 2.00 |
| 65 | 346130 | 83429 | 1377 | 44.5% | .050 | new_order    | 18067991 | 4451 | 2.53 |
|    |        |       |      |       |      | payment      | 18068003 | 1606 | 2.37 |
|    |        |       |      |       |      | order_status | 1806799  | 169  | 1.10 |
|    |        |       |      |       |      | delivery     | 1806801  | 682  | 2.41 |
|    |        |       |      |       |      | stock_level  | 1806803  | 621  | 2.08 |
| 66 | 346354 | 83429 | 1395 | 33.2% | .033 | new_order    | 18076666 | 4512 | 2.09 |
|    |        |       |      |       |      | payment      | 18076615 | 1617 | 2.09 |
|    |        |       |      |       |      | order_status | 1807667  | 171  | 2.51 |
|    |        |       |      |       |      | delivery     | 1807665  | 740  | 2.10 |
|    |        |       |      |       |      | stock_level  | 1807663  | 601  | 1.90 |
| 67 | 346525 | 83429 | 1417 | 38.0% | .183 | new_order    | 18112674 | 4571 | 2.80 |



|    |        |       |      |       |      |              |          |      |      |
|----|--------|-------|------|-------|------|--------------|----------|------|------|
|    |        |       |      |       |      | payment      | 18112718 | 1634 | 2.20 |
|    |        |       |      |       |      | order_status | 1811265  | 194  | 2.20 |
|    |        |       |      |       |      | delivery     | 1811265  | 753  | 3.40 |
|    |        |       |      |       |      | stock_level  | 1811276  | 625  | 2.18 |
| 68 | 346134 | 83429 | 1430 | 46.4% | .033 | new_order    | 18065146 | 4693 | 2.40 |
|    |        |       |      |       |      | payment      | 18065180 | 1677 | 1.85 |
|    |        |       |      |       |      | order_status | 1806520  | 191  | 1.35 |
|    |        |       |      |       |      | delivery     | 1806519  | 689  | 1.91 |
|    |        |       |      |       |      | stock_level  | 1806512  | 647  | 1.89 |
| 69 | 345452 | 83429 | 1447 | 31.3% | .058 | new_order    | 18034094 | 4739 | 2.07 |
|    |        |       |      |       |      | payment      | 18034135 | 1675 | 2.17 |
|    |        |       |      |       |      | order_status | 1803408  | 189  | 1.90 |
|    |        |       |      |       |      | delivery     | 1803409  | 749  | 2.22 |
|    |        |       |      |       |      | stock_level  | 1803414  | 643  | 2.10 |
| 70 | 345704 | 83429 | 1472 | 27.7% | .042 | new_order    | 18044214 | 4799 | 2.71 |
|    |        |       |      |       |      | payment      | 18044235 | 1720 | 2.60 |
|    |        |       |      |       |      | order_status | 1804421  | 200  | 1.80 |
|    |        |       |      |       |      | delivery     | 1804422  | 804  | 2.40 |
|    |        |       |      |       |      | stock_level  | 1804420  | 626  | 1.70 |

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 CASE - COMMERCE

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construindo sua  
infra-estrutura  
sempre ativa com  
servidores hp

## soluções de servidor de internet poderosas e flexíveis para uma infra-estrutura sempre ativa

O centro de processamento de dados da Internet é o elemento crítico que possibilitará a próxima geração dos negócios. E ao projetar e implementar sua solução de Internet, sua primeira preocupação deve ser encontrar produtos e serviços de tecnologia que sejam construídos corretamente logo na primeira vez. Sua próxima preocupação será assegurar que o que funciona hoje também vai atender as suas necessidades futuras, à medida que novas oportunidades — e novos desafios — se apresentarem.

A infra-estrutura de tecnologia correta é aquela que está sempre ativa onde e como for necessário. Isso é o que a HP pode ajudá-lo a construir — e não há precedentes na indústria.

Os servidores HP Superdome fornecem uma combinação sob medida de tecnologia e serviços. Construída com componentes-chave, tais como as habilidades comprovadas da HP em centros de processamento de dados, sua experiência em e-services e sua força em desenvolvimento de utilitários, sua infra-estrutura sempre ativa fornecerá uma experiência excepcional para os clientes, assegurando a facilidade, velocidade e eficácia.

### sua infra-estrutura sempre ativa

Tratando dos inúmeros desafios difíceis que você enfrenta ao construir e gerenciar uma empresa de Internet, a HP fornece:

- HP Superdome Servidores UNIX líderes da indústria
- Blocos de construção de utilitários-somente da HP
- A mais ampla oferta de capacidades de particionamento da indústria, com o "continuum" particionamento da HP
- Itanium™ e capacidade para SOs variados

### sempre presente

A HP também está sempre presente para você, desde o primeiro contato. A HP fornece:

- Gerenciamento de soluções de loop fechado
- Avaliações iniciais
- Pré-integração e testes
- Treinamento baseado em necessidades
- Serviços de migração

E asseguramos que sua infra-estrutura funcionará continuamente com:

- Serviços proativos
- Acordos para reparos

### uma experiência excepcional para o cliente

A implementação bem-sucedida de um centro de processamento de dados exige muito mais do que tecnologia. É por isso que a infra-estrutura sempre ativa está sempre com você — em todas as etapas do caminho.

- **invente:** facilidade de planejamento e projeto para uma solução que é feita sob medida para se adequar imediatamente aos seus negócios
- **construa:** velocidade de integração e instalação de uma infra-estrutura pronta para funcionar
- **execute:** serviços de missão crítica e tecnologias que possibilitam uma operação contínua, uma capacidade flexível e um gerenciamento eficiente para assegurar a excelência operacional do dia-a-dia
- **evolua:** plano à prova de obsolescência, desenvolvimento de utilitários e cuidado contínuo para atender a suas necessidades por toda a vida de sua empresa



hp superdome

NOTA FISCAL - CPMI - CORRIGIDA  
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Doc. 3004  
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# três configurações do hp superdome para atender a suas necessidades



As implementações de grande porte em geral não correspondem às expectativas, como resultado de habilidades inadequadas que são aplicadas nas etapas de projeto e implementação. Com o Superdome, a HP garante a você uma experiência excepcional de computação, através de serviços HP líderes da indústria e parceiros de canal selecionados, disponível em três configurações pré-definidas. Para todas as configurações existem soluções de financiamento disponíveis para atender os seus requisitos orçamentários.

## configuração básica

A construção da base correta reduz drasticamente os problemas e acelera o tempo de instalação em produção, de forma que todas as soluções Superdome incluirão a Configuração Básica como base para um desempenho excelente. A Configuração Básica destina-se a empresas cujos aplicativos têm requisitos de disponibilidade de baixa prioridade ou que possuem especialistas em suas equipes para executar e gerenciar seus próprios ambientes de TI.

Gerenciamento de projetos em loop fechado utilizando metodologias baseadas em processos e medidas para assegurar seu sucesso e satisfação

- Serviços de consultoria para um projeto detalhado de arquitetura para assegurar que esteja correto logo na primeira vez
- Avaliação de habilidades e treinamento específico em Superdome para fornecer à equipe de TI as habilidades necessárias
- Preparação completa do local/ambiente para ajudá-lo a compreender e abordar as exigências de sua localização física
- Integração e testes de fábrica da HP para assegurar que o sistema esteja adequadamente configurado e chegue pronto para funcionar
- Suporte contínuo de centro de respostas, disponível 24 horas por dia, 7 dias por semana, com compromisso de resposta em 4 horas

## configuração de sistemas críticos

Para um alto nível de disponibilidade de sistema, a experiência da HP reconhecida pela indústria fornece suporte do tipo missão crítica como base da configuração de Sistemas Críticos. Esta configuração é o nível mínimo de serviço para ambientes de missão crítica. Ela aumenta a prioridade dos serviços reativos e adiciona serviços de suporte proativos com monitoramento da disponibilidade.

## sua infra-estrutura sempre ativa potencializa soluções robustas para os principais aplicativos da atualidade

**Planejamento de Recursos Corporativos (ERP):** A estrutura fundamental para novas áreas de vantagem competitiva: supply chain, e-commerce e desenvolvimento de produtos.

**Computação de Missão Crítica:** Produtos e soluções de alta disponibilidade para ajudá-lo a obter os níveis de disponibilidade que você precisa para atender a seus clientes.

**E-Intelligence:** Obtenha o máximo de valor de seus ativos de dados — tanto internos quanto externos — utilizando ferramentas de ponta para análise, business intelligence e aplicativos da HP.

**E-commerce:** Gerencie as custas de sites de e-commerce, refinando as recursos de computação para atender as necessidades que estão sempre mudando e assegurar que seu site de e-commerce crítico esteja disponível e possua a capacidade que necessita.

**Computação Técnica:** Os aplicativos de computação técnica nunca conseguem obter poder suficiente. Os níveis extremamente altos de desempenho e capacidade de expansão oferecidos por uma infra-estrutura sempre ativa atendem a essas necessidades de frente.

**Consolidação de Sistemas:** Reduza os custos, aumente a flexibilidade, a disponibilidade e o desempenho, e melhore a gerenciamento das infra-estruturas de TI com o complexidade reduzida e o disponibilidade ampliada das configurações sempre ativa.

Ela inclui o Configuração Básica, acrescida de:

- Um plano de suporte detalhando os requisitos específicos da conta em questão e o compromisso de resposta da HP
- Engenheiros de Conta Designados
- Análise de Prontidão do Superdome para ajudá-lo a atender a seus requisitos de alta disponibilidade e desempenho
- Tópicos de Consultoria Técnica para seleção
- Diagnóstico remoto de alta velocidade e coleta de dados críticos para acompanhar o desempenho do sistema e prevenir problemas antes que ocorram
- Compromisso de resposta em 6 horas para chamadas de reparo de hardware
- Recuperação de Sistema Prioritário
- Serviços de Recuperação de Negócios (opcional)

## configuração de continuidade de negócios

A Configuração de Continuidade de Negócios fornece muito mais do que uma lista de serviços. Ela fornece uma forma diferente de abordagem para o planejamento da disponibilidade. A Continuidade de Negócios é uma colaboração entre a HP e o cliente, criando um plano para abordar de forma pro-ativa todos os elementos do ambiente de TI que afetam a disponibilidade dos negócios. Ela foi projetada e construída tendo como meta a disponibilidade máxima e seu foco é na operação ideal dos negócios. A Continuidade de Negócios fornece serviços proativos sofisticados e o melhor serviço de suporte da indústria.

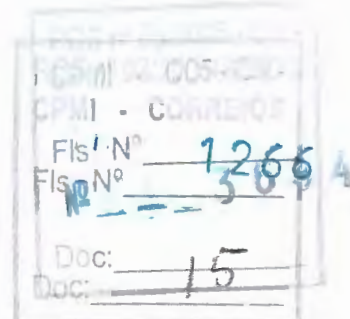
Ela inclui a Configuração Básica e a de Sistemas Críticos, além de:

- Uma equipe dedicada à conta e um plano personalizado de serviços proativos
- Resposta de prioridade máxima fornecida por especialistas treinados
- Processos de gerenciamento de mudanças altamente detalhados
- Revisões de conta mensais
- O único compromisso de resposta em 4 horas para chamadas de restauração de hardware e software da indústria
- Solução permanente de software dentro de 14 dias

## novos sistemas operacionais para a era da internet

O ambiente operacional HP-UX 11i fornece a melhor plataforma para empresas de Internet do tipo sempre ativa.

- **O sistema operacional Microsoft® Windows NT®/Linux mais amigável atualmente,** com um ambiente de desenvolvimento Linux Open Source e suporte a WebGain Studio.
- **A melhor funcionalidade ponta-a-ponta de Internet crítica,** alta disponibilidade de sistema único, capacidade de gerenciamento, segurança e integração UNIX/Windows®
- **Desempenho e capacidade de expansão definitivos** com capacidade sob demanda instantânea, suporte a particionamento físico e virtual, forte desempenho Java™ e capacidade de expansão para Symmetric Multi-Processing (SMP) de 64 processadores de alto desempenho
- **A melhor proteção e longevidade de investimentos** através de compatibilidade binária com os processadores PA-RISC (64 bits) e Itanium Processor Family (IPF)
- **Três opções de conjuntos de capacidade de gerenciamento HP-UX Service Control** para um controle centralizado e capacidade otimizada eficazes quanto ao custo
- **Três opções de ambientes operacionais completos** feitos sob medida para as necessidades de computação de Internet, corporativas ou de missão crítica





## visão rápida do hp superdome



### disponibilidade

Adição e substituição on-line de placas de E/S PCI, compartimentos de placas de E/S e células (CPU/memória\*)

6 ou 12 ventiladores e 4, 6 ou 12 fontes de alimentação, todos hot swap, incluindo N+1

Verificação e correção de erros em todos os caminhos de CPU e memória

Caminhos de dados de E/S com proteção de paridade

Fonte de alimentação dupla

até 16 partições físicas (nPartitions)

-HP Virtual Partitions (vPar) - até 64

Suporte a soluções de cluster local e remoto para projetos de site backup com distância ilimitada

Recursos de alta disponibilidade embutidos fornecem níveis superiores de

- confiabilidade
- capacidade de suporte
- capacidade de reparos
- disponibilidade de sistema único
- disponibilidade de sistemas múltiplos

para ajudar a obter o máximo de tempo ativo para aplicativos de missão crítica

Fornecer capacidade de particionamento físico

Fornecer capacidade de particionamento lógico

Soluções completas para alta disponibilidade em clusters eliminam os pontos de falha individuais

### capacidade

Núcleo único: 1 ou 64 de 552MHz, 750MHz, 875MHz

CPUs de alto desempenho P A-8700+ com 2.25MB de cache on-chip por CPU

Desempenho de liderança

Capacidade de particionamento (1 a 16 nPartitions) para alocação de recursos, diversos ambientes operacionais ou escalonamento de aplicativos

Até 64 partições virtuais

Permite expansão de diferentes processadores no mesmo gabinete. A estrutura do servidor superdome também aceitará novos processadores PA-RISC

Seus benchmarks são recordes mundiais e um padrão para a indústria

Permite que o gerenciador do sistema otimize a alocação de recursos entre cargas de trabalho concorrentes. Quando utilizando 16 nPartitions não existe perdas de escalabilidade, pois com 64 CPUs o servidor mantém suas capacidades máximas de memória e slots PCI para proteger os investimentos em hardware

Desempenho de subsistema de memória aumentado para o processamento rápido e confiável de aplicativos de alto desempenho

Manipula facilmente aplicativos com muitas operações de I/O e possibilita um escalonamento rápido para acomodar demandas mais altas

Até 256 GB de memória (512GB previsto para julho 2003)

Largura de banda de memória de 64GB/s por gabinete de 64 CPU

PCI padrão da indústria de 64 bits 33MHz (2x) ou 66MHz (4x)

Até 16 canais de E/S de 265MB/s (PCI de 33MHz) ou 530MB/s (PCI de 66MHz)

Até 192 slots PCI hot swap de E/S (com gabinete para expansão de E/S)

Opções de armazenamento incluindo arrays de disco JBOD, Fibre Channel ou HP Surestore; HP AutoRAID, Multiplexador HP Fibre-Channel-to-SCSI, unidades de fita e bibliotecas

Armazenamento flexível de alta capacidade que protege os dados críticos

### conectividade

Operações básicas de E/S incluindo LAN 10/100Base-T

Conectividade de rede: para Token Ring, 1000Base-SX, 1000Base-T,

10/100Base-TX, Terminal MUX, PKC, HIPPI, X.25, ATM, Hyperfabric e FDDI

Conectividade de armazenamento: Ultra2 SCSI, F/W SCSI, Fibre Channel

Capacidade de conexão em rede fácil e pronta para funcionar

Soluções completas de conectividade ponta-a-ponta para e-services

Suporte a servidor WAP Nokia

Grande variedade de opções de conectividade de armazenamento de alta velocidade

Conectividade para aplicativos sem fio

### segurança

Deteção de invasão baseada no host

Capacidade de rede virtual privada IPSec ponta-a-ponta

Segurança e proteção definitivas contra ataques

Segurança de camada de rede independente de aplicativo

### capacidade de gerenciamento

Estação de Gerenciamento de Suporte

Gerenciador de Partições (parmgr)

Sistema de Gerenciamento de Falhas Estendido

HP WebQoS Peak integrado

HP Servicecontrol Manager integrado

HP-UX Workload Manager

Acesso remoto centralizado a firmware e ferramentas de diagnóstico de varredura, para uso em todos os sistemas Superdome no centro de processamento de dados

Interface GUI intuitiva para gerenciar e modificar facilmente todas as partições de um sistema Superdome

Console para a exibição do status do sistema (local e remoto), restauração do sistema, poder de controle para ligar e desligar

Estabiliza o desempenho de sites na Web sob cargas muito pesadas para melhorar a confiabilidade do site e a produção de transações

Controle central dos recursos do servidor rápido e eficaz quanto aos custos para o mais alto grau de eficiência na administração do sistema

Primeiro gerenciamento de recursos baseado em metas da indústria UNIX. Reconfigura automaticamente as alocações de CPU, baseado nos objetivos de nível de serviço do cliente (SLOs)

### proteção e flexibilidade dos investimentos

Projetado para atualizações futuras para diversas gerações de PA-RISC e IPF

Licença ilimitada embutida para o sistema operacional de Internet HP-UX 11i; opções de atualização para o Enterprise ou Mission-Critical HP-UX

Suporte futuro a Windows NT e Linux

Seleção de opções integradas de servidor Web: padrão da indústria para um desempenho mais rápido e mais expansível

Plataforma de software aberto E-speak para o desenvolvimento e distribuição de e-services

Proteção superior dos investimentos e longevidade

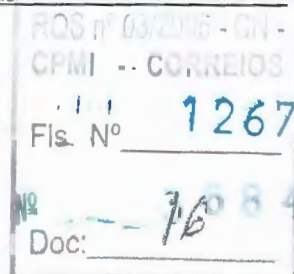
Opção de escolha entre três ambientes operacionais com todos os componentes básicos de sistema operacional necessários para ambientes de Internet, corporativos ou de missão crítica

Oferece uma seleção de ambientes com transição fácil para a produção na robusta plataforma HP-UX 11i

Facilidade de distribuição para novos sites na Web ou otimizado para sites com alta tráfego

Possibilita a descoberta dinâmica e interação de aplicativos e e-services através do Internet, incluindo capacidades de agenciamento

\*Disponível em versões futuras do HP-UX





## ajudando a construir uma infra-estrutura sempre ativa para seu centro de processamento de dados da internet

### Arquitetura SMP (Symmetric Multi Processing)

placas de células de 4 CPUs<sup>1</sup>

memória mínima/máxima (com DIMMs de 512 MB), com proteção ECC

compartimentos para placa de E/S de 12 slots completamente hot-swap

slots de E/S PCI completamente hot-swap

fontes de alimentação redundantes hot-swap (N+1 incluído)

ventiladores de E/S

ventiladores redundantes hot-swap (N+1 incluído)

particionamento físico (nPartitions)

largura de banda transversal

controladora de célula para largura de banda de subsistema de E/S

largura de banda de E/S

largura de banda de memória

sistema operacional

especificações físicas:

altura

largura

profundidade

peso

temperatura de operação

Tensão nominal de alimentação e frequência

taxa máxima de variação de temperatura

umidade relativa de operação

umidade relativa fora de operação

altitude de operação

altitude fora de operação

1 a 64 CPU de alto desempenho

1-16

2GB/256GB

até 16

até 192 com gabinete de expansão para E/S (128 slots de 33MHz, 64 slots de 66MHz)

12

12

8

até 16

64GB/s

2.0GB/s

32GB/s

64GB/s

HP-UX 11i

1,96 m

1.524 mm

1.220 mm

1.196 kg

15°C a 35°C

200 a 240 volts - 50Hz ou 60Hz

20°C/h

15% a 80%, a 35°C

90% a 650

0 a 3000m

0 a 4500m

<sup>1</sup>Capacidade de substituição e adição online oferecido com o HP-UX versão posterior a 11i

### para mais informações

Visite nosso site sobre os servidores HP Superdome na

Web em:

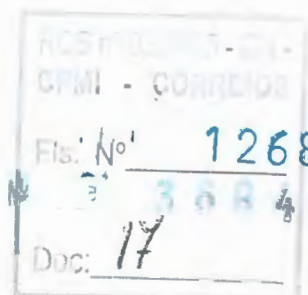
<http://www.hp.com/go/superdome>

### faça seu pedido on-line agora

As informações sobre produtos e documentação técnica da HP estão disponíveis on-line em [www.docs.hp.com](http://www.docs.hp.com)



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# Superdome Site Preparation Guide

**HP 9000 Systems**

**Eighth Edition**



**Manufacturing Part Number: A5201-10024**  
**80602**

USA

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**Eighth Edition**

June 2002

|                |
|----------------|
| REGISTRATION   |
| CPMI - CONSULT |
| File No. 1269  |
| Doc: 308       |





**Example 1-1** The customer has a 3-phase source with a Source Voltage of 208 VAC measured phase-to-phase indicating that a 4-wire PDCA is required.

**Example 1-2** The customer has a 3-phase source with a Source Voltage of 220 VAC measured phase-to-neutral indicating that a 5-wire PDCA is required.

**Example 1-3** The customer has a 3-phase source with a Source Voltage of 230 VAC measured phase-to-phase indicating that a 4-wire PDCA is required.

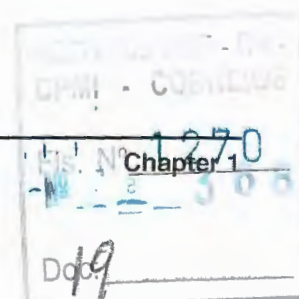
**Example 1-4** The customer has a 3-phase source with a source voltage of 415 VAC measure phase-to-phase and a measured phase-to-neutral source voltage of 240 VAC, indicating a 5-wire PDCA is required.

## Input Power Options

Table 1-6 describes the available power options:

**Table 1-6 Available Power Options**

| PDCA Product Number            | Source Type | Source Voltage (nominal)                                                         | PDCA Required | Input Current Per Phase 200-240 VAC | In-line Connector Required                                                                                                                        |
|--------------------------------|-------------|----------------------------------------------------------------------------------|---------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| A5800A Option 001 <sup>a</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-neutral, 50/60 Hz (EUR typical) <sup>b</sup> | 5-wire        | 24A Maximum per phase               | None required. Electrician must hard wire power to the PDCA <sup>c</sup>                                                                          |
| A5800A Option 002 <sup>a</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-phase, 50/60 Hz (US typical)                 | 4-wire        | 44A Maximum per phase               | None required. Electrician must hard-wire power to the PDCA <sup>c</sup>                                                                          |
| A5800A Option 004 <sup>d</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-phase, 50/60 Hz (US typical)                 | 4-wire        | 44A Maximum per phase               | In-line connector and plug provided with a 2.5-meter power cable. Electrician must hard-wire in-line connector to 100A site power. <sup>c,e</sup> |



**Table 1-6 Available Power Options (Continued)**

| PDCA Product Number               | Source Type | Source Voltage (nominal)                                            | PDCA Required | Input Current Per Phase 200-240 VAC | In-line Connector Required                                                                                                                                                                                                                                                                |
|-----------------------------------|-------------|---------------------------------------------------------------------|---------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A5800A<br>Option 005 <sup>d</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-neutral, 50/60 Hz (EUR typical) | 5-wire        | 24A Maximum per phase               | In-line connector and plug provided with a 2.5-meter power cable. Electrician must hard-wire in-line connector to 60/63A site power. <sup>c,e,f</sup>                                                                                                                                     |
| A5800A<br>Option 006 <sup>g</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-phase, 50/60 Hz                 | 4-wire        | 44A Maximum per phase               | 2.5meter UL power cord and UL approved plug provided. The customer must provide the mating in-line connector or purchase quantity one A6440A opt 401 to receive a mating inline connector. An electrician must hard wire the in-line connector to 60A/63A site power. <sup>c,f,h</sup>    |
| A5800A<br>Option 007 <sup>i</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-neutral, 50/60 Hz               | 5-wire        | 24A Maximum per phase               | 2.5meter <HAR> power cord and VDE approved plug provided. The customer must provide the mating in-line connector or purchase Quantity 1 A6440A opt 501 to receive a mating in line connector. An electrician must hard wire the in-line connector to 30A/32A site power. <sup>c,h,j</sup> |

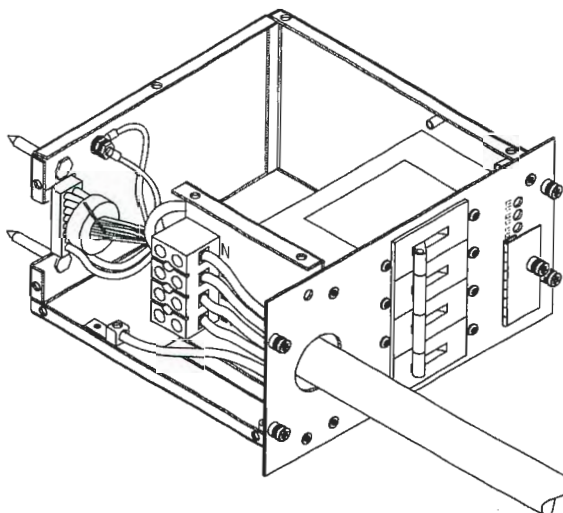
- a. Options 1 and 2 have been deleted.
- b. 415 VAC phase-to-phase is possible.
- c. A dedicated branch is required for each PDCA installed.
- d. Options 4 and 5 have been deleted.
- e. Refer to Table 1-7 for detailed specifics related to this option.
- f. In the U.S.A., site power is 60 Amps; In Europe site power is 63 Amps.
- g. Customer must provide in-line connector or purchase A6440A option 401.
- h. Refer to Table 1-8 for detailed specifics related to this option.
- i. Customer must provide in-line connector or purchase A6440A option 501.





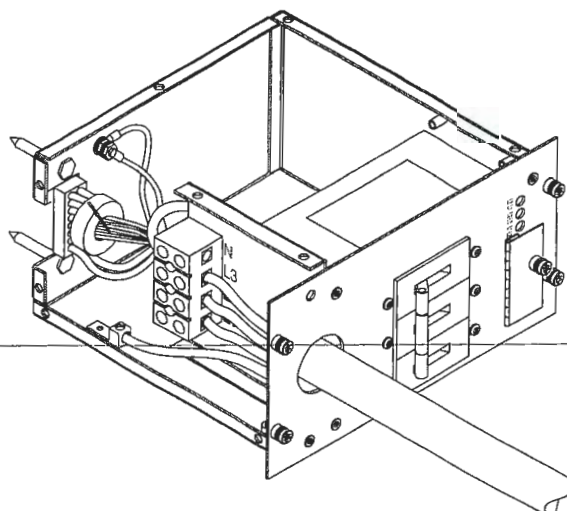
**NOTE** Figure 1-11 shows a 4-wire cable for illustrative purposes only. 5-wire cable is dimensionally identical regarding insulation and jacket removal. The only exception is the number of conductors.

**Figure 1-12 PDCA (Five Wire) Input Wiring Connections**



60SP041A  
7/13/00

**Figure 1-13 PDCA (Four Wire) Input Wiring Connections**



60SP041B  
7/13/00



## System Power Requirements

Table 1-9 and Table 1-10 list the AC power requirements for a Superdome. These tables provide information to help determine the amount of AC power needed for your computer room.

**Table 1-9 Power Requirements (without Support Management Station)**

| Requirements                                   | Value                   | Comments                                    |
|------------------------------------------------|-------------------------|---------------------------------------------|
| Nominal input voltage                          | 200/208/220/230/240 VAC |                                             |
| Input voltage range (minimum - maximum)        | 200 - 240 VAC           | Autoselecting (measured at input terminals) |
| Frequency                                      | 50/60 Hz                |                                             |
| Number of phases                               | 3                       |                                             |
| Maximum inrush current                         | 90 A peak               |                                             |
| Product Label maximum current, 3-phase, 4-wire | 44 A max                | Per phase at 200-240VAC                     |
| Product Label maximum current, 3-phase, 5-wire | 24 A max                | Per phase at 200-240VAC                     |
| Power factor correction                        | 0.95 minimum            |                                             |
| Ground leakage current (mA)                    | > 3.5 ma                | See WARNING below.                          |

**WARNING** Beware of shock hazard. When connecting or removing input power wiring, always connect the ground wire first and disconnect the ground wire last.

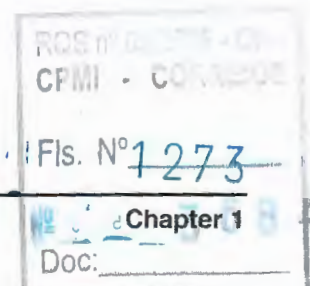
## Component Power Requirements

Table 1-9 and Table 1-10 list the AC power requirements for a Superdome. These tables provide information to help determine the amount of AC power needed for your computer room.

**Table 1-10 Component Power Requirements (without Support Management Station)**

| Power Required (50/ 60 Hz)               | VA                    |
|------------------------------------------|-----------------------|
| Maximum configuration Superdome (32-Way) | 12,196 <sup>a,b</sup> |
| Cell Board                               | 900                   |
| I/O Cardcage                             | 500                   |

- a. A number that should be used for planning to allow for enough power to upgrade through the life of the system.  
b. Use Appendix A to determine the actual values required for your system.







## Safety and Regulatory Information



For your protection, this product has been tested to various national and international regulations and standards. The scope of this regulatory testing includes electrical/mechanical safety, radio frequency interference, acoustics, and know hazardous materials. Where applicable, approvals obtained from third-party test agencies are shown on the product label.

### Notational Conventions

---

**WARNING** Warnings highlight procedures or information necessary to avoid injury to personnel. The warning should tell the reader exactly what will result from what actions and how to avoid them.

---

---

**CAUTION** A caution highlights procedures or information necessary to avoid damage to equipment, damage to software, loss of data, or invalid test results.

---

---

**NOTE** A note highlights supplemental information.

---

### Acronyms

Table 2 lists acronyms used in this document.

Table 2 Acronyms

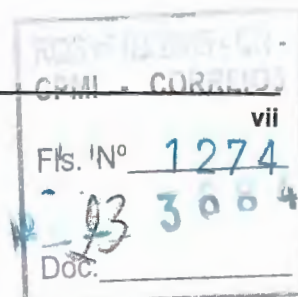
| Acronym | Definition                             |
|---------|----------------------------------------|
| PE      | Protective earth                       |
| Class 1 | Grounded equipment                     |
| PDCA    | Power Distribution Controller Assembly |
| EPSS    | Electronic Performance Support Service |

### Safety in Material Handling

---

**WARNING** Do not lift the cabinet manually. To avoid physical injury you must use a mechanical lifting device.

---





## Dimensions and Weights

This section provides dimensions and weights of the system components.

### Component Dimensions

Table 1-1 lists the dimensions for the cabinet and components of a Superdome.

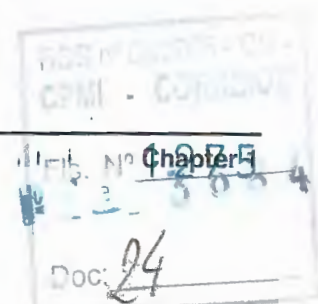
**Table 1-1 Server Component Dimensions**

| Component                           | Width<br>(cm)  | Depth/<br>Length<br>(cm) | Height<br>(cm)  | Maximum<br>Quantity per<br>Cabinet |
|-------------------------------------|----------------|--------------------------|-----------------|------------------------------------|
| Cabinet                             | 30<br>(76.2)   | 48<br>(121.9)            | 77.2<br>(195.6) | 1                                  |
| Cell board (HCB)                    | 16.5<br>(41.9) | 20.0<br>(50.2)           | 3.0<br>(7.6)    | 8 <sup>a</sup>                     |
| Cell board power<br>board<br>(HCPB) | 16.5<br>(41.9) | 10.125<br>(25.7)         | 3.0<br>(7.6)    | 8a                                 |
| I/O backplane<br>(HIOB)             | 11<br>(27.9)   | 17.6<br>(44.7)           |                 | 1                                  |
| Master I/O<br>backplane (HMIOB)     | 3.25<br>(8.3)  | 23.75<br>(60.3)          | 1.5<br>(3.8)    | 1                                  |
| I/O cardcage                        | 12.0<br>(30.5) | 17.5<br>(44.4)           | 8.38<br>(21.3)  | 4                                  |
| PDCA                                | 7.5<br>(19.0)  | 11.0<br>(27.9)           | 9.75<br>(24.3)  | 2                                  |

a. Superdome 16 Way is limited to a maximum of 4.

**Table 1-2 I/O Expansion Cabinet Component Dimensions**

| Component    | Width<br>(cm)  | Depth/<br>Length<br>(cm) | Height<br>(cm)  | Maximum<br>Quantity per<br>Cabinet |
|--------------|----------------|--------------------------|-----------------|------------------------------------|
| Cabinet      | 24.0<br>(61.0) | 53.2<br>(135.1)          | 77.3<br>(196.0) | 1                                  |
| ICE          | 17.6<br>(44.8) | 33.5<br>(82.0)           | 16.2<br>(39.7)  | 3                                  |
| I/O cardcage | 12.0<br>(30.5) | 17.5<br>(44.4)           | 8.38<br>(21.3)  | 6                                  |



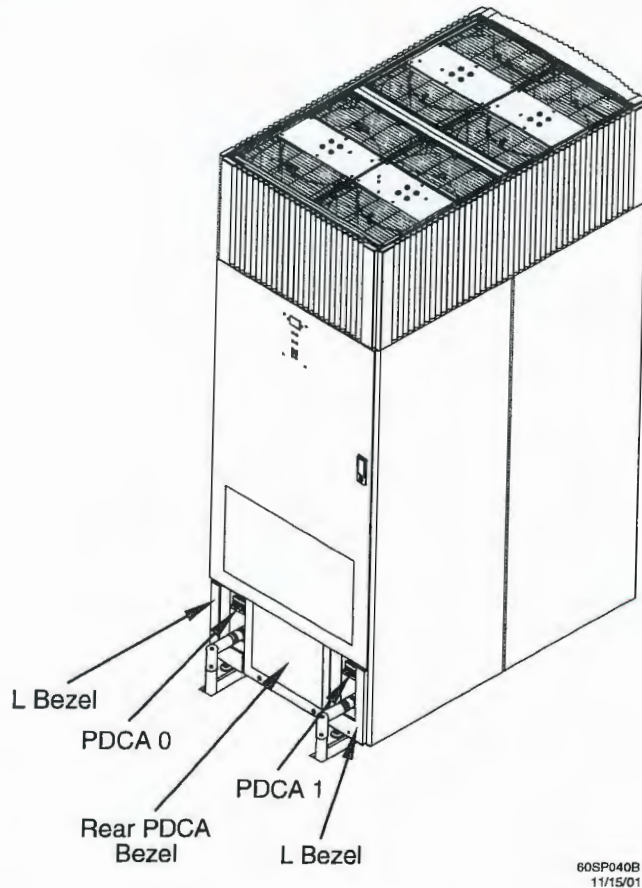


**Table 1-6 Available Power Options (Continued)**

| PDCA Product Number               | Source Type | Source Voltage (nominal)                                            | PDCA Required | Input Current Per Phase 200-240 VAC | In-line Connector Required                                                                                                                                                                                                                                                                |
|-----------------------------------|-------------|---------------------------------------------------------------------|---------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A5800A<br>Option 005 <sup>d</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-neutral, 50/60 Hz (EUR typical) | 5-wire        | 24A Maximum per phase               | In-line connector and plug provided with a 2.5-meter power cable. Electrician must hard-wire in-line connector to 60/63A site power. <sup>c,e,f</sup>                                                                                                                                     |
| A5800A<br>Option 006 <sup>g</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-phase, 50/60 Hz                 | 4-wire        | 44A Maximum per phase               | 2.5meter UL power cord and UL approved plug provided. The customer must provide the mating in-line connector or purchase quantity one A6440A opt 401 to receive a mating inline connector. An electrician must hard wire the in-line connector to 60A/63A site power. <sup>c,f,h</sup>    |
| A5800A<br>Option 007 <sup>i</sup> | 3-phase     | Voltage range 200-240 VAC, phase-to-neutral, 50/60 Hz               | 5-wire        | 24A Maximum per phase               | 2.5meter <HAR> power cord and VDE approved plug provided. The customer must provide the mating in-line connector or purchase Quantity 1 A6440A opt 501 to receive a mating in line connector. An electrician must hard wire the in-line connector to 30A/32A site power. <sup>c,h,j</sup> |

- a. Options 1 and 2 have been deleted.
- b. 415 VAC phase-to-phase is possible.
- c. A dedicated branch is required for each PDCA installed.
- d. Options 4 and 5 have been deleted.
- e. Refer to Table 1-7 for detailed specifics related to this option.
- f. In the U.S.A., site power is 60 Amps; In Europe site power is 63 Amps.
- g. Customer must provide in-line connector or purchase A6440A option 401.
- h. Refer to Table 1-8 for detailed specifics related to this option.
- i. Customer must provide in-line connector or purchase A6440A option 501.

**Figure 1-5 PDCA Locations**



## Power Cords

This section discusses the different possibilities for Superdome PDCA power cords.

### Pre-wired PDCAs Options 6 and 7

All Superdomes are delivered with the appropriate cable and plug. The mating in-line connector is not provided.

---

**IMPORTANT** Verify that the source power is correct for the appropriate PDCA wiring.

---



---

**NOTE** When installing the power connector, allow enough room for mating the connector with the plug.

---

Check the voltages at the connector prior to connecting the newly installed connector to the PDCA plug. Refer to Figure 1-7 and Figure 1-8 on page 21 for pin locations.



2-04

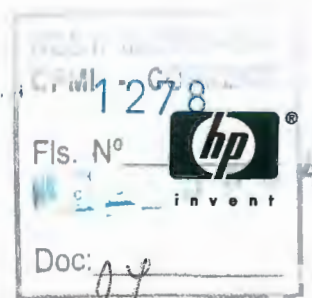


## HP-UX 11i

HP-UX advances the state of the art in enterprise UNIX®



HP-UX 11i is designed to anticipate and exceed the needs of today's enterprises as the foundation of an adaptable environment—the best enterprise UNIX just got better for both PA-RISC-based and Itanium®-based systems



In today's fast-changing world, enterprises need a computing platform that provides leading technologies, robustness, and stability. HP-UX 11i is engineered to provide these qualities.

HP-UX 11i is the best operating system (OS) to power the enterprise:

- #1 rated UNIX<sup>®</sup> operating system in the industry (DH Brown UNIX OS Review, Gartner and Butler Group—UK)

HP-UX 11i has the robustness, performance, scalability, high availability, manageability, and bulletproof security required by business-critical computing.

- Proven 64-bit technology
- Stability for the long haul, even across architectures
- Adapts automatically to changing environments—always flexible
- Highly secure to protect enterprise data from damage or theft
- Most widely used high-availability solutions in the industry

#### Power on demand to run your enterprise

Designed from the ground up to be the best commercial UNIX operating environment for the enterprise, HP-UX 11i has been the leading enterprise UNIX OS for the last 15 years, and it continues to push the software technology envelope.

Key examples of HP's technological innovation extend the partitioning continuum and the virtual server environment of HP-UX 11i with:

- Adaptive infrastructure that, upon application failover or migration (Serviceguard), automatically adjusts system resources according to defined business priorities (Workload Manager) and can automatically activate additional CPUs when needed
- Hard and soft partitioning
- Native real-time host intrusion detection
- Dynamic code translation technology providing binary compatibility across PA-RISC and Intel<sup>®</sup> Itanium<sup>™</sup> architectures

#### Industry-leading applications

HP-UX 11i supports all the applications that are critical to your business. We have the support of all the key ISV applications and middleware suppliers, such as Oracle<sup>®</sup>, SAP, I2, PeopleSoft, and SAS. This means that, whatever your need, you'll find an industry-leading application solution supported by HP-UX.

#### Middleware and application development tools

HP-UX 11i is supported by leading middleware and application development tool providers such as BEA and Rational. Add to that integrated development environments (IDEs) from leading IDE vendors including TogetherSoft, Borland, and Sitraka, and you can count on optimal application performance. HP-UX 11i offers a complete developer ecosystem with Java<sup>™</sup>, Linux/open source, and a native development environment for faster time to deployment.

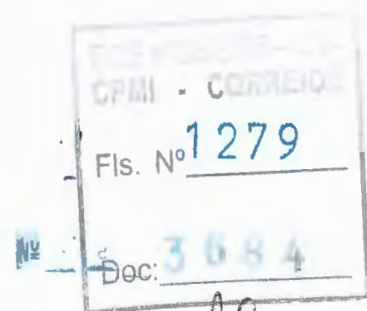
#### The foundation of your enterprise infrastructure

HP-UX 11i offers business-critical necessities at the highest level: the world's best combination of performance, performance scalability, availability, manageability, and security.

- Performance scalability: The efficient support of large numbers of processors provides near-linear performance scalability as processors are added.
- Single-system availability capabilities include online system tuning, online data backup, online component replacement, and automatic detection and de-allocation of at-risk components.
- Multi-system availability capabilities include automatic and bi-directional failover of business-critical data and applications over extended distances.
- Manageability tools provide role-based capability sets, the ability to manage hundreds of servers from a single browser-based console, and automatic re-allocation of system resources.
- Security fortifications include a host firewall and an intrusion-detection facility that can monitor multiple servers simultaneously.

The operating environment for worry-free computing, HP-UX 11i comes as part of four world-class operating environments, all fully integrated and tested by HP. These operating environments, ordered and supported as a single product, feature fast and easy installation and administration:

- The HP-UX 11i Foundation Operating Environment provides capabilities needed by most customers.





## HP-UX 11i operating environments: components

### HP-UX 11i Foundation Operating Environment

- Network drivers
- HP Apache Web server
- Ignite-UX
- Real-time host intrusion detection
- Java RTE, JDK, and JPI
- CIFS client
- CIFS server
- Servicecontrol Manager
- System Inventory Manager
- HP-UX Kernel Configuration
- Software Distributor-UX
- Netscape LDAP directory server
- PAM Kerberos
- EMS Framework
- Netscape Communicator
- Base VERITAS File System for HP-UX
- Base VERITAS Volume Manager for HP-UX

### HP-UX 11i Enterprise Operating Environment (everything in the foundation OE, plus the following)

- Online JFS 3.3
- Mirrordisk/UX
- Process Resource Manager (PRM)
- Glanceplus
- OpenView Performance Agent
- Event Monitoring Services (EMS) HA monitors

### HP-UX 11i Mission Critical Operating Environment (everything in the enterprise OE, plus the following)

- Serviceguard
- HP-UX Workload Manager
- Serviceguard NFS toolkit
- Enterprise Cluster Master (ECM) toolkit

- The HP-UX 11i Enterprise Operating Environment adds additional system management and high-availability capabilities.
- The HP-UX Mission Critical Operating Environment provides the highest levels of manageability and high availability, including the world's only goal-based UNIX workload manager.

### Hardware platforms: PA-RISC and Intel Itanium architecture

HP-UX 11i supports two industry-leading architectures—PA-RISC and the Intel Itanium architecture.

HP-UX 11i v1 is available to run on PA-RISC. This product and platform are designed to be the workhorse that handles heavy mission-critical processing loads. HP-UX 11i v1 includes the dynamic expansion of storage components, IPv4 and IPv6 (including Mobile IP), the highest levels of security certification, virtual partitioning, workload management, and the highest levels of application availability and scaling.

HP-UX 11i v2 runs on the Intel Itanium architecture. HP and Intel jointly developed this architecture, and it promises new levels of performance and value. Now, all the operating environments are available on HP-UX 11i v2 for true enterprise readiness—and they have the same look and feel as HP-UX 11i v1, available on PA-RISC. HP-UX 11i v2 scales to 64 Intel Itanium processors and runs all the HP high-availability, security, manageability, and Internet-readiness solutions. This architecture design features explicit parallel execution to derive the best possible performance from the steadily increasing number of components in microprocessors.

### Architectural compatibility

HP-UX 11i provides unparalleled compatibility across the PA-RISC and Itanium-based server platforms with complete data and application build environment (source code) compatibility. HP-UX 11i v2 even has the built-in capability to execute PA-RISC binaries on the Intel Itanium architecture via Aries dynamic code translation.

### Superior Linux compatibility

HP-UX 11i provides Linux API (application programming interface) compatibility, making it easy to develop an application using the popular, economical Linux platform and then deploy it in a mission-critical environment using HP-UX 11i. And with HP-UX 11i on Itanium-based server platforms, Linux compatibility will be extended to include binary compatibility.

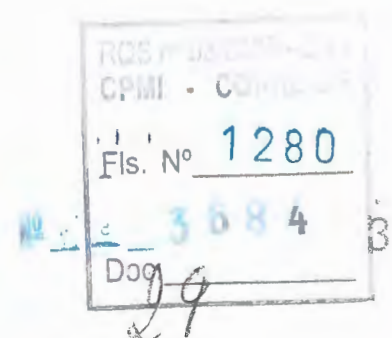
### Summary

HP-UX 11i is designed to meet, exceed, and anticipate the needs of today's enterprises as the linchpin of an always-on and adaptable infrastructure. It has the robustness, performance scalability, high availability, manageability, and bulletproof security required by business-critical computing. HP-UX 11i is also the only operating system with a clear bridge to the next-generation Intel Itanium architecture, including data, source, and even binary compatibility across the architectures.

### For more information

For more information about HP-UX 11i, please visit [www.hp.com/go/hp-ux](http://www.hp.com/go/hp-ux) or call your local sales representative.

For downloads and information on HP-UX software visit [www.software.hp.com](http://www.software.hp.com).







## P-UX 11i Foundation Operating Environment content (except where noted as add-on product)

### Scalability

- 1-64 way symmetric multiprocessing scalability (up to 128-way by the end of 2003)
- Up to 256 gigabytes of memory (increasing to 1 terabyte by end of 2003)
- 2-terabyte maximum file system and file size (increasing to 4 terabytes in 2003)
- Autopart aggregation for higher networking bandwidths (add-on product)<sup>2</sup>
- Dynamic memory page sizing
- Instant capacity on demand (iCOD—add-on product)

### Performance

- Support for high-performance PA-RISC processors
- Support for the Intel Itanium Processor Family
- MaxN threads for optimal Java performance<sup>1</sup>

### Reliability and availability

- Integrated operating environments
- Dynamic processor resilience
- Dynamic memory resilience
- Memory sparing technology
- Online file system administration (Online Journaled File System—add-on product)
- File system recovery (Journaled File System)
- Disk mirroring (Mirrordisk/UX—add-on product)
- System administrator notification of system exception conditions
- Dynamically tunable kernel parameters
- Autopart aggregation for transparent link redundancy (add-on product)<sup>2</sup>
- Serviceguard for automatic application failover (add-on product)
- Highly available SAP and Oracle9i RAC environments with Serviceguard extension products (add-on products)
- Serviceguard Manager for centralized cluster management (HP-UX and Linux clusters)
- Toolkits for rapid application deployment (add-on products)
- Dynamic failover to iCOD CPUs
- Geographically Dispersed Clusters including Disaster Tolerant Solutions and Business Continuity Solutions (Extended Campus Cluster, Metracluster, and Continentalclusters<sup>2</sup>—all add-on products)

### Security

- Hardened kernel
- Trusted users, passwords, disks, file systems, and permissions
- Public Key Infrastructure (PKI) support<sup>2</sup>
- Buffer overflow protection (transparent to applications)
- IPSec—Internet Protocol Security including OSF Application Environment Specification (AES) Encryption and Internet Key Exchange (IKE)
- Real-time host intrusion detection system
- IPFilter host firewall
- Internet daemon services
- Built-in encryption/decryption accelerators
- Netscape directory server LDAP
- LDAP-UX integration with UNIX and Windows<sup>®</sup> 2000<sup>2</sup>
- AAA (Authentication, Authorization, and Accounting) Server (RADIUS)
- Security Patch Check
- AAA Mobile Server (DIAMETER)
- Common Criteria EAL 4—CAPP Certified
- Pluggable Security modules
- Kerberos server (available for Itanium-based server)
- HP-UX Bastille (secure system lockdown)
- Install-time security lockdown through Bastille<sup>1</sup>
- Secure Shell

### Connectivity and interoperability

- Industry-standard TCP/IP
- Web Services Suite
- TCP Wrappers for network activity monitoring
- SLP (Service Location Protocol)
- ARPA Services
- IPv4, IPv6
- WU-FTP (Washington University File Transfer Protocol)
- Mobile IPv4<sup>2</sup>
- Dynamic Host Configuration Protocol v4 and v6 (DHCP)
- Berkeley Internet Name Domain (BIND) 9.2
- Dynamic Name Service (DNS)
- Sendmail 8.11.1
- Common Internet File System (CIFS)
- Internet Express

### Web application infrastructure

- HP Apache-based Web Server Suite integrated with additional HP features, including built-in Secure Sockets Layer (SSL); tuned for high performance
- BEA WebLogic Platform 7.0 including the #1 J2EE BEA WebLogic Server
- Oracle 9i Application Server<sup>2</sup>

### Manageability

- Centralized management console with GUI interface (Servicecontrol Manager)
- Networkable multi-system configuration tracking (System Inventory Manager)
- Online GUI-based dynamic kernel configuration (HP-UX kernel configuration)
- Management of hundreds of remote nodes (Centralized Web Console—add-on product)
- Role-based system administrator capabilities
- Automatic system administrator notification of exception conditions (Event Monitoring Service)
- Hardware-based partitions
- Software-based partitions<sup>2</sup> (HP-UX Virtual Partitions—add-on product)
- Graphical user interface for creating and viewing hard partitions (Partition Manager)
- Allocation of system resources (Process Resource Manager—add-on product)
- Single-system intelligent policy engine that advises or automatically acts to provide goal-based allocation of system resources across Virtual Server Environment technologies (HP-UX Workload Manager—add-on product)
- Automatic OS updates over a network (Ignite-UX)
- Automatic application software updates over a network (Software Distributor-UX)

### Linux compatibility

- GNU Tool Chain
- Over 50 Open Source tools
- Application Programming Interface (API) compatibility
- Application Binary Interface (ABI) compatibility<sup>1</sup> (available second half, 2003)
- Scanner to identify problems and recommended changes
- Extensive documentation on Best Practices on Porting to HP-UX 11i accessible online at [www.hp.com/go/LPK](http://www.hp.com/go/LPK)

### Application development tools

- COBOL
- Java
- C
- C++
- Fortran

### Cross-architectural compatibility

- Source code compatibility (including 32-bit PA-RISC applications)
- Data compatibility
- Aries dynamic code translation technology<sup>1</sup>

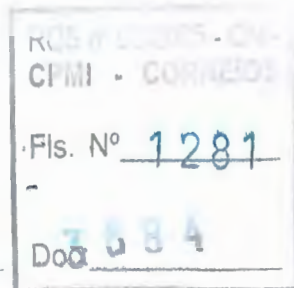
<sup>1</sup> Itanium-based systems only  
<sup>2</sup> PA-RISC-based systems only

To learn more, visit [www.hp.com](http://www.hp.com).

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# **HP JFS 3.3 and HP OnLineJFS 3.3 VERITAS File System 3.3 System Administrator's Guide**

**for HP-UX 11.00 and HP-UX 11i**

**November, 2000**

**HP 9000 Systems**



**Manufacturing Part Number: B3929-90011  
E1100**

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United States

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The VxFS File System  
**JFS 3.3 and OnLineJFS 3.3 Product Availability**

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## **JFS 3.3 and OnLineJFS 3.3 Product Availability**

HP JFS 3.3 and HP OnLineJFS 3.3 are available for HP-UX 11.00 and later systems. You can download JFS 3.3 for HP-UX 11.00 for free from the HP Software Depot (<http://www.software.hp.com>), or you can request a free JFS 3.3 CD from the Software Depot. You can purchase HP OnLineJFS 3.3 (product number B3929CA for servers and product number B5118CA for workstations) for HP-UX 11.0 or HP-UX 11i from your HP sales representative. JFS 3.3 is included with HP-UX 11i systems.





## A4902A- HP Rack System/E, 41U, quartz color A4902D- HP Rack System/E, 41U, graphite color ■

### Technical Data

#### Save valuable floor space with the vertically extendible HP Rack System/E

Designed and built to the highest HP quality standards, the Rack System/E delivers leading edge protection in the simplest form. Ease of use, integration and installation characterizes this 41U rack that is comprised of:

- 63% Perforated, locking rear door (ordered as A5213AZ/A5213DZ)
- Bolt-on front/back anti-tip feet
- Numbered columns
- Fully perforated top cap
- 3-inch urethane casters
- Leveling feet
- Side panels

Multiple racks may be tied together to create continuous data center rack space. Individual racks may be expanded an additional 8Us of vertical space.

#### Standards

Conforms to the Electronic Industries Association (EIA) standard 310-D. It is a Type A cabinet with 41U of vertical mounting space. One 'U' is equal to 44.45 mm (1.75 in).

Customer must order rear door, A5213AZ(quartz)

A5213DZ (graphite)

#### Features

- Ability to move and ship fully integrated racks
- Optimized ventilation with fully perforated top, and rear door
- Extendibility can add 8Us of vertical mounting space
- Easy, bolt-on (front and back) anti-tip feet
- Numbered 12-gauge steel columns for easy installation and secure racking of up to 907 kg (2000 lbs) of equipment
- Columns include threaded inserts (AVKs) at strategic locations for quick installation of common accessories such as the tie kit, front door and PDUs

#### Shipping/Setup

- Can fit through most doorways around the world
- Packaging designed for integrated rack shipment
- Self-tuning pallet adjusts for variable integrated rack weights
- Shipping pallet includes ramp for easy set-up

Product Number  
A4902D



#### Tools required for setup:

- Torx T25 screwdriver
- Phillips #2 screwdriver
- 13mm Socket wrench

#### Warranty

One- year replacement

RFID - CPMI - CPMI

Fls. N° 1284

3084

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## Specifications

*Color (A4902A- quartz)*

**Columns and base:** Slate gray

**Top:** Quartz gray

**Side panels:** Quartz gray

**Rear door:** Quartz gray

*Color (A4902D- graphite)*

**Columns and base:** Graphite metallic

**Top:** Graphite metallic

**Side panels:** Graphite

**Rear door:** Graphite metallic

## Material

**Columns:** 12-gauge, cold-rolled steel

**Base:** 10-gauge, cold-rolled steel

**Top cap:** 18-gauge, cold-rolled steel

### A4902D

A 1961.1 mm

B 1824.7 mm

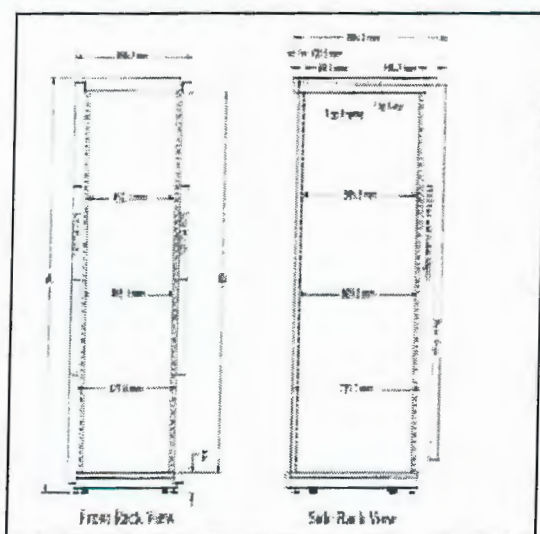
C 111.2 mm

### A4901D

A 1605.5 mm

B 1469.1 mm

C 111.2 mm



## Weight

**Rack (empty):** 100.45 kg (221 lbs)

**Rack (empty) on shipping pallet:**  
169.3 kg (372.5 lbs)

**Rear door (unpacked):** 10.68 kg (23.5 lbs)

**Anti-tip foot:** 16.14 kg (35.5 lbs)

## Supported weight

**Load capacity:**

On shipping pallet: 816 kg (1800 lbs);

Off shipping pallet: 907 kg (2000 lbs)

**Casters rating:** 453.6 kg (1000 lbs)  
per caster

\* Dimensions are for reference only

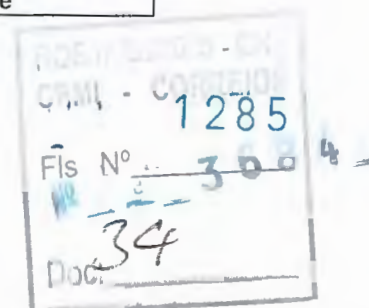
## Optional Accessories

### Related Products

Other sizes available are:

- **A4901A (quartz)**
- **A4901D (graphite)**
- 33U of vertical mounting space, includes side panels, bolt-on (front and back) anti-tip feet
- **A4900A (quartz)**
- 25U of vertical mounting space, includes side

|                   |                                                           |
|-------------------|-----------------------------------------------------------|
| J1506A/<br>J1506D | Side Panel Kit (1 kit per rack) included in standard rack |
| J1509A/<br>J1509D | Front Door: Perforated, lockable                          |
| J1512A/<br>J1512D | Tie Kit                                                   |
| J1514A/<br>J4387A | Filler Panels (set of 6)                                  |
| J1518A/<br>J1518D | Keyboard Kit, retractable                                 |
| J1519A/<br>J1519D | Monitor Kit                                               |
| J1520A/<br>J1520D | Plain Shelf, static                                       |
| J1521A            | Lift Hooks (set of 4)                                     |
| J1522A            | Mounting Hardware                                         |





hp-ux 11i  
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# *hp-ux 11i operating environments enterprise release*

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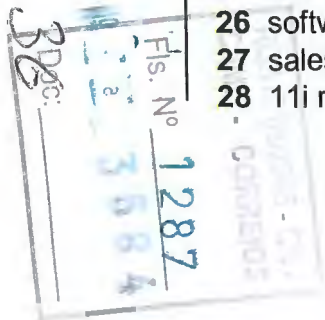
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hp-ux 11i  
oes

# hp-ux 11i operating environments benefits

## greatly simplified software deployment

- Only one reboot needed to install the Operating Environment (OE) of your choice
- No codewords are necessary to access any of the functionality/application products resident on the OE media
- Comprehensive offering of Network, Mass Storage, and I/O Drivers available during install process
- Online Diagnostics loaded during cold install

## simple to purchase license

- Each OE license product contains licensing for the base HP-UX O/S and all of the included HP applications

## attractive pricing

- Pricing of the OE licenses reflects a built-in advantage over purchasing individual OE components separately

## published testing results

- Testing results of application products in the OEs will be published on docs.hp.com for worldwide access both inside and outside HP

## simple to purchase software support

- Simplification in Software Support ordering and contract administration has been achieved in parallel with the introduction of HP-UX 11i Operating Environments
- For more information, please visit: <http://nternet.fc.hp.com/catscore/communic.htm>



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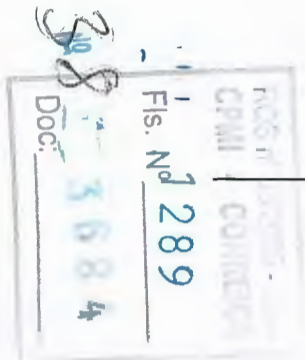


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hp-ux 11i  
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# getting to know hp-ux operating environments

- The following series of slides will show how HP-UX 11i Operating Environments are constructed from pieces of the total 11i Software Solution



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hp-ux 11i  
oes

# getting to know hp-ux operating environments

## design overview

- Each of the Commercial Server Operating Environment license and media products are designed to be supersets of one another
- The TCOE represents a singular solution for Technical Servers and Workstations
- Base HP-UX and Application content common across all four OEs is synchronized with the same revision level

## commercial servers

### 11i Mission Critical Operating Environment

Applications specific to the  
Mission Critical OE

### 11i Enterprise Operating Environment

Applications specific to the  
Enterprise OE

### 11i Operating Environment

Applications specific to the  
11i OE

Customer Selectable Software  
for Commercial Server OEs

## technical servers and workstations

Applications specific to the  
Technical Computing OE

### 11i Technical Computing Operating Environment

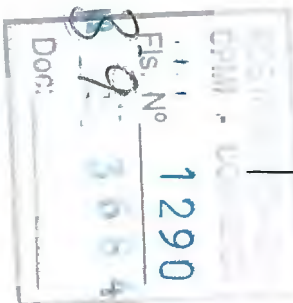
Customer Selectable Software  
for the Technical Systems OE

Functionality in Base HP-UX (version B.11.11)



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hp-ux 11i  
oes

# getting to know hp-ux operating environments

- HP-UX version B.11.11 is at the heart of each HP-UX 11i Operating Environment and provides the sound foundation onto which each OE Solution is built
- Two global base HP-UX bundles are delivered at B.11.11 and are differentiated by bitness: HPUXBase64 for 64-bit capable hardware, and HPUXBase32 for 32-bit capable hardware

**HP-UX 11i Core Functionality**  
HPUXBase64 (64-bit)  
HPUXBase32 (32-bit)



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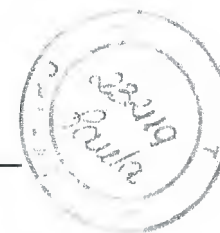
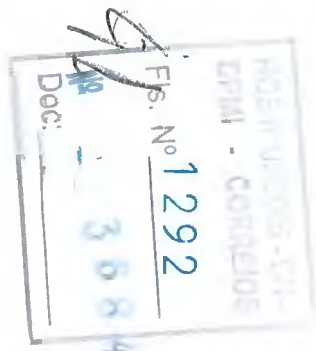
# 11i (B.11.11) operating system features

## major new features of hp-ux 11i (version B.11.11 and future)

- Built-in Unlimited Simultaneous User Level License for HP-UX
- Includes Linux APIs
- Introduces online replacement and addition of I/O cards for N-Class and L-Class servers
- Fully supports the low-end A500 and A400 servers, designed for ISP operation, where performance per rack and serviceability are keys
- Supports L2000 and L1000, an economical N-Class server with an upgrade path to IA-64
- Supports the V2500/V2600 platform
- Offers VERITAS (JFS 3.3) file system support
- Has improved and expanded file system support from CacheFS
- Supports NFS over TCP/IP
- Adds systems management improvements (PRM enhancements)
- Offers secure defaults and intrusion detection
- Has extensive performance tuning for one-way to 32-way configurations

## more information on the www

- HP-UX 11i Quick Reference Card  
<http://esp.cup.hp.com:2000/nav24/ppos/358/hPUX/11iQRC.pdf>
- 11i Technical Overview paper on ESP  
<http://esp.cup.hp.com:2000/nav24/ppos/358/hPUX/technOverv/techOV.doc>



hp-ux 11i  
oes

# getting to know hp-ux operating environments

- Functionality complementary to base HP-UX is included in a separately constructed, always-installed bundle called HPUXBaseAux
- For B.11.11, Software Distributor (swdist) moves from "core" to this separate bundle (a primary reason why HPUXBaseAux is always-installed)
- The entire software contents (product.filesets) of the following products are wholly contained within the HPUXBaseAux bundle: DMI & SCR, EMS Framework, ObAM5, Partition Manager, and Software Distributor (swdist)
- The following products are available on the 11i Application Release media:
  - EMS Framework, product B7609BA
  - DMI & SCR, product B6816AA
  - Partition Manager, product B6826AA

## Contents of HPUXBaseAux

DMI&SCR

EMS Framework

ObAM5

Partition Manager

Software Distributor

## HP-UX 11i Core Functionality

HPUXBase64 (64-bit)

HPUXBase32 (32-bit)



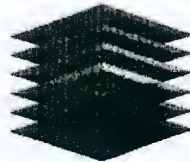
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December 11, 2000

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*Single-System High Availability  
at the Forefront in Hewlett-  
Packard's Server Line*



October 2001

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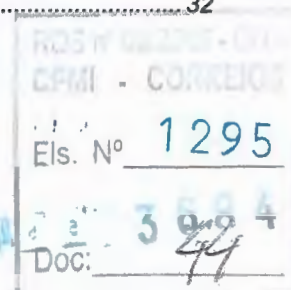
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## *Single-System High Availability at the Forefront in Hewlett- Packard's Server Line*

### **EXECUTIVE SUMMARY**

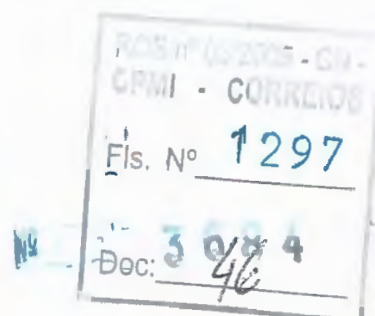
A vendor's ability to deliver high availability is key to the vendor's differentiation in the e-commerce world and other venues where downtime is dead time. Other variables such as technical excellence and cost-of-ownership are, of course, also important. However, given the business costs and other costs of a disruption, the pressure from corporate and information technology management, system administrators, and users the overwhelming factor is to have their systems highly available.

Hewlett-Packard has long recognized the need for highly available servers – even before the current industry emphasis on such capability. To provide its customers with the most available servers, HP has followed the guidelines of its internally developed high-availability infrastructure architecture. This infrastructure is modeled in the form of a tree with three main branches, each with three sub-branches. This is no mere theoretical construct; the sub-branches are populated with HP and third-party products that meet the practical, operational high-availability needs of HP customers.

For HP, server high availability is a multifaceted, holistic effort guided by a prime directive that the design-in of high availability into the server software and hardware architecture is fundamental. This principle results in literally hundreds of features and functions in each HP server that are dedicated to providing specific benefits to the server administrator and user.

As a result of HP's ability to implement and deliver on this philosophy, D. H. Brown Associates, Inc. (DHBA) believes that HP's high-availability architecture tree and its component parts provide an industry-leading model for the server community. The model is comprehensive and feature-function rich. This white paper provides an overview of this tree, its branches and sub-branches, and an overview of the component parts and their functionality.

After reading this material, the existing or potential HP server administrator or user, and numerous other interested parties in the IT community, will have a fundamental understanding of HP's high-availability efforts, why they are industry-leading, and what kind of benefits they offer.







## INTRODUCTION AND OVERVIEW

A vendor's ability to deliver high availability is key to the vendor's differentiation in the e-commerce world and other venues where downtime is dead time. Other variables such as technical excellence and cost-of-ownership are, of course, also important. However, given the business and other costs of a disruption, the pressure from corporate and information technology management, system administrators, and users the overwhelming factor is to have their systems highly available.

Hewlett-Packard has long recognized the need for highly available servers – even before the current industry emphasis on such capability. To provide its customers with the most available servers, HP has followed the guidelines of its internally developed high-availability architecture infrastructure. This infrastructure is modeled in the form of a tree with three main branches, each with three sub-branches. This is no mere theoretical construct; the sub-branches are populated with HP and third-party products that meet the practical, operational high-availability needs of HP customers.

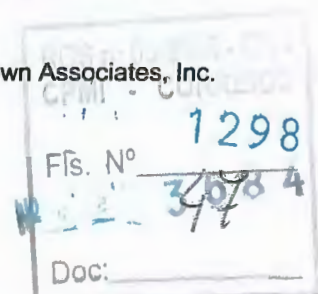
HP's "always on" vision includes Single-System High Availability (SSHA) and Cluster HA solutions. This white paper focuses on SSHA functionality and solutions.<sup>1</sup> There is, of course, much more to consider in order to provide high availability that is not discussed herein. For example, customers should keep in mind not only the overall HA solutions being offered by HP products (delivering both single-system and cluster HA), but also support services (such as Business Continuity Support or Critical System Support), IT processes support (consulting, disaster-recovery services, etc.), and partnerships with third parties (e.g., Oracle, Cisco, SAP) for fully integrated high-availability solution offerings.

For HP, server high availability is a multifaceted, holistic effort guided by a prime directive that the design-in of high availability into the server software and hardware architecture is fundamental. This principle results in literally hundreds of features and functions in each HP server that are dedicated to providing specific benefits to the server administrator and user.<sup>2</sup>

The conceptual and practical thinking behind the development of the tree components that provide these hundreds of features and functions is detailed in this white paper. After reading this material the existing or potential HP server administrator or user will have a fundamental understanding of HP's high-availability efforts, why they are industry leading, and what kind of benefits they offer.

<sup>1</sup> MC/ServiceGuard is a specialized software facility that provides clustering and high-availability functionality for HP 9000 computer system products. MC/ServiceGuard is not discussed here.

<sup>2</sup> These hundreds of features and functions are examined in detail elsewhere. Information about them is available from HP or DHBA.

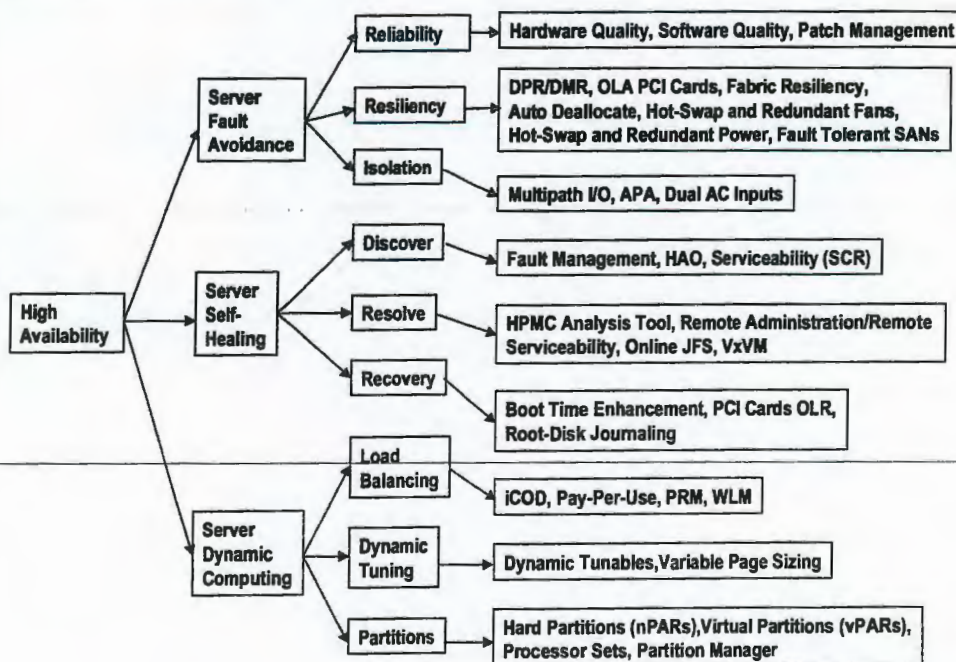


HP breaks down its high-availability architecture concept into a tree structure with three main branches. These three main branches are each further broken down into three sub-branches (Figure 1: HP's Tree-Based Server High Availability Architecture). The main branches and sub-branches are:

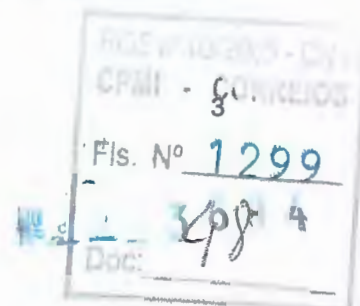
- Server Fault Avoidance
  - Reliability,
  - Resiliency, and
  - Isolation.
- Server Self-Healing
  - Discover,
  - Resolve, and
  - Recover.
- Server Dynamic Computing
  - Load Balancing,
  - Dynamic Tuning, and
  - Partitioning.

The nine sub-branches are further broken down into multiple component parts per sub-branch as shown in Figure 1. This paper provides an overview of the 33 components made available in the nine sub-branches<sup>3</sup> and examines their administrator and user value.

**FIGURE 1:**  
*HP's Tree-Based Server  
High Availability  
Architecture*



<sup>3</sup> The number of components will continue to grow.







## HIGH AVAILABILITY: SERVER FAULT AVOIDANCE

The sole purpose of HP's HA feature set is to address the real causes of customer downtime, as determined by actual field data. HP knows that delivering always-on solutions requires more than just delivering laundry lists of HA features with limited utility, or worse, HA features riddled with so many caveats as to render them useless. The real HA measure is how much uptime is seen by customer applications.

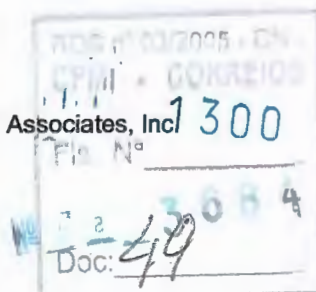
Avoiding faults is critical as the first line of defense to deal with server downtime causes. Crashing a system first, then dealing with recovery is not the optimum solution. Dealing with recovery, while important, should not be a primary HA strategy. Avoiding faults in the first place is key.

The term "failure avoidance" should not be confused with other schemes that provide standby hardware to be swapped in after a system crash has occurred. Sometimes, a server that is described as having 100% hardware redundancy in reality only allows for standby hardware to be swapped in – a less desirable condition. For HP, redundancy means that sufficient resources are available online to restore the system to proper operation without any application interruption.

HP's field data has shown that the primary causes of server hardware and/or software downtime is the following (roughly in order of occurrence):

1. main memory failures,
2. cache failures,
3. power supply failures,
4. I/O card errors,
5. sockets/interconnects,
6. networking/mass storage,
7. software panics,
8. ASIC/Backplane failures, and
9. clock failures.

The top seven items in the above list amount to 98% of downtime causes. Main memory and cache memory amount to about 50% of the fault-generation cases. Knowing this distribution, HP has addressed these failure sources to deliver the maximum availability with the features and functions described in the sections that follow.



## HIGH AVAILABILITY: SERVER FAULT AVOIDANCE – RELIABILITY

Reliability is the first sub-branch in the Server Fault Avoidance main branch of HP's availability tree. A reliability metric, and there are many, measures failures in a system, both hardware and software related. A highly reliable system has few failures of any hardware or software component (due to either planned or unplanned downtime).

HP pays major attention to its server reliability through robust system-architecture design, careful vendor and component selection, sophisticated manufacturing processes, and elaborate, time-tested software qualification and design processes. At the user production site, both hardware and software techniques work around failed components to reduce maintenance, the number of service calls, and warranty costs.

To better understand HP's reliability work, the next sections examine the issues of hardware and software quality. Then, patch management is detailed.

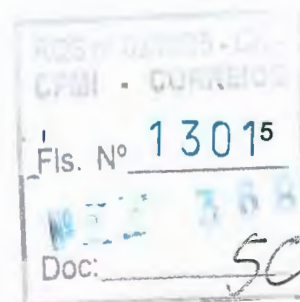
### RELIABILITY – HARDWARE QUALITY

The first step in fault avoidance is using high-quality components in a server design. Toward this end, HP has implemented sophisticated field tracking processes that record and analyze all system and component failures in order to detect trends and provide feedback to allow the HP hardware design laboratory to build more robust future products. As a result of having this data, HP systems have been designed from the ground up to address these detected failure sources.

HP uses a number of hardware quality-ensuring measures designed to deliver reliable, high-quality servers. These measures include,

- a modular architecture to minimize server component count;
- a system design and qualification methodology that pushes the hardware to its maximum while running customer applications;
- provision for extensive component supplier qualification;
- use of high-volume blowers to maintain ASIC and CPU junction temperatures as cool as possible;
- vendor-selection processes that require demonstrated high-quality manufacturing processes, as well as demonstrated high reliability;
- vendor requirements to execute ASIC burn-in tests, which result in ten times the ASIC quality as compared to standard components;<sup>4</sup> and
- boards and systems receive HP burn-in, running customer applications, a process that weeds out early life failures.

<sup>4</sup> In contrast to non-burn-in.







#### RELIABILITY – SOFTWARE QUALITY

The best way to examine software quality is to directly query the software user. Who knows better than the user what is really going on as far as software quality is concerned? With the goal of going right to the user source for information, HP has conducted software quality studies at the Interex (HP Users Group) meetings.<sup>5</sup> As a result of HP's software quality emphasis, in the three years that the Interex study has been conducted, customer satisfaction with HP software quality and reliability has grown from 70% to 80%.

In a separate, randomized study this year (January 2001), overall satisfaction with HP-UX-based products is very strong with 71% of respondents indicating they are very satisfied, 23% indicating moderate satisfaction, and very few (less than 6%) indicating dissatisfaction.<sup>6</sup>

#### RELIABILITY – PATCH MANAGEMENT

HP employs a two-stage patch-testing process. When a defect or escalation is reported, it is important to respond quickly (especially if the defect is critical). This necessity for fast response must be balanced with the need for a high-quality patch whose delivery must not be delayed.

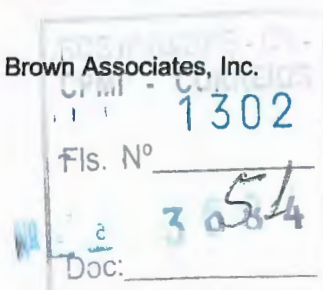
Understanding these criteria, HP has two patch models – reactive patch and proactive patch. The former is designed to solve an existing problem with timeliness as the highest priority – fix the problem the first time in a reliable manner and minimize change. There is some risk here since the fix speed may compromise complete patch testing.

A proactive patch is designed for preventive maintenance. With such a patch, reliability (rather than timeliness as is the case with the reactive patch) is most important. A proactive patch is a stable, tested patch. It is planned in advance, issued at defined times, and fully tested. The changes that occur because of the proactive patch are evaluated in advance and fully understood. Risk is minimized by full testing although large proactive patch use may still involve some risk.

A patch is put through a fix-creation process, a peer review, and the standard functional, and reliability testing for the subsystem that involves the patch. HP then releases the patch with a one star rating to indicate that it is for reactive patching only and to use it only if the problem is evident. One star patches are used only when two star or three star patches are not available.

<sup>5</sup> The study is conducted annually and the 2001 result included 2,533 participants who spend \$9.3 billion on IT products (\$3.3 billion on HP products).

<sup>6</sup> World-class performance on surveys such as this exceeds 50% in the very satisfied category, 90% in both the very and moderately satisfied category, and is 10% or less in the dissatisfied category. By far (48%), the primary reason that customers cite for being very satisfied with HP-UX products is high system availability. (HP support comes in second at 18%.)



A two star patch is a proactive patch that has met certain test criteria but is not fully qualified. It is to be used only when a three star patch is not available. The two star patch's probability of recall is typically 60% lower than that of a one star patch.

The patch then continues to be put through system testing in the HP enterprise patch test center, which duplicates the most common customer environments. Here it is bundled with other patches and the entire set is put through rigorous interoperability tests. This process typically takes five to eight weeks. At the successful conclusion of this testing the patch is rated three stars. Three star patches have 80% fewer recalls than do one star patches.

## HIGH AVAILABILITY: SERVER FAULT AVOIDANCE – RESILIENCY

Even the highest quality components can, at some point, fail. Because of this fact, it is important to understand the failure rates of all components, understand the failure modes, and then design HA features to deal with these failure modes to minimize application downtime.

These points are captured in Resiliency, the second sub-branch of Server Fault Avoidance. Resiliency is the ability to keep running in the presence of faults so that applications see no downtime due to hardware or software failures. In a resilient server, work-arounds for problems are developed through a combination of redundant or self-correcting components and software techniques to enable transparent failover to a working component or system.

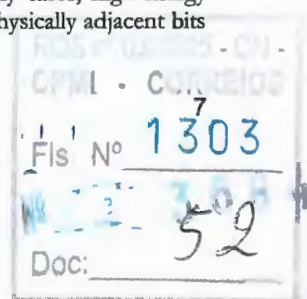
Good examples of resiliency technology are Dynamic Processor Resilience (DPR) and Dynamic Memory Resilience (DMR). The section that follows explains DPR and DMR. Subsequent sections provide explanations for the other five Figure 1 Resiliency components.

### RESILIENCY – DYNAMIC PROCESSOR AND DYNAMIC MEMORY RESILIENCE

Dynamic Processor Resilience (DPR) permits a server to be resilient to the CPU cache errors that are a major contributor to system downtime. In an HP server with DPR, if a CPU generates cache errors at a predetermined, unacceptable rate, the CPU is automatically deconfigured, online. Moreover, to solve the problem, the server can be configured to automatically swap-in a spare CPU.

HP's server CPU caches are protected from single-bit hard errors and random soft errors generated from cosmic rays and other intermittent error-generation sources. Furthermore, the HP CPU has a physical cache layout that reduces the chance of a multi-bit error due to a random cosmic ray strike.<sup>7</sup>

<sup>7</sup> Cosmic ray strikes affect memory arrays by removing the charge on specific cell locations. In many cases, high-energy strikes can affect multiple physically adjacent bits. It is important to make sure (architecturally) that physically adjacent bits do not show up in the same logical cache line. Certain competing systems do not do this.







While CPU cache-error generation is an issue, main memory failure is the hardware event that causes the most customer downtime. HP addresses this failure mode with four features:

- memory chip spare,
- dynamic memory resilience (DMR),
- hardware memory scrubbing, and
- automatic deconfigure on reboot.

Memory chip spare is the server's ability to continue to run in the face of any single, or multi-bit chip DRAM error. HP server system DRAMS are set up as N+1 per set of 128 DRAMS per memory word since the firm believes this architecture is essential in the design of reliable memory systems. Systems without this functionality may fail at a high rate compared to HP systems with this functionality.<sup>8</sup>

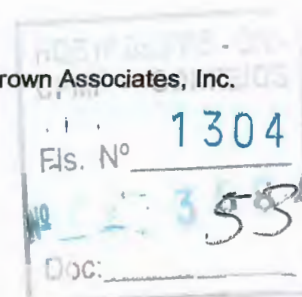
Certain vendors deal with multi-bit SDRAM failures by accepting the fact that they will occur. This means that a scheme is used that supports failure detection, but not correction. This scheme, while it may be acceptable in low-end markets, is a dangerous choice for those customers who bet their business on not having any downtime. Systems based upon this corner cutting are at high risk to fail due to memory problems.

DMR represents the server's ability to online (i.e., while the application is running) deallocate failed memory pages. DMR is similar to DPR in that if a memory location is problematic (i.e., exhibits persistent errors), that memory will be online deallocated with no visible-to-the-user impact. HP believes that, as long as the server is shipped with adequate memory, it is likely that a failed memory will never have to be replaced over the product life. This likelihood results in a significant planned downtime reduction compared to non-DMR systems.

Aiding in this process is the hardware memory scrubber (available in the rp8400 and Superdome servers). The scrubber automatically corrects and clears single-bit errors in every memory line that is read by the CPUs. This is an advantage over most software-based scrubbers, which are limited to scrubbing only that memory which is not locked down by the operating system or an application.

Automatic deconfigure on reboot is the system's ability to dynamically remove failing memory during boot from the available memory pool without halting the entire system.

<sup>8</sup> HP has seen this at customer sites that use both the HP architecture and other architectures.



#### **RESILIENCY – PCI CARDS ON-LINE ADDITION (OLA)**

The PCI Cards OLA capability, the second Figure 1 Resiliency component, enables the online addition of PCI I/O cards to HP-UX-based servers designed to support this feature.<sup>9</sup> The server hardware uses a standard per-PCI slot power-control technology combined with operating-system support for the PCI Card OLA feature to allow the addition of a new card without affecting other components or requiring a reboot.

The OLA feature enhances server high availability by reducing both planned and unplanned downtime since the server can still run while an I/O adapter is added and configured. All HP PCI cards (including Gigabit Ethernet, Fibre Channel, SCSI, Term I/O) and their drivers support this feature.

As just noted, OLA can provide additional I/O resources and new I/O technology without a reboot. This means that administrators can add resources on demand, based on workload. As a result, the need for the difficult exact deployment planning of I/O cards in a server is reduced. Additional I/O cards can also increase the server availability by providing alternative failover paths.

#### **RESILIENCY – FABRIC RESILIENCY**

Fabric Resiliency is the third component of the Figure 1 Resiliency sub-branch. A fabric ties CPU and memory resources together. Moreover, if the server has partitions,<sup>10</sup> the partitions may share this fabric. If the fabric is not resilient, the server will suffer decreased uptime. Of course, from the server-functionality point-of-view, if the fabric is not resilient, neither are the server partitions. HP addresses fabric resiliency through four technologies:

- highly reliable fabric ASICs,
- redundant and hot-swappable DC-DC converters,
- hardware isolation between crossbar chips, and
- full end-to-end error correction.

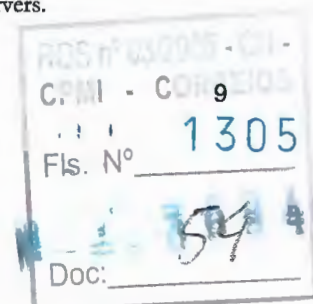
HP's fabric backplane ASICs are manufactured and tested with processes that result in a ten-fold reliability increase over comparable ASICs not similarly manufactured with such expensive components and procedures. The result in the field is virtually zero backplane ASIC failure.

~~The DC-DC converters that power ASICs and other backplane chips are fully redundant and hot swappable.~~

This further adds to system availability, and significantly reduces shared failure modes between partitions. Only HP provides redundant power for backplane components; others provide redundancy only for clocks, which rarely fail.

<sup>9</sup> As of September 2001, this includes N-class, L-class, Superdome, and the newly released rp8400 servers.

<sup>10</sup> Different partition types are discussed later in this white paper.







The HP server backplane is built from crossbars with point-to-point connections. In a properly configured server, communication traffic in a partition is restricted to that partition so that there is no link sharing. Since each crossbar chip port is independent, the cells of different partitions coexist without affecting each other.

In competing bus-based servers, all domains participate in the communication coherency scheme and share address busses. This means that, in these systems, all domains are linked in some manner and there may be shared failure modes that can contribute to increased, unplanned downtime.

Figure 2 in the Appendix and its associated explanatory text provide a simplified example of both the HP crossbar-based backplane and a competing vendor's bus-based backplane, and how the HP approach provides superior high availability.

#### **RESILIENCY – AUTO-DEALLOCATE**

Nearly all HP server hardware is redundant.<sup>11</sup> The result is virtually zero failures that would keep a partitionable system down waiting for parts. If a component or entire subsystem fails self-test, for example, the server will automatically deallocate the faulty hardware, continue to boot, and run the application when the server partition (or server) comes up.

Auto-deallocate applies to CPUs, memory, fabric links, and I/O. Hardware redundancy accommodates PCI card I/O failures, the complete PCI chassis, or the connected cell board. With a properly configured I/O system, there is no failure that causes I/O loss.

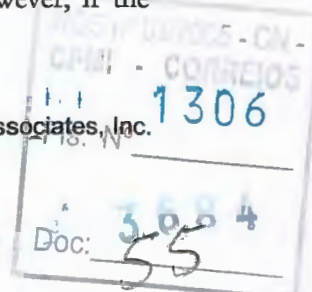
#### **RESILIENCY – HOT SWAP AND REDUNDANT FANS**

All HP servers have redundant and hot swap fans. This design is fundamental to ensure the best server reliability. Certain HP servers, e.g., Superdome, have such high-capacity fans and blowers that sufficient airflow is provided for all conditions even in the presence of a failure. The new high-density HP rp8400 server is even more sophisticated. It takes a unique approach by adding special CPU fans to keep the CPUs cool even in the small rp8400 form-factor.

Heat is the mortal enemy of components that need to be as reliable as possible, so the heat issue in a high-density system requires special consideration. The rp8400's two-level cooling scheme offers the required cooling capacity at nominal cost. To accomplish this feat, the rp8400 uses turbo-cooler fans that draw air directly into the heat sinks of the critical CPU and cell VLSI chips.

At the extreme server operating-temperature ranges, the turbo-cooler fans maintain internal temperatures well below the design maximums. Under normal ambient operating conditions, turbo-coolers are not required. However, if the

<sup>11</sup> Minor exceptions include clocks and power-control circuitry that rarely fail (rated at a 1% per year failure rate).



23404  
Paula

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turbo-coolers run, the silicon operates well within its maximum lifetime thermal window. Again, the result is increased overall server-system reliability.

To further improve reliability, manageability software monitors the rp8400 fan speeds, including turbo-cooler fans. This software detects the first slowdown hint associated with fan bearing wear-out. As a result, the system administrator has an early alert (at least 100 hours) to the remote possibility of a turbo-cooler fan failure.

#### **RESILIENCY – HOT SWAP AND REDUNDANT POWER**

The front-end power supplies in all HP servers are fully redundant and hot swappable. The Superdome (high end) and rp8400 (midrange) servers also have redundant and hot swappable backplane DC-DC converters. The latter feature fully removes power conversion as a cause of multi-partition crashes. The rp8400 midrange server also has redundancy in many other areas of power conversion. This also contributes to its increased uptime.

#### **RESILIENCY – FAULT TOLERANT SANs**

Fault Tolerant SANs are the seventh, and last component of the Figure 1 Resiliency sub-branch. HP uses Fibre Channel technology for its SAN solutions and supports three Fibre Channel topologies – point-to-point, arbitrated loop, and switched-based fabric.

For the arbitrated-loop architecture, HP servers can interoperate with switches or hubs that have the Emulated Private Loop (or Quick Loop) feature. These switches regenerate the signals on each port (unlike passive hubs) and thus can stop bad signals or faults. For the switched fabric topology, links are point-to-point so that faults are inherently isolated.

HP-UX supports multipath I/O in both of the just-described fibre topologies. Such I/O can be used to ensure that there can be redundant links to a target and the target can be reached even if there is a fault in a SAN link or port. In all of these cases, administrators can use the fault tolerant and the multipath I/O technology to configure their SANs for maximum availability.

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### **HIGH AVAILABILITY: SERVER FAULT AVOIDANCE – ISOLATION**

Isolation is the third sub-branch of the Server Fault Avoidance branch of the HP high-availability tree. For HP, isolation means, for example, that each Superdome I/O slot has an independent I/O channel or PCI bus. This architectural design supports improved I/O performance since each PCI card can run at its full PCI speed and, at the same time, enjoy fault isolation.

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When this capability is coupled with HP's Auto Port Aggregation (APA),<sup>12</sup> Logical Volume Manager (LVM),<sup>13</sup> and AutoPath, then Ethernet network links such as 100BT and Gigabit Ethernet, and mass storage links such as SCSI and FC can provide automatic failover, load balancing, and isolation from card or I/O bus failures. This capability contributes mightily to minimize application downtime.

#### ISOLATION – MULTIPATH I/O

A multipath I/O feature allows accessibility to a storage device or networking end-node through multiple paths. The access can be simultaneous (in an active-active configuration) or streamlined (in an active-passive configuration).

In a mass storage configuration, a disk LUN (Logical Unit Number) is reached from a controller via various switches or ports (i.e., for Fibre Channel) or via split cables (i.e., for SCSI). In a networking configuration (i.e., switched 100BT and Gigabit Ethernet), connectivity between two hosts may be achieved through various switches, routers, or controllers.

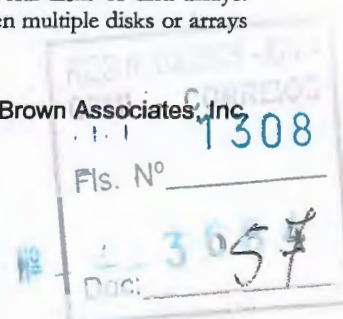
Care must be taken in these architectures to eliminate single-points-of-failure (SPOFs) between two end points. For further fault isolation, each PCI card resides on its own PCI bus. Therefore, all PCI card errors are contained on the card that generated the error and cannot propagate to other I/O cards.

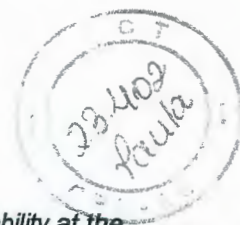
The multipath I/O feature provides failover, load balancing, and failure isolation. Networking and mass-storage products such as APA and LVM provide path-failure detection and failover capabilities. Products such as APA/EMC-Powerpath/XP-Autopath can load balance among various paths. Failure to a path does not disrupt activities on other paths. This isolation is important for delivering high availability, since I/O is inherently error prone.

As an example of the above, consider a configuration wherein the APA product uses two Gigabit Ethernet adapters in an active-standby mode. The network is configured such that the two adapters can be connected to the same or different switches but can reach the same destination servers/clients. If one of the adapters/cables/switches fails due to an error, APA detects the error and can quickly route packets to the other adapter. Thus multiple paths greatly increase the system availability by providing redundancy and complete fault isolation.

<sup>12</sup> Discussed in the next section.

<sup>13</sup> Logical Volume Manager (LVM) is a subsystem for managing file systems and disk-storage spaces that are structured into logical volumes rather than being restricted to the beginning and end points of a physical disk. Logical volumes can be smaller than the disk or disk array on which they reside, or they can include all or part of several disks or disk arrays. Logical volume boundaries are not required to coincide with the boundaries of physical disks when multiple disks or arrays are used.





### ISOLATION – AUTO PORT AGGREGATION (APA)

Auto Port Aggregation (APA) is an HP kernel-based networking product. It provides link aggregation, or trunking. This capability amounts to aggregation of two or more network physical ports into a single logical port (pipe). APA technology is transparent to higher-level communication protocol layers (e.g., TCP/IP).

APA is a cost effective software solution for upgrading to higher bandwidth while maintaining an existing infrastructure and providing a quick (less than a second), and easy failover mechanism. Links can be aggregated on an active-active basis or an active-standby basis.

Aggregation on an active-active basis helps in load balancing among links. APA can be configured to use several different load-balancing algorithms<sup>14</sup> for outbound traffic (depending on the configuration). Inbound traffic load balancing depends on the support of this feature by the infrastructure switches. Aggregation on an active-passive basis helps in the failover scenario. APA can automatically detect failures and failover to a standby link within one second (with minimal or no application disruption).

Administrators use APA to provide load balancing among similar links and also as a quick transparent failover mechanism. High bandwidths can be achieved by combining several low-bandwidth links together from the existing infrastructure.

### ISOLATION – DUAL AC INPUTS

The HP 9000 Superdome server family was the first in the industry to achieve an Uptime Institute certification for fault-tolerant power compliance.<sup>15</sup> The second

<sup>14</sup> *Server-to-Switch: MAC-Based*

This algorithm balances the load by hashing the eight least significant bits of the destination MAC address stored within an Ethernet packet. It then directs the packet to a specific link within an aggregate. This algorithm is most optimal when used in environments that contain no routing between the server and the clients.

*Server-to-Router: IP-Based*

This algorithm balances the load by hashing the eight least significant bits of the destination IP address stored within an Ethernet packet. It then directs the packet to a specific link within an aggregate. This algorithm is most optimal when used in environments that contain routers between the server and clients.

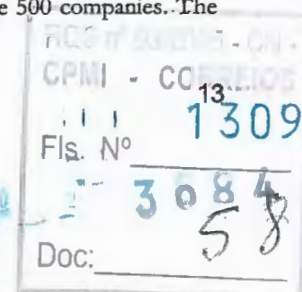
*Server-to-Server: CPU-Based*

Ethernet packets do not contain a CPU ID. For this reason, the CPU-based algorithm makes a separate system call to obtain the originating CPU ID for each thread. It then uses this CPU ID to direct the thread to an Ethernet port assigned to that CPU by the APA software.

*Server-to-Server: TCP/UDP Port-Based*

This algorithm uses the TCP/UDP source and destination port numbers to distribute traffic across the ports in a Link Aggregate. This algorithm is intended to be used in networking environments where direct Server-to-Server Link Aggregation is needed. However, this algorithm may also be used in place of the MAC, IP, or CPU-based algorithms.

<sup>15</sup> The Uptime Institute developed its fault-tolerant power compliance specification in cooperation with members of the Site Uptime Network and major hardware manufacturers. The Site Uptime Network includes 48 Fortune 500 companies. The specification is available at [www.uptimeinstitute.com](http://www.uptimeinstitute.com).







is HP's new rp8400. In fact, these HP server systems are the only currently available servers fully compliant with this standard for dual, fault-tolerant AC inputs. Compliance means that HP's servers can be powered from two fully independent input power sources that do not need to be in-phase.

The tests passed by Superdome and the rp8400 include a variety of power-source conditions that contain abnormal out-of-tolerance voltages, faulted AC power sources, brownout conditions, and more. As required, the Superdome family operates with no data loss and no performance degradation, as initially installed or at its ultimate capacity.

HP believes that as a result of the Uptime Institute's certification, HP's customers can minimize power-fault uncertainty as another step toward decreased unplanned downtime. Server systems lacking such certification may be susceptible to AC faults that allow data loss and hardware and/or performance degradation. In some cases, power-distribution difficulties may be generated for a site's facility-engineering team if the server power source is not as capable as the Uptime Institute requires it to be.

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## HIGH AVAILABILITY: SERVER SELF-HEALING

### HIGH AVAILABILITY: SERVER SELF-HEALING – DISCOVER

As indicated in Figure 1, HP breaks down the Server Self-Healing branch of its high-availability tree into three sub-branches – Discover, Resolve, and Recovery. The Discover sub-branch has three components – Fault Management, High Availability Observatory (HAO), and Serviceability (System Configuration Repository, [SCR]).

The following sections discuss how HP-UX helps administrators discover server problems. They can set hardware monitors using HP Fault Management, which will then alert them to potential problems. They can also have HP proactively discover server problems via the High Availability Observatory (HAO) suite of support software and technologies. Administrators can also discover problems themselves by taking snapshots of their inventory using HP's System Configuration Repository (SCR) tool and analyzing the resultant data.

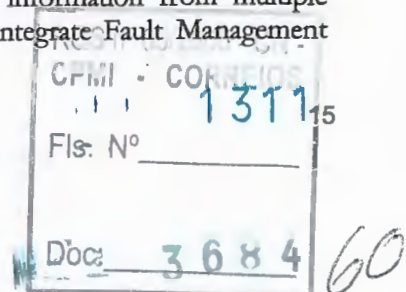
#### DISCOVER – FAULT MANAGEMENT

Fault Management is the name given to HP's overall strategy and program to provide a value chain for detecting, notifying, and repairing server problems so that uptime is maximized. Proper Fault Management requires working with hardware and operating-system designers from the beginning of a server design to create hardware and software capabilities and instrumentation points that create the ability to detect and isolate server anomalies.

For example, HP creates monitors to poll server health information or to asynchronously respond to server instrumentation points designed to report problems or faults. Fault Management also implements several methods for maintaining historical event information for trend analysis. Faults that generate errors and warnings are automatically logged to the syslog. Notes and audit information are logged to an event log.

Fault Management provides alerts to potential problems, as well as to occurring problems as soon as they are detected so that administrators can take corrective action. In some cases fault monitors are smart enough to repair or prevent future faults from occurring. Fault Management currently uses the HP Event Monitoring Service (EMS) infrastructure for its notification methodology. EMS enables a wide variety of notification methods (e-mail, SNMP traps, system console, system log, text logfile, TCP/UDP, and OpenView OPC messaging).

Fault Management events can be viewed and browsed directly by the administrator on a functioning server. Alternatively, the administrator can install HP's TopTools Management server and aggregate information from multiple systems in a domain. There is also the option to integrate Fault Management







events with enterprise-management software like HP's OpenView Operations or other enterprise-management software from BMC, Tivoli, Computer Associates, or MicroMuse.

When HP Support is purchased, Fault Management events can be forwarded to the HP Support Organization. HP can then monitor, filter, and "trend" the events and take action on items that need attention. At the premium end of HP's support offering for the ultimate in high availability, services may be acquired from HP's High Availability Observatory (HAO).

HAO provides continuous and proactive IT environment monitoring. HP uses a dedicated, private ISDN network that allows secure information flow between the customer site and HP's Support Organization and provides the HP Support Organization direct access to the customer's server. As part of the HAO implementation, HP installs a Support Node at the customer site, linked securely to HP.

Fault Management, together with its monitors, proactively reviews the health of server components and generates close to real-time events when problems develop. These events can trigger corrective action to enable the server to continue functioning, or they can trigger alerts to administrative personnel.

Fault Management furthers the philosophy of proactive as compared to reactive fault management. One of HP's high-availability goals is to continue to move in the direction of proactive fault management because of its ability to minimize downtime. HP's Fault Management system provides accurate problem diagnosis the first time, as the problem occurs. This results in a substantial decrease in any downtime associated with an event.<sup>16</sup>

#### **DISCOVER – HIGH AVAILABILITY OBSERVATORY (HAO)**

The High Availability Observatory (HAO) is a suite of support technologies, tools, and processes that HP provides to its customers with mission-critical applications. These customers include those with Business Continuity Support (UNIX only) or Critical System Support (UNIX or Windows servers). The combination of HAO technology, people, and processes in place provides a total HA solution. HP has quantified that HAO reduces resolution by approximately 40 minutes per case in which it is used.

The HAO consists of an HP-owned Support Node workstation and network router that resides on the customer site, a secure communication link back to HP's Mission Critical Support Center (MCSC), and equipment and software within the MCSC to maintain and analyze information about the customer servers. Configuration and status data from servers, software, and network interconnect devices is collected via the support node and securely transmitted to

<sup>16</sup> Data is available from HP to show this improvement.

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the MCSC. This data is viewed by HP support engineers or securely shared with HP experts to help solve customer problems.

The data is also analyzed at the MCSC to alert HP and the customer of potential issues in their environment (e.g., bad patches or out-of-date firmware revisions). Hardware failure events within the customer mission-critical environment are detected by the HAO and alerts are sent back to HP for action.

#### **DISCOVER – SERVICEABILITY (SYSTEM CONFIGURATION REPOSITORY [SCR])**

HP's System Configuration Repository (SCR) is a no-cost tool that enables the collection of periodic or snapshot information about a server to a central database. SCR is a DMI management application. As such, SCR gets all the information it stores from standard APIs supported by HP's DMI service provider. The DMI service provider is SCR's collection agent on a managed node.

SCR accesses the DMI information available about a server and stores it as a snapshot in a central database. It follows the client-server model, i.e., a single server runs SCR and uses DMI to access client nodes. The information captured can be controlled, down to the level of each individual attribute, through the use of filters.

System administrators use SCR for troubleshooting. They can, for example, view their system state and compare it to previous known states (e.g., to determine that the correct state has been restored). System administrators also use SCR to generate system status, inventory, recordkeeping, and planning reports for internal (e.g., for change management) and external use (e.g., for third-party and purchase use).

### **HIGH AVAILABILITY: SERVER SELF-HEALING – RESOLVE**

HP-UX provides capabilities and tools to resolve system problems. Toward this end, the Servicecontrol management-applications suite addresses the centralized configuration, fault, and workload-management requirements of an always-on Internet infrastructure and its servers. As indicated in Figure 1, the Resolve sub-branch of the Server Self-Healing branch has four components. The first of these components is the HPMC Analysis Tool part of the Servicecontrol management applications suite.

#### **RESOLVE – HPMC ANALYSIS TOOL**

The HPMC Analysis Tool automatically analyzes all server-stored error-log information after a catastrophic error. It is designed to describe the course of action to take to remedy the problem. This tool is useful for hardware problem diagnosis of those problems whose cause is not apparent through the system logs.

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The idea here is proactive rather than reactive diagnosis to avoid, where possible, of the need for service personnel to run time-consuming diagnostics. This tool is a safety net for those hardware problems that are not automatically detected and corrected by the server itself.

#### RESOLVE – REMOTE ADMINISTRATION/REMOTE SERVICEABILITY

The second component of the Resolve sub-branch is Remote Administration/Remote Serviceability. Centralized web-based remote administration for HP-UX is delivered through the Servicecontrol suite of management applications. These applications include Ignite-UX, Software Distributor, System Configuration Repository, Servicecontrol Manager, Fault Management, Secure Web Console/Central Web Console, Partition Manager, System Administration Manager (SAM,) and MC/ServiceGuard.<sup>17</sup> These applications, either directly, or through Servicecontrol Manager integration, provide remote, web-accessible management.

- **Ignite-UX:** Ignite-UX allows remote image-based deployment. It also supports remote management of recovery images by collecting recovery images to a central server and then using them to repair systems remotely. Ignite-UX further provides the ability to ignite (cold install) client systems manually from the Ignite server console or automatically via the `bootsys` command.

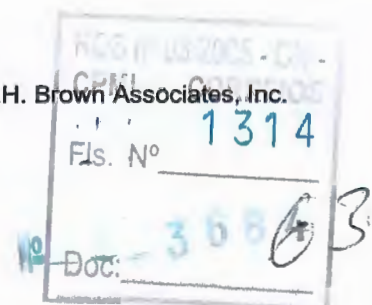
Such client-system installs are known as push installations. Ignite-UX can support multiple push installations in parallel. These parallel operations can, in turn, include multiple operating-system versions. Ignite-UX also provides the capability to ignite clients from a remote system, or ignite the client locally by “pulling” an operating system from an Ignite-UX server.

- **Software Distributor:** Software Distributor allows remote operating system and application installation and update. In addition to its ability to pull software from a central depot, Software Distributor also provides remote-operations features that allow software to be pushed to remote systems (targets) from the local host.

These features and functions can be used interactively to monitor the results of all Software Distributor commands with the Software Distributor job browser GUI (graphical user interface) or the command line. Finally, Software Distributor can also deploy operating system and applications patches and, later, remotely roll back problematic patches (one at a time).

- **System Configuration Repository:** System Configuration Repository (discussed earlier in this white paper) collects and maintains hardware and software inventories from remote servers to a central repository.
- **Servicecontrol Manager:** Ignite-UX, Software Distributor, and System Configuration Repository applications independently support remote

<sup>17</sup> MC/ServiceGuard is well known and is not further discussed here.



management. Through the Servicecontrol Manager umbrella, these applications are also available through a browser launched web interface. Other standalone HP-UX management applications are available remotely through Servicecontrol Manager integration. In fact, administrators can integrate and make available remotely (through Servicecontrol Manager's web interface) any standalone command line or X Windows-based application. With ServiceControl Managers' Distributed Tasks Facility (DTF), administrator scripts can be copied and executed across a set of systems easily and securely. ServiceControl Manager also supports a full command-line interface for further scripting of remote and multisystem management.

- **Fault Management:** Automatic rapid detection is a key contributor to high availability. Fault Management provides the framework and monitors to automatically generate events and forwards them to any enterprise-management system (e.g., HP's OpenView) or to a number of other notification methods.

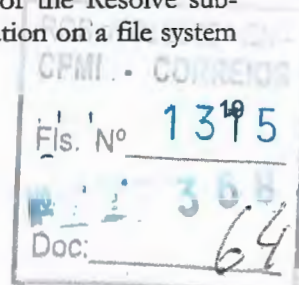
- **Secure Web Console and Central Web Console:** Secure Web Console is a device that can either be embedded in certain HP Servers or attached to the console port for other HP servers. Secure Web Console provides secure web access to a console port through which the administrator gains access to an otherwise unavailable server. This access allows the reboot of a non-responsive system and interaction with the system-boot process. However, remote power-on is not supported.

Central Web Console provides a console-consolidation capability for other console-access technologies such as terminal servers. With Central Web Console, large numbers of server consoles can be consolidated, managed and accessed from a common web-enabled interface. Central Web Console can use 3-DES encryption to encrypt the terminal-server session for secure access, including across firewalls.

- **Partition Manager:** For highly scalable servers, HP's Partition Manager is a web-enabled management interface for remote management of physical partitions. Once partitions are created all the Servicecontrol products and Servicecontrol Manager can manage each partition individually or together with Partition Manager (discussed later in this white paper).
- **System Administration Manager (SAM):** Running System Administration Manager (SAM) (through Servicecontrol Manager) provides system administrators with the ability to remotely manage server disks, file systems, peripheral devices, kernel configuration, users or groups, printers or plotters, and trusted-systems features. SAM is a GUI supplied with all HP-UX systems. SAM log files allow the tracking of system changes.

#### RESOLVE – ONLINE JOURNALED FILE SYSTEM (JFS)

Online Journaled File System (JFS), the third component of the Resolve sub-branch, provides the capability to perform system administration on a file system







while it remains online and user-accessible. These system-administration functions include defragmentation, resizing, and online backup. Such capability allows optimum user-data availability while file-system downtime for maintenance is minimized.

With Online JFS, for example, disk defragmentation is eased. To resolve the fragmentation issue on a mounted file system, a defragmentation utility in Online JFS relocates data to remove unused space from directories, makes small files contiguous, and consolidates free blocks for file-system use.

Online JFS also provides backup capabilities. A snapshot or point-in-time image of a mounted file system may be made to provide a method for creating a backup (of selected files, a complete file system, or incremental backups).

Moreover, with Online JFS, file-system resizing is eased. Since file systems are originally created at a particular size, as system usage evolves the file systems may be too large or too small to accommodate changing usage patterns. Online JFS provides a method of solving these problems while the file systems remain mounted and user-available, e.g., the file system can be expanded or contracted. The fourth component of the Resolve sub-branch, the Veritas Volume Manager (VxVM), discussed in the next section, provides this specific capability.

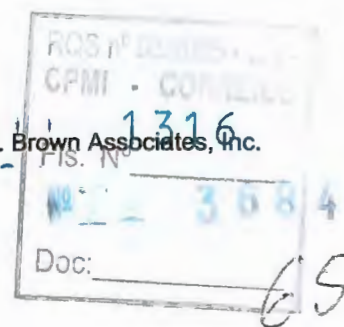
#### **RESOLVE – VERITAS VOLUME MANAGER (VxVM)**

The Veritas Volume Manager allows (among other features) file-system resizing while the file system is mounted and user-available. The list below summarizes the VxVM capabilities.<sup>18</sup>

##### **Veritas Volume Manager (VxVM) Functionality:**

- dynamic reconfiguration of mirrors and volumes;
- support for multiple online data snapshots (for high availability and quick recoverability);
- automatic disk discovery (dynamic add of new disk arrays without reboot);
- hot sparing (allows administrator to designate disks in each disk group as spares);
- online relocation (add or replace or relocate disk drives while server is running); and
- disk-group split and join (dynamic reorganization of disk groups).

<sup>18</sup> VxVM and the Veritas Cluster Volume Manager are integrated into MC/ServiceGuard.





## HIGH AVAILABILITY: SERVER SELF-HEALING – RECOVERY

Recovery is the third sub-branch of the Server Self-Healing branch of the HP high-availability tree. To reduce unplanned down time, Recovery has three components provided by HP-UX 11i – Boot Time Enhancement, PCI Cards OLR, and Root Disk Journaling. These components decrease the time it takes to recover after a server or server-component crash.

### RECOVERY – BOOT TIME ENHANCEMENT

Single-system boot time is the time interval from the initial power-on or reset of a system (i.e., a clean start state) to the time the system is available for the startup of services available on the network and/or user applications. Minimizing the time required for a server to boot up and become operational has a significant impact on the downtime associated with all single-server planned and unplanned downtime events. In other words, a boot-time reduction directly improves overall server availability while at the same time making planned events that require reboot more manageable.

Three software parts of HP-UX 11i are, or are being tuned to provide improved boot time. These parts are shown in the list below.

#### HP-UX 11i Boot Time Enhancements:

- ioscan-k option performance enhancement (both kernel optimization and ioscan command improvements);
- multiple SCSI LUN scanning (tuning SCSI LUNs scanning by leaving the target open for multiple LUN scans); and
- parallel I/O device scanning during boot (rather than serial scanning). The implementation is supported by enabling multiple threads early in the boot process.

### RECOVERY – PCI CARDS ONLINE RECOVERY (OLR)

PCI Cards Online Recovery (OLR) enables the online replacement of PCI I/O cards on HP-UX-based systems designed to support this feature (i.e., as of September 2001, N-class, L-class, and Superdome). In operation, the server hardware uses the built-in per-PCI slot power-control hardware feature combined with operating-system support for the PCI Card OLR feature. This combination allows the replacement of an existing card without affecting other components or requiring a reboot.

This online-replacement feature allows increased availability since the server remains active while an I/O adapter is replaced. All PCI I/O cards (Gigabit Ethernet, Fibre Channel, SCSI, and 100BT) and their corresponding drivers support this feature. A replacement operation is limited to a like-for-like board replacement (i.e., the new card must be the same product as the replaced card).

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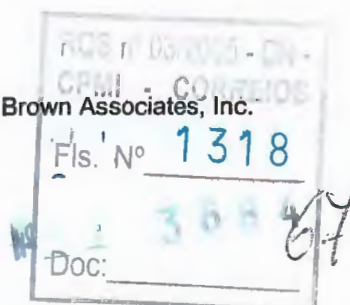
For those hardware environments where there are redundant link solutions, the I/O card replacement can take place without application impact.

#### RECOVERY – ROOT-DISK JOURNALING

Root-Disk Journaling, the third component of the Recovery sub-branch, enables fast file-system recovery after a system crash. Journaling, otherwise known as file-system logging, requires committing system writes to a sequential log file. Since the writes are stored on disk, not in system memory, the sequential nature in which they are written speeds up disk-write activity.

Note that VxFS (in JFS) uses a circular intent log. All file-system structure changes, or metadata changes, are written to this intent log in a synchronous manner. The file system periodically flushes these changes out to their corresponding disk blocks.

This journaling decreases the time it takes to recover after a crash (i.e., reduces unplanned downtime). Without such journaling, every block would have to be examined after a crash – a time-intensive process. With the use of an intent log, VxFS can recover from system downtime in a fraction of the time taken when an intent log is not used. The system simply scans the intent log, noting which file-system changes have completed and which had not. In some cases, the file system can roll forward changes to the metadata structures, because the changes were saved in the intent log. This capability adds availability and integrity to the overall file system.





## HIGH AVAILABILITY: SERVER DYNAMIC COMPUTING

### HIGH AVAILABILITY: SERVER DYNAMIC COMPUTING – LOAD BALANCE

As indicated in Figure 1, the Server Dynamic Computing branch of the high-availability tree has three sub-branches – Load Balance, Dynamic Tuning, and Partitions. The sequel discusses how these three components increase a server's availability.

HP offers several schemes for system load balancing. For example, there is the flexibility to grow compute resources to meet business needs through purchasing more preconfigured (by HP) server capacity or by leasing compute resources. There are also techniques to optimize network bandwidth and load-balance network traffic across multiple similar links. Finally, administrators can focus the appropriate amount of compute resources on specific tasks and define service level agreements to ensure the system will automatically adjust these resources to meet the predefined needs.

HP's availability tree defines four components in the Load Balance sub-branch. These components are Instant Capacity on Demand (iCOD), Pay-Per-Use (PPU),<sup>19</sup> Process Resource Manager (PRM), and Workload Manager (WLM).

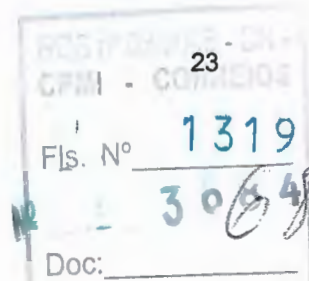
#### LOAD BALANCE – ICOD

Instant Capacity on Demand (iCOD) is an application program that allows the use of capacity already configured in a purchased system. Through iCOD, administrators purchase a specified number of activated processors, and pay a right-to-access fee for a specified number of deactivated processors. These deactivated processors can be activated at the user site, after which activation a fee is paid.

By preloading a system with additional capacity, the administrator enjoys the benefit of being able to add server-processing capacity (without reboot) and without having to pay until it is needed. In addition, there are high-availability benefits. An active processor identified as a potential failure can be automatically deactivated and replaced with an operational inactive processor. This capability allows a system to maintain full capacity and postpones the time when the system needs to be shutdown to replace the failing processor (perhaps until a regularly scheduled maintenance window).

On HP Superdome systems, the number of inactive processors is audited from a system perspective, not a partition perspective. This audit technique allows an administrator to perform load balancing between partitions by deactivating a

<sup>19</sup> Formerly known as Utility Pricing.







previously active, but under-used processor in one partition, and activating a previously inactive processor in another partition. There is no cost to this procedure since the net total of server-active processors does not change.

iCOD is a quick, reliable way to add processing power. Physical addition of processor resources is (in relative terms) both time consuming and error prone, due to the procedure's manual nature. Whenever the server can be rebalanced without touching hardware there is an advantage.

#### **LOAD BALANCE – PAY-PER-USE (PPU)**

Pay-Per-Use (PPU) Pricing is an HP pricing model in which the administrator is charged for actual processor usage. The customer site acquires a specific hardware platform and number of processors, and is billed monthly for the actual usage, based on the number of active processors. The billing amounts vary, as processor usage increases or decreases. This billing model is, of course, different from the traditional financing approaches based on fixed payment amounts for the coverage period.

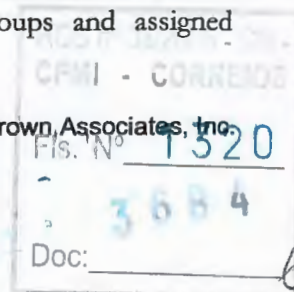
Where iCOD allows an administrator to respond to increasing processing demand by instantly activating and purchasing additional capacity, PPU allows flexibility in both usage directions – increased and decreased. When demand is high, additional processing resources are activated. When demand is low, excess processing resources are deactivated. For customers with a cyclic or unpredictable demand, PPU provides the flexibility to meet requirements without a permanent hardware investment to handle peak usage. PPU also has the high-availability benefit of replacing potentially failing processors with inactive processors (as does iCOD).

#### **LOAD BALANCE – PROCESS RESOURCE MANAGER (PRM)**

HP's Process Resource Manager (PRM) is a resource-management tool that allows a system administrator to focus the appropriate amount of server resources where the business at hand requires such resources. HP's PRM manages resources by partitioning a system based on PRM groups. A PRM group is a collection of processes that is assigned system resources. The system administrator assigns applications and users to PRM groups and establishes resource allocations for each group. PRM then manages each group's CPU, disk bandwidth, and memory resources according to the current configuration. The list below summarizes what may be done with PRM.

##### **Process Resource Manager (PRM) Capabilities:**

- *System Consolidation* – With HP's PRM, administrators can run multiple, mission-critical applications on a single system.
- *Response Time* – Administrators can improve the response time for critical users and applications through the use of PRM groups and assigned resources.



- *Performance Expectations* – Administrators can set and manage user expectations for performance through the use of PRM groups and assigned resources.
- *Budget-Based Sharing* – With HP's PRM, administrators can allocate resources on shared servers based on how much of the server each department funded.
- *Convenient to Use* – Administrators can change the PRM configuration any time – even under load. Also, applications do not require modification to work with PRM.
- *Failover Recovery* – Administrators can ensure that an application package in a ServiceGuard cluster has sufficient resources after a failover.

#### **LOAD BALANCE – WORKLOAD MANAGER (WLM)**

HP-UX Workload Manager (WLM) supplements the functionality of HP's Process Resource Manager (PRM) by offering automatic resource-allocation and application-performance management through the use of prioritized service-level objectives (SLOs). The list below summarizes what may be done.

#### **HP-UX Workload Manager (WLM) Capabilities:**

- *Define SLOs* – With WLM, administrators can define and set priorities for goal-based and entitlement-based SLOs. Goal-based SLOs can be based on usage or performance. Entitlement-based SLOs allow administrators to specify a workload entitlement without specifying a goal.
- *Assign Multiple, Prioritized SLOs* – Administrators can assign one or more SLOs to a workload. The ability to assign multiple SLOs is helpful for workloads that require more than one SLO to accommodate a "must meet" goal and optional, lower-priority stretch goals.
- *Use GlancePlus Metrics* – For goal-based SLOs, administrators can use various GlancePlus metrics to define SLOs.
- *Assign CPU on a Per-Metric Basis* – WLM can grant a workload a certain amount of CPU as defined by a metric. For example, administrators can give a workload 2% of the CPU for each process in the workload group.
- *Manage Oracle® Instances* – Administrators can control Oracle instances and adjust their CPUs based on a number of factors. These factors include, among others, desired transaction response times, number of users connected, and whether a particular job is active.

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## HIGH AVAILABILITY: SERVER DYNAMIC COMPUTING – DYNAMIC TUNING

Dynamic Tuning, the third sub-branch on the Server Dynamic Computing Branch of the HP availability architecture tree is an HP-UX capability that provides the ability to change the value of kernel tunables or memory page sizes without system rebuild or reboot. Dynamic Tuning has two components – Dynamic Tunables and Variable Page Setting.

### DYNAMIC TUNING – DYNAMIC TUNABLES

Dynamic Tunables on HP-UX 11i provide the capability to change the value of certain kernel tunables without the need for system rebuild or reboot. Dynamic Tunables also provide the ability to ensure that changes to tunables are persistent across reboots.

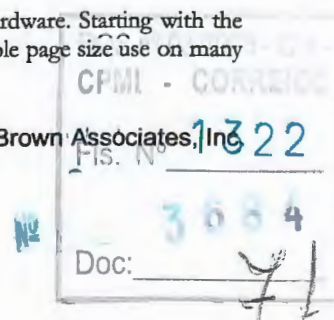
Dynamic Tunables are supported via HP's System Administration Manager (SAM). As mentioned earlier, SAM is a GUI supplied with all HP-UX systems. Dynamic Tunables are also supported through a command-line interface. In addition, software developers can write software that changes tunable parameters.

Dynamic Tunables provide the ability to minimize downtime due to kernel reconfiguration. This capability increases the availability and productivity of HP 9000 users. Dynamic Tunables also allow easier kernel-configuration manageability by supporting commands and GUIs that align with work practices.

### DYNAMIC TUNING – VARIABLE PAGE SIZING

Based on application-program heuristics and size, HP-UX dynamically, and by default, selects appropriately large page sizes for each memory object it accommodates. This use of larger pages conserves translation lookaside buffer (TLB) entries and reduces the occurrence of costly TLB misses. This capability improves the performance of many applications, particularly those with large reference sets and large amounts of contiguous memory (e.g., databases). Such increased performance provides increased availability since jobs complete more quickly.<sup>20</sup>

<sup>20</sup> HP 9000 systems with PA-RISC 2.0 processors support page sizes from 4 KB up to 1 GB in hardware. Starting with the HP-UX 11i release, HP-UX provided general support for variable-sized pages, thus allowing variable page size use on many user objects.





## HIGH AVAILABILITY: SERVER DYNAMIC COMPUTING – PARTITIONS

Partitions are the third sub-branch of the Dynamic Computing branch of the HP availability tree. There are four components to this sub-branch – Hard Partitions (nPARs), Virtual Partitions (vPARs), Processor Sets, and Partition Manager.<sup>21</sup> The HP family of partitioning solutions – HP's Partitioning Continuum for Always-On Infrastructure – provides, or will provide, Hard Partitions, Virtual Partitions, and Resource Partitions on an individual HP 9000 server node or within the HyperPlex (HP's 9000 Enterprise Server clustering implementation), as well as other HP server offerings including Superdome and the rp8400.

HP's various partitioning solutions offer the flexibility to execute multiple workloads on the same server while preserving application isolation. In fact, isolation between operating systems and applications is the great benefit of partitioning. Hard Partition (nPARs) hardware and software firewalls work together to provide the highest isolation possible within a server. HP software has been designed to operate completely within an nPAR and prevent any interference with other nPARs. In addition, hardware firewalls filter out all external traffic to ensure that wayward requests do not affect the partition.

In contrast to nPARs, Virtual Partitions (vPARs) allow multiple operating-system instantiations within an nPAR to provide software and application isolation. Each vPAR is isolated to the point that it can be rebooted, patched, and configured independent of all other partition vPARs.

For well-behaved applications, administrators use Processor Sets to assign compute resources to specific applications that run in the same operating-system environment. The Partition Manager configuration tool manages partitioned environments.

### PARTITIONS – HARD PARTITIONS (nPARS)

An nPAR may be viewed as corresponding to a single, standalone system. Both Superdome and the rp8400 can be subdivided into partitions, each containing one or (usually) more cells that coherently communicate through the use of a high-bandwidth, low-latency crossbar fabric. Programmable hardware in the cells defines the partition boundaries so that the isolation is maintained from the actions of other partitions. Each partition runs its own independent operating system instance.

Hard partitions may be considered to be roughly equivalent to Sun domains. However the nPAR's architecture has several high-availability advantages. The use of nPARs in high-availability configurations requires the minimization or

<sup>21</sup> The partition concept is discussed in the HP white paper "HP-UX Virtual Partitions (vPARs)," September 2001.







elimination of any possible shared failure modes between partitions. This minimization is not usually possible with Sun domains.

Typically, for example, other vendor-partition schemes use partitions that are involved in each other's coherency scheme. Therefore, any failure can theoretically cause the crash of multiple domains. Examples of this phenomenon include main memory multi-bit errors, cache errors, and backplane-addressing errors. This difficulty stands in contrast to HP systems for which extra care was taken to minimize the number of common components between nPARs, and to maximize the reliability of those that remain.

Also, unlike other systems with domains, the partitions in the rp8400 have hardware dedicated to guarding them from errant transactions generated on failing partitions. A failure in one domain will not affect any other domains. For example, each port on the crossbar chips is fully independent.

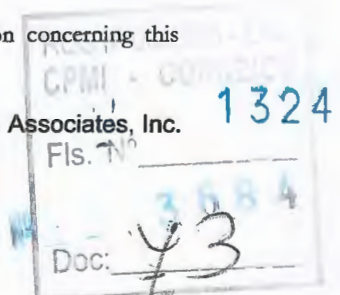
The hardware isolation provided by nPARs is ideal for datacenter simplification through server consolidation.<sup>22</sup> This is the case because each nPAR is free to run any operating-system type or version available, be it HP-UX, Windows, or Linux. Management and advanced-availability features are simpler and easier to implement on one larger system than on a group of smaller servers.

nPARs are also a win for product-development teams since they allow small development environments to sit alongside large production systems with complete isolation (thus conserving resources, ensuring high-availability levels, and more). The list below explains what accrues through nPAR use.

#### **nPAR Capabilities and Benefits:**

- Increase system usage through isolated hardware.
  - Partition a single physical server into several smaller servers.
  - nPARs have virtually no interaction and can be treated as independent servers.
  - Change capacity when needed by adding or deleting partition components.
- Increase flexibility through multiple, independent HP-UX, Windows, and Linux instances.
- Simplify the data-center.
  - Consolidate multiple servers into one server.
  - Add or change servers without changing the infrastructure or affecting other servers.
  - Capitalize on reliability and availability features offered by larger servers.

<sup>22</sup> DHBA conducts an on-going multi-client study of server consolidation and can provide information concerning this subject.



- Provide a server-independent easy upgrade path.
- Use GUI management tools to view the server group as one server.

#### **PARTITIONS – VIRTUAL PARTITIONS (vPARs)**

Virtual Partitions (vPARs) may be considered to be roughly equivalent to IBM LPARs. It is often necessary to dynamically create, modify, or delete the isolated operating environments on a running server without interrupting non-related partitions. Toward this end, HP developed HP-UX Virtual Partitions (vPARs). vPARs provide application (including name space) and operating-system isolation that runs on single-server nodes or nPARs (Hard Partitions on Superdome). Available for L3000, N-Class, Superdome, and future server nodes, vPARs are dynamically created using software commands. Each partition runs its own HP-UX 11i operating system (or later) image. Moreover, within each vPAR, up to 64 resource partitions can be created using solutions such as the earlier discussed HP-UX Process Resource Manager and Workload Manager.

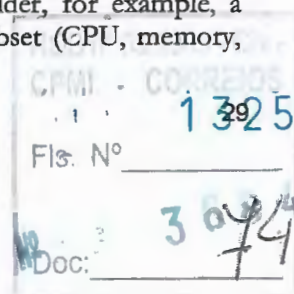
vPARs allow an administrator to allocate a system-resource subset to each partition. In general, a vPAR owns a specified amount of memory, a specified CPU pool, and an I/O card set in the server.

In traditional server environments, all CPUs run the same operating-system instance and one or more applications so application or operating-system failures may affect the entire system. Running vPARs can limit the impact of such failures on application availability. For improved single-system availability vPARs allow an administrator to run one application per partition. Should a software failure occur in one partition, the application of that particular partition may be lost, but the rest of the applications on the other partitions continue to run. In fact, even if the operating system panics in one partition, applications running on other vPARs are not affected.

One of the inherent problems in a single system is the difficulty in expanding CPU resources when the demands of the application or multiple applications exceed the server's configuration. Usually the system needs to be shut down and additional CPUs added. With vPARs, a large server could have CPUs dynamically moved from one vPAR to another without bringing down the entire system. Resources can be moved to vPARs with the greatest demands, or removed when they are no longer required.

In a generic HP server without vPARs, the entire server is controlled by a single HP-UX instance. All of the resources (CPU, memory, and disk) are dedicated to the applications running in this single instance. The software stack for this server is traditional and consists of the application(s) talking to the operating system that communicates with the system firmware and hardware.

When vPARs are used the architecture is different. Consider, for example, a server divided into two partitions, each with a hardware subset (CPU, memory,







disk, etc.). Each vPAR will have its own boot disk, at least one CPU, one LAN connection and enough memory to run HP-UX and the applications intended to be hosted on the vPAR. As mentioned, each vPAR runs its own HP-UX copy (perhaps at different release or patch levels), and each is isolated from software errors, system panics, etc.

The software stack in the vPAR configuration has an application running in each of the two vPARs, each vPAR runs its own operating-system instance, and, importantly, each operating-system instance communicates with a single vPAR Monitor software layer which, in turn, communicates with the server's firmware and hardware.

This additional software layer, the Virtual Partition Monitor (vPAR Monitor), manages the partitioning of the resources, loads kernels, emulates global platform resources, and otherwise creates the illusion for each HP-UX instance that it is on a standalone system with only the resources that have been dedicated to that vPAR. Each HP-UX instance is unaware of the other system hardware while having complete ownership of the hardware resources it is assigned to. Note that the monitor is not involved in accessing I/O hardware or physical memory once it has transferred hardware ownership to a vPAR.

A partition database is at the heart of the monitor and it tracks what resources are associated with which vPAR. When the vPAR Monitor runs, the master database copy is kept in the monitor. All partition database changes are preserved across system reboots.

vPARs actually provide a tool that makes it possible to run multiple workloads. Each workload operates with its own unique operating-system configuration requirements on the same server at the same time. vPARs are also suited to make effective use of underused server nodes. Finally, they are ideal for testing new and/or enhanced products in a production environment. The list below shows what accrues through vPAR use.

#### **vPAR Capabilities and Benefits:**

- Increase system usage through partition of a single physical server or hard partition into multiple virtual machines or partitions (for L-Class, N-Class, and Superdome servers).
- Increase flexibility through multiple independent HP-UX instances and dynamic CPU migration across virtual partitions.
- Achieve greater isolation of applications running within separate operating-system instances within a single server, where each instance can be individually reconfigured and rebooted.
- Optimize application performance by adjusting operating-system resources. Tune the kernel differently in each Virtual Partition. This tuning eliminates the problems of trying to coax two different applications into running in the same operating-system environment when each application requires a different kernel parameter set.

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## PARTITIONS – PROCESSOR SETS

HP-UX Processor Sets offer a mechanism to manage<sup>23</sup> system-processor resources among multiple workloads, users, and departments within an enterprise. A Processor Set represents an array of processors grouped together for exclusive access to applications assigned to that Processor Set. Processor Sets allow server partitioning into multiple Scheduling Allocation Domains such that workloads running in different Processor Sets do not contend with one another for server processor resources.<sup>24</sup> This capability also aids in server consolidation.

Processor Sets support dynamic-runtime reconfiguration. This means that a new Processor Set may be created, an existing Processor Set may be deleted, and a processor may be dynamically reassigned from one Processor Set to another (with access permissions). To accomplish this chore, the implementation of Processor Sets has a flexible ownership and access-permissions model. Every Processor Set has access-permission values that define who may change a configuration or who can execute the Processor Set workload. A Processor Set owner need not be a super user. This flexibility means that the need to completely rely on the administrator to control the Processor Set configuration and to assign Processor Set workloads is eliminated.

A server with Processor Sets capability is configured with one System Default Processor Set when it is started. All processors are assigned to this Default Processor Set. The Default Processor Set has its access permission set to allow all system users to execute their workload on the Default Processor Set processors. The Default Processor Set always has at least one processor, and is always available to all users and applications.

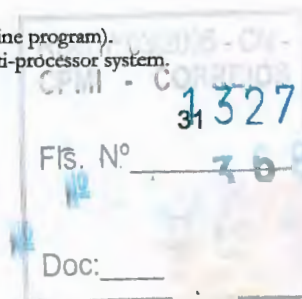
Processor Sets provide flexibility through set-able Processor Set attributes to allow administrators to control the server behavior. It is possible to anticipate and resolve this issue. For example, what happens if a person with permissions tries to delete a Processor Set that has a currently executing workload?

Processor Sets complement the fair-share scheduling CPU allocation mechanism available with PRM. In some instances it is better to allocate dedicated processors to workload via processor sets rather than using the default PRM scheduling. Processor Sets are integrated with the HP-UX Process Resource Manager. This means that a PRM group can be mapped to a Processor Set for processor resources rather than processor shares.

Processor Sets provide a flexible, lightweight mechanism to manage processor resources among multiple workloads, users, and departments. They allow consolidation of multiple independent applications on a single large server to avoid the need to maintain one server per application model. With their use, a

<sup>23</sup> HP-UX provides an API set to programmatically manage Processor Sets (along with system calls and a command-line program).

<sup>24</sup> Resource management based on Processor Sets is hardware platform-independent and can be used on any HP multi-processor system.







single large server can be shared among multiple departments rather than providing separate servers.

Organizations can have varying workloads depending on time of day, month, or year. As a result, the fact that Processor Sets allow dynamically changed resource allocations to workloads as needed without having to resource plan for the worst-case resource need of every workload is a major Processor Sets advantage.

Processor Sets can be applied to batch-processing workloads. In this scenario, a workload is assigned a Processor Set based on its resource needs. The configuration is changed to meet the needs of the next workload as the first completes. What is more, Processor Sets can provide processor-resource isolation for real-time applications to achieve better throughput response times.

#### **PARTITIONS – PARTITION MANAGER**

Partition Manager provides a GUI for managing Superdome servers that support nPARs. Partition Manager makes it easy to perform partition configuration tasks such as creating, modifying, and deleting partitions. Partition Manager also provides configuration and status information about a Superdome server. This information includes such high-availability information as the status of all power and cooling subsystems. In addition, Partition Manager includes automatic fault checking at its start up as well as on demand.

Partition Manager also performs a variety of high-availability-related checks whenever a partition is created or modified. These checks aid the administrator to ensure Superdome and partition availability.

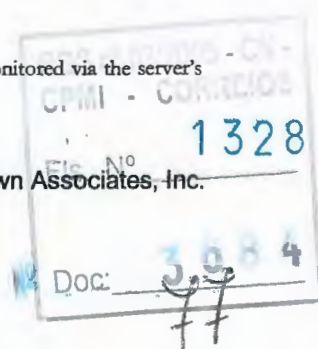
The list below, Partition Manager Hardware Fault Checks, indicates the server hardware fault checks performed. The following list, Partition Manager Partition Fault Checks, indicates the performed partition fault checks. These two lists show that, in a variety of ways, Partition Manager alerts the administrator to situations in which the availability of the server, or a system partition, may be compromised.<sup>25</sup>

#### **Partition Manager Hardware Fault Checks:**

- Checks for power or cooling subsystems that contain failed or missing components (such as a failed fan or power supply). In addition to reporting failed or missing components, the checks also report if the subsystem redundancy is not at least N+1.<sup>26</sup> Thus, the administrator is alerted to potential availability problems before server operation is affected.
- Checks for cells with failed processors or memory DIMMs. Superdome systems are designed such that a partition boots using as many of the

<sup>25</sup> Note that all component failures also result in error notification via the chassis log mechanism, which can be monitored via the server's Service Processor user interface.

<sup>26</sup> N+1 indicates that a component can fail without affecting the subsystem operation.



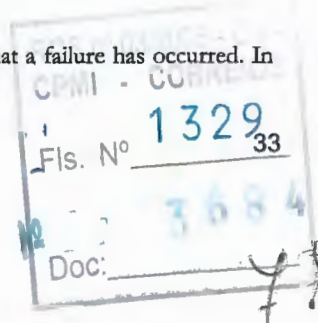
resources assigned to it as possible. For example, if a processor has failed, the cell's remaining processors, memory, and I/O are still used. The Partition Manager fault checks help make sure that the administrator is aware that a partition is running with less than its resource complement.<sup>27</sup>

- Checks for failed crossbar ports. Such failures occur infrequently, and are reported via the chassis log mechanism. Here again Partition Manager provides redundancy for the administrator.

#### **Partition Manager Partition Fault Checks:**

- Checks for partitions with inactive cells, including an indication of inactivity as a result of incompatible cells within a partition. Proper partition configuration requires that all cells within a partition are compatible (e.g., same processor characteristics and system firmware revision). However, events can occur that break cell compatibility (e.g., upgrading system-firmware in only some cells). Thus, these checks alert the administrator to situations in which a partition is booted with less than its full resource complement.
- Checks for partitions with asymmetric memory configurations. Such a condition is not a failure, but could lead to less than optimal partition performance.
- Checks for cells with less than two working processors and cells with less than eight working memory DIMMs. A partition cannot use a cell if the cell has no working processors or no working memory DIMMs. Thus, the checks for at least two processors and at least eight DIMMs ensure that the cell could suffer a processor or DIMM failure (one DIMM failure results in a deconfiguration of the rank of four DIMMs containing the failed unit) and still be used by the partition. This procedure minimizes the potential loss of partition resources.
- Checks for partitions with less than two core cells. A partition must have at least one working cell that is attached to an I/O chassis with core I/O (such a cell is designated as the partition's core cell at boot time). Therefore, the check for a minimum of two possible core cells in a partition ensures that a partition can boot in the face of a cell, I/O chassis, or I/O card failure.

<sup>27</sup> Failures are also reported via the chassis log so that it is likely that the administrator knows that a failure has occurred. In this regard, the Partition Manager check is redundant.





## DISCUSSION AND CONCLUSIONS

High availability is the watchword for HP's server line. Cognizant of this watchword and recognizing that high availability is a key enabler that keeps its IT manager, system administrator, and end-user constituency content,<sup>28</sup> HP has maintained a company-wide effort to design in high availability from the beginning in its server software and hardware.

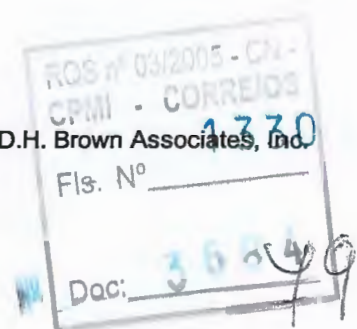
This design-in has been guided by HP's high-availability infrastructure model. This infrastructure, modeled as a tree architecture, has three main branches (Server Fault Avoidance, Server Self-Healing, and Server Dynamic Computing), each with three sub-branches and multiple components in each sub-branch (33 components in all). The overview of these components provided in this white paper indicates the breadth and depth of what HP makes available to its customers to ensure that highly available servers are a reality.

The effort to improve server availability is never-ending. Although, as this white paper demonstrates, HP is well situated with its current and forthcoming products, the firm cannot and clearly will not reduce its high-availability efforts as high availability continues to grow as an ever more important market differentiator.

HP has shown its ability to implement and deliver the real world, production-worthy components of its guiding high-availability architecture tree. As a result, DHBA believes that HP's efforts are a model for the server industry. The components are comprehensive and feature-rich. Although the hundreds of features and functions that these components deliver are not described here because of lack of space, the overview provided indicates the richness of the offering.

Now that this white paper is complete, DHBA believes that the careful reader (IT manager, system administrator, or end user) will have gained a fundamental understanding of HP's high-availability efforts, why they are industry leading, and what kind of benefits they supply.

<sup>28</sup> Nevertheless, this constituency always seeks ever-higher availability (at lower cost).



## APPENDIX: HP CROSSBAR-BASED BACKPLANE AND COMPETING BUS-BASED BACKPLANE

Figure 2 provides a simplified example of both the HP crossbar-based backplane (top) and another vendor's bus-based backplane (bottom). This Appendix describes how the HP architecture provides superior high availability.

Consider each system broken into two nPARs as shown in the figure. On the HP system, the crossbar logically separates the two physical partitions to provide performance and isolation. The competitor's shared backplane has all its cells competing for the same electrical bus. In this design, a snoopy bus-coherency scheme requires all transactions to be broadcast to and processed by all system cells. The high-queuing delays and saturation of the shared backplane bus can limit performance scaling.

To understand the reason for the just-made statements, consider a basic read from Cell 1 in Partition 1 of the crossbar-technology diagram to remote memory that resides on Cell 2 of Partition 1 of the crossbar-technology diagram. Partitions 1 and 2 are isolated by hardware firewalls. HP's crossbar switch and directory-coherency scheme allow the request to be sent only to the destination cell with data returning directly to the requesting cell. Remote memory traffic is restricted to the source and destination cells. The coherency directory is checked in the read-requesting cell and generates no additional traffic.

In contrast, for the same read operation, the competitor's shared backplane bus system must broadcast the memory read on the system address bus to all cells in the system to maintain coherency. Each cell must perform a snoop to determine whether or not the data is stored in its CPU cache and send coherency information to the read-requesting cell. Once the coherency data has been reported, the requested memory owner can return the data to the requester on the data bus. As noted above, scaling can be limited by queuing delays in the saturatable common bus. The snoopy coherency-scheme reliability and the need for bus-repeater chips limit availability.

A major weakness of the shared bus is that any failure during the read, either in the bus or during the coherency snoop, will result in crashing all cells in the system. At this point, the best that can be done is to deconfigure the broken hardware and reboot. Alas, downtime is a given in this design and has already occurred.

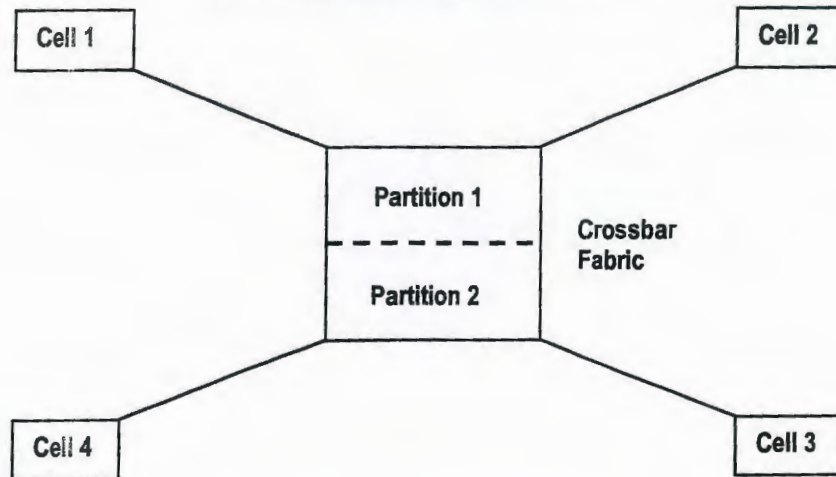
There is an additional partition-reliability benefit to the HP design. Unlike other snoopy coherency systems that must accept and respond to all coherency requests from all domains, HP server partitions have hardware firewalls. These firewalls are dedicated to guarding the server partitions from errant transactions generated on failing partitions. As a result, a failure in one server partition does not affect any other partitions.





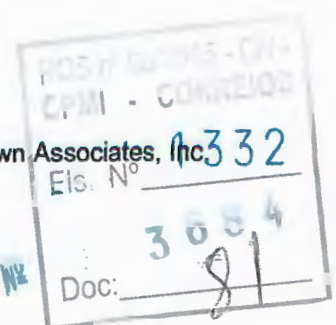
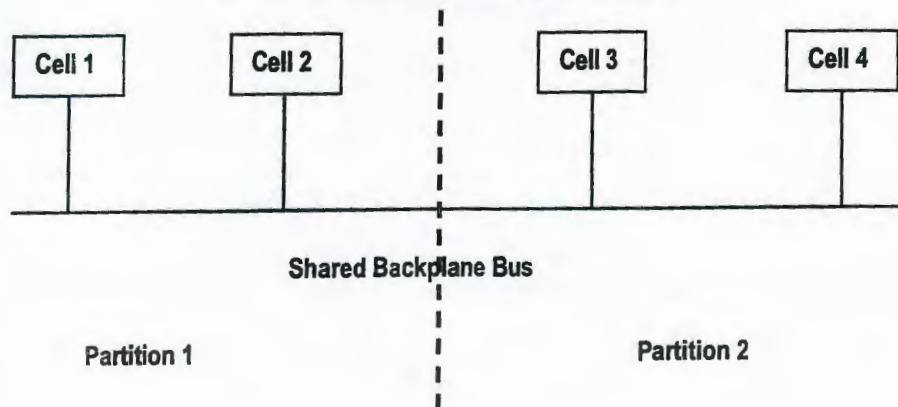
Full end-to-end error correction in the HP design means that all fabric data paths are resistant to both random single-bit errors and persistent single-wire "stuck at" faults. The fabric is therefore resilient to any single failure of pin, connector, socket, or soldering.

**HP Crossbar-Based Backplane Schematic**



**FIGURE 2:**  
*Simplified View of  
HP Crossbar-Based  
Backplane and Competing  
Bus-Based Backplane*

**Competitor Bus-Based Backplane Schematic**





## hp StorageWorks disk system 2100

space-saving  
disk storage  
delivering up to  
293.6 GB capacity

The feature-packed, worry-free HP StorageWorks Disk System 2100 delivers an industry-leading, high-capacity 1U storage solution. This entry-level, rack-optimized Disk System 2100 features open systems compatibility with HP-UX, MPE/iX, Windows NT®, Windows® 2000, Linux, NetWare, Solaris, and AIX, and offers the industry's lowest cost of entry. And because it's built with the HP commitment to developing dependable products and service, the HP StorageWorks Disk System 2100 ensures data integrity and manageability.

A fully loaded Disk System 2100 holds four 73.4 GB disks for a massive 293.6 GB of high-performance, upgradable storage. It also provides an impressive 160 MB/s transfer speed with built-in Ultra3 SCSI technology, all in a compact 1U package. For "set-it-and-forget-it" storage, your best choice is the HP StorageWorks Disk System 2100.

### key features and benefits

- **large storage capacity**—293.6 GB of storage
- **space efficient**—1U of rack space
- **fast**—160 MB/s with built-in Ultra3
- **value for money**—daisy-chain multiple enclosures (up to 3 per HBA) for the cost of competing single-box systems
- **compatible**—works with any SCSI server or workstation
- **hot swap**—disk drives

### technical specifications

|                             |                                                                                            |                |                |                |                |
|-----------------------------|--------------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|
| disk drive capacity         | <u>18.2 GB</u>                                                                             | <u>18.2 GB</u> | <u>36.4 GB</u> | <u>36.4 GB</u> | <u>73.4 GB</u> |
| rotational velocity         | 10,000 rpm                                                                                 | 15,000 rpm     | 10,000 rpm     | 15,000 rpm     | 10,000 rpm     |
| transfer rate               | 160 MB/s                                                                                   | 160 MB/s       | 160 MB/s       | 160 MB/s       | 160 MB/s       |
| average seek time           | 5.2 ms                                                                                     | 3.7 ms         | 5.2 ms         | 3.7 ms         | 4.9 ms         |
| maximum enclosure capacity  | 293.6 GB                                                                                   |                |                |                |                |
| interface                   | Ultra3 SCSI                                                                                |                |                |                |                |
| interconnect transfer speed | 160 MB/s                                                                                   |                |                |                |                |
| connection                  | LVD—68 pin high density                                                                    |                |                |                |                |
| daisy chaining              | Yes—up to 3 per host bus adapter                                                           |                |                |                |                |
| certified operating systems | HP-UX, MPE/iX, Windows NT, Windows 2000, NetWare, Unixware, Linux, Solaris, SCO UNIX®, AIX |                |                |                |                |

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## hp StorageWorks disk system 2100



height  
width  
depth  
weight  
rack height  
power consumption  
power requirements  
operating temperature  
operating humidity  
hot swap disk slots

### physical specifications—disk system 2100 enclosure

1.7 in (43 mm)  
18.0 in (451 mm)  
15.0 in (381 mm)  
10.9 lb (4.9 kg)  
1U  
100W  
100 to 240V AC, 50 to 60 Hz  
32° to 104°F (0° to 40°C)  
hard disks 5% to 95% (at 40°C or 104°F)  
4 disks

### product numbers enclosure products

|                      |                               |                                         |
|----------------------|-------------------------------|-----------------------------------------|
| A5675A <sup>1</sup>  | Disk System 2100 field rack   | Must be ordered with at least one drive |
| A5675AD <sup>1</sup> | Disk System 2100 desktop      | Must be ordered with at least one drive |
| A5675AZ <sup>1</sup> | Disk System 2100 factory rack | Must be ordered with at least one drive |
| A5675AE <sup>2</sup> | Disk System 2100 field rack   | Empty enclosure                         |
| A5675ED <sup>2</sup> | Disk System 2100 desktop      | Empty enclosure                         |

### disk drives

|        |                                 |
|--------|---------------------------------|
| A6537A | 18 GB 10K rpm Ultra3 SCSI drive |
| A6538A | 36 GB 10K rpm Ultra3 SCSI drive |
| A6539A | 73 GB 10K rpm Ultra3 SCSI drive |
| A6540A | 18 GB 15K rpm Ultra3 SCSI drive |
| A6541A | 36 GB 15K rpm Ultra3 SCSI drive |

### rail kits & miscellaneous upgrades

|        |                                        |
|--------|----------------------------------------|
| A5679A | Rail kit - Rosebowl II and Rittal rack |
| A5680A | Rail kit - Rosebowl I rack             |
| A6519A | Deskside pedestal kit                  |
| A6576A | Rail kit - two post telco              |

### cables

|        |                                             |
|--------|---------------------------------------------|
| C2361B | SCSI cable 1m VHDS68/HDS68 M/M multimedia   |
| C2362B | SCSI cable 2.5m VHDS68/HDS68 M/M multimedia |
| C2364A | SCSI terminator LVD/SE HDS68 multimedia     |
| C2365B | SCSI cable 5m VHDS68/HDS68 M/M multimedia   |
| C2911C | SCSI cable 1m HDS68 M/M multimedia          |
| C2924C | SCSI cable 2.5m HDS68 M/M multimedia        |
| C2978B | SCSI cable 0.5m HDS68 M/M multimedia        |
| C2979B | SCSI cable 1.5m HDS68 M/M multimedia        |
| C7520A | SCSI cable 5m VHDS68/HDS68 LVD/SE IIT       |
| C7521A | SCSI cable 5m HDS68 M/M multimedia          |
| C7541A | SCSI cable 2m VHDS68/HDS68 LVD/SE IIT       |

### for more information

For more information on HP storage products, contact any of our worldwide sales offices or visit our Web site at:  
[www.hp.com/go/storage](http://www.hp.com/go/storage)

<sup>1</sup> Available only through HP UNIX authorized resellers

<sup>2</sup> Available through Open Distribution and HP UNIX authorized resellers

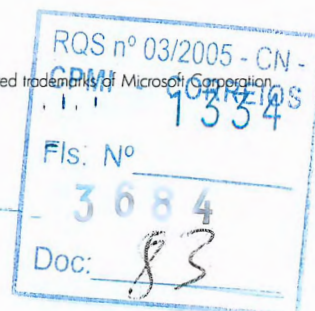
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## hp delivers performance and flexibility

## two Ultra160 LVD SCSI channels on one PCI adapter doubles performance and saves valuable slot space

The HP A6829A PCI Dual-Channel Ultra160 SCSI host bus adapter delivers the performance and flexibility required for today's high-bandwidth servers. The 160 MB/second maximum data transfer rate across each of two independent Ultra160 SCSI buses makes it a perfect match for high-throughput applications such as data mining, streaming video, and scientific modeling. The A6829A adapter's 64-bit PCI interface maximizes the capability of the dual SCSI channels by increasing the throughput on the PCI bus to a maximum of 320 MB/second, preventing a system bottleneck from hindering data flow. This PCI interface doubles the PCI bandwidth from 133 MB/second to 266 MB/second, enabling maximum system throughput for both Ultra160 SCSI channels. This adapter also fits into 32-bit PCI slots, enabling users to qualify a single adapter for all server platforms regardless of the PCI architecture.

Complementing the Ultra160 SCSI offering is the HP A6828A Single-Channel PCI Ultra160 SCSI PCI host bus adapter—perfect for configurations requiring a single channel with all the features and functionality of Ultra160 SCSI.

With Ultra160 low voltage differential (LVD) SCSI technology, extended cable lengths of 12 meters for a fully loaded bus (or 25 meters for point-to-point connections) make this adapter ideal for disk clustering and RAID configurations.

The A6829A and A6828A PCI Ultra160 SCSI host bus adapters deliver superior I/O performance. Ultra160 technology doubles previous Ultra2 SCSI data transfer rates. With two channels, A6829A host adapter delivers up to 320 MB/second bandwidth.

The A6829A and A6828A PCI Ultra160 SCSI host bus adapters support both single-ended (SE) and LVD devices. When a single-ended device is attached, the card defaults to single-ended mode. With Ultra160 LVD devices, the adapter uses LVD mode and can perform at full Ultra160 speeds.

Ultra160 SCSI devices are widely available today. Ultra160 LVD is the industry standard for high performance and low cost. These adapters enable the best speed, compatibility, and technology available today. HP has led the way into Ultra160 LVD SCSI, while many of our competitors have been too slow to move to the latest technologies.

## customer benefits

- up to 160 MB/s data transfer rate on two Ultra160 SCSI channels on a single PCI slot
- connect up to 30 SCSI devices (15 per channel)
- advanced multimode I/O supports Ultra160 LVD or legacy SE devices
- extended 12-meter cable length

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## application areas

Web-based Internet/intranet information distribution and transaction processing requires both fast response times and high availability. The Ultra160 SCSI host bus adapters make the SCSI-link fast and reliable.

High productivity client/server systems require high-bandwidth, high-availability paths between the client, server, and data. The A6829A and A6828A with HP MC/Serviceguard and Logical Volume Manager (LVM) provide the high-speed, high-availability link between the server and the data.

Database backup demands very high bandwidth and availability to ensure one-pass backup. This is an ideal application for the HP Ultra160 SCSI adapters.

The A6829A and A6828A Ultra160 SCSI host bus adapters are perfect for solutions requiring high performance connections for voice, video, streaming, multimedia, and high-end applications.

All high-performance mass storage demands high availability and high throughput. The A6829A and A6828A Ultra160 SCSI host bus adapters meet the need.

| features                                                       | benefits                                                                                                                                                                                                |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ultra160 SCSI host bus adapters</b>                         |                                                                                                                                                                                                         |
| two high-speed Ultra160 SCSI channels on one PCI card (A6829A) | <ul style="list-style-type: none"><li>• saves valuable PCI slots</li><li>• wide Ultra160 LVD SCSI is the leading edge of SCSI performance and reliability</li></ul>                                     |
| up to 160 MB/second maximum burst rate on each channel         | <ul style="list-style-type: none"><li>• high-speed data transfer rates mean faster access to data and files</li><li>• faster database queries and accesses</li><li>• faster backup</li></ul>            |
| mc/serviceguard and LVM                                        | <ul style="list-style-type: none"><li>• high availability through automatic switchover to alternate adapter path</li></ul>                                                                              |
| customer installable hardware and software                     | <ul style="list-style-type: none"><li>• easy customer installation and configuration means less reliance on HP assistance</li></ul>                                                                     |
| imode LVD (low voltage differential) and SE (single ended)     | <ul style="list-style-type: none"><li>• backwards compatibility to SE enables easy integration with existing environment</li></ul>                                                                      |
| long cable lengths                                             | <ul style="list-style-type: none"><li>• up to 12 meters with LVD; increased cable length provides greater flexibility in system configuration, especially in clustering and RAID applications</li></ul> |
| up to 15 devices per channel in a daisy-chain fashion          | <ul style="list-style-type: none"><li>• meets need for large disk arrays, multiple disks, and JBODs</li></ul>                                                                                           |

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## specifications at a glance

| host bus adapter card | A6829A                                                                                                                                                       | A6828A                                                                                                                                                       |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PCI form factor       | <ul style="list-style-type: none"> <li>• standard PCI</li> <li>• L=8.95 in (22.7 cm)</li> <li>• W=4.25 in (10.7 cm)</li> <li>• H=0.72 in (1.8 cm)</li> </ul> | <ul style="list-style-type: none"> <li>• standard PCI</li> <li>• L=8.95 in (22.7 cm)</li> <li>• W=4.25 in (10.7 cm)</li> <li>• H=0.72 in (1.8 cm)</li> </ul> |
| PCI                   | <ul style="list-style-type: none"> <li>• PCI specification v2.1</li> <li>• PCI 4X (64-bit, 66 MHz)</li> <li>• universal (3.3V and 5V)</li> </ul>             | <ul style="list-style-type: none"> <li>• PCI specification v2.1</li> <li>• PCI 4X (64-bit, 66 MHz)</li> <li>• universal (3.3V and 5V)</li> </ul>             |
| SCSI channels         | • 2                                                                                                                                                          | • 1                                                                                                                                                          |
| connectors            | • (2) external 68-pin VHDCI*                                                                                                                                 | • (1) external 68-pin VHDCI*                                                                                                                                 |
| configuration         | • channels independently configurable                                                                                                                        | • channel independently configurable                                                                                                                         |
| termination           | <ul style="list-style-type: none"> <li>• active automatic termination</li> <li>• self-resetting term-power fuse</li> </ul>                                   | <ul style="list-style-type: none"> <li>• active automatic termination</li> <li>• self-resetting term-power fuse</li> </ul>                                   |

\*VHDCI=very high density cable interconnect

## platforms and maximum cards supported

|               |      |      |
|---------------|------|------|
| superdome     | • 96 | • 96 |
| rp8400        | • 16 | • 16 |
| rp7400 series | • 12 | • 12 |
| rp5400 series | • 10 | • 10 |
| rp2400 series | • 3  | • 3  |

## operating system support

|       |                  |                  |
|-------|------------------|------------------|
| hp-ux | • 11.0 and later | • 11.0 and later |
|-------|------------------|------------------|

## environmental/regulatory specifications

|                               |                                                                                                                                                                                                                         |                                                                                                                                                                                                                         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| temperature                   | <ul style="list-style-type: none"> <li>• non-operating: -40° to +70° C (-40° to 158° F)</li> <li>• operating: +5° to +40° C (41° to 104° F)</li> <li>• recommended operating: +10° to +40° C (50° to 104° F)</li> </ul> | <ul style="list-style-type: none"> <li>• non-operating: -40° to +70° C (-40° to 158° F)</li> <li>• operating: +5° to +40° C (41° to 104° F)</li> <li>• recommended operating: +10° to +40° C (50° to 104° F)</li> </ul> |
| humidity                      | • recommended operating: 40% to 60% RH at 22° C (70° F)                                                                                                                                                                 | • recommended operating: 40% to 60% RH at 22° C (70° F)                                                                                                                                                                 |
| altitude                      | • 10,000 ft (3.1 km)                                                                                                                                                                                                    | • 10,000 ft (3.1 km)                                                                                                                                                                                                    |
| electromagnetic compatibility | <ul style="list-style-type: none"> <li>• North America: FCC class A</li> <li>• international: EN 55022 class A</li> </ul>                                                                                               | <ul style="list-style-type: none"> <li>• North America: FCC class A</li> <li>• international: EN 55022 class A</li> </ul>                                                                                               |

## cables/terminators

### recommended VHDCI to 68-pin HD SCSI cables

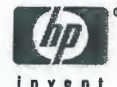
|        |                            |                            |
|--------|----------------------------|----------------------------|
| C2361B | • 1.0m VHDCI to 68-pin HD  | • 1.0m VHDCI to 68-pin HD  |
| C2362B | • 2.5m VHDCI to 68-pin HD  | • 2.5m VHDCI to 68-pin HD  |
| C2365B | • 5.0m VHDCI to 68-pin HD  | • 5.0m VHDCI to 68-pin HD  |
| C2363B | • 10.0m VHDCI to 68-pin HD | • 10.0m VHDCI to 68-pin HD |

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hp server  
connectivity

Ultra160  
SCSI adapter



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## specifications at a glance (continued)

### cables/terminators (continued)

#### recommended VHDCI to VHDCI SCSI cables

|        |                        |                        |
|--------|------------------------|------------------------|
| C2372A | • 1.0m VHDCI to VHDCI  | • 1.0m VHDCI to VHDCI  |
| C2373A | • 2.0m VHDCI to VHDCI  | • 2.0m VHDCI to VHDCI  |
| C2374A | • 5.0m VHDCI to VHDCI  | • 5.0m VHDCI to VHDCI  |
| C2375A | • 10.0m VHDCI to VHDCI | • 10.0m VHDCI to VHDCI |

#### recommended LVD/SE multimode SCSI terminators

|        |                                         |                                         |
|--------|-----------------------------------------|-----------------------------------------|
| C2364A | • 68-pin HD LVD/SE multimode terminator | • 68-pin HD LVD/SE multimode terminator |
| C2370A | • VHDCI LVD/SE multimode terminator     | • VHDCI LVD/SE multimode terminator     |

Note: This card is self-terminating when no cable is attached. However, a terminator is required on the final device in the SCSI chain. The appropriate terminator for that device should be ordered and utilized.

## ordering information

### A6829A or A6828A

|             |                      |
|-------------|----------------------|
| option #OD1 | • factory integrated |
| option #AVN | • release notes      |

### restrictions and limitations

- HVD (high voltage differential) devices are not supported

### for more information

For additional information on this or other HP enterprise networking solutions, please visit us on the Web at <http://www.hp.com/go/hp9000io>, or contact any of our worldwide sales offices or HP Channel Partners.

(in the U.S., call 1 800 637 7740)

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HP product information and technical documentation is available online. In addition, configuration tools and pricing information allow registered users to place orders online.

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## dual port 100Base-T and dual port wide ultra2 SCSI adapter

» return to original page

The demand for server resources is greater than ever in today's enterprise computing environment. Getting the most functionality, performance, and flexibility out of your computing resources is crucial to meeting this increased demand. The HP Dual-Port 100Base-T and Dual-Port Wide Ultra2 SCSI Adapter card gives you two high-speed network connections and two high-speed mass storage connections, all in a single PCI slot.

### product information

- » overview & features
- » specifications
- » information library

Servers supporting images, video, client/server applications, heavy LAN traffic, and databases require greater I/O bandwidth and connectivity. Data reliability, device connectivity, and cable lengths are often the issues with these critical systems. HP's Dual-Port 100Base-T and Dual-Port Wide Ultra2 SCSI Adapter provides impressive I/O bandwidth, high reliability, and 12-meter SCSI cable lengths in one standard PCI adapter. It is perfect for high-connectivity servers demanding high-speed LAN and SCSI connections.

The HP Dual-Port 100Base-T and Dual-Port Wide Ultra2 SCSI Adapter integrates nicely into existing infrastructures providing substantial cost savings. The auto-sense dual 100Base-T adapter can be immediately deployed in a 10Mbps environment. When the environment changes to 100Mbps, the adapter senses the new speed and you instantly have 10X the speed.

Ultra2 LVD SCSI is widespread in the marketplace due to its low power, high speed, and reliability. With the capability to multi-mode, this adapter is backwards compatible with SE (single-ended) SCSI devices.

The flexibility of this adapter is amazing. It can be utilized and integrated in a great variety of environments and solutions.

### application areas

Web-based Internet/Intranet Information Distribution and Transaction Processing requires both fast response times and high availability. The HP A5838A LAN/SCSI Card with Auto-Port Aggregation software provides the increased bandwidth. With MC/ServiceGuard the A5838A provides high availability. The 10/100Base-T and LVD technologies improve overall speed and performance.

Client/Server systems require high-bandwidth, high-availability paths between the database servers and the application servers. The HP Auto-Port Aggregation and Ultra2 SCSI solutions are well suited for these popular high-productivity client/server application systems.

Database backup demands very high bandwidth and availability to ensure one-pass backup. This is an ideal application for the HP A5838A LAN/SCSI Card.

Multimedia transmission of voice, video and data requires high bandwidth and reliability. Again, HP A5838A LAN/SCSI Card meets these needs brilliantly, resulting in well-implemented multimedia applications.

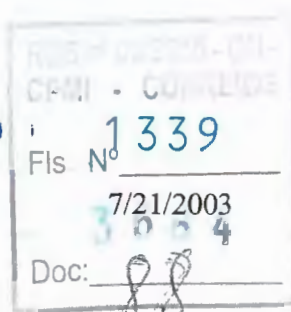
### features

#### A5838A Adapter Card

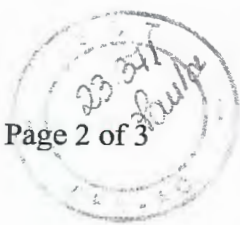
Two high-speed Ultra2 SCSI ports and two 10/100Base-T RJ45 ports on one PCI card

### benefits

- Saves valuable PCI slots by combining storage and LAN solutions onto one card.
- Full-bandwidth power of two Wide Ultra2 SCSI and two 100Base-T LAN ports means faster Internet, Intranet, data, file, and application access, especially for multimedia and high-end apps.
- Low-cost, high performance: 100Base-T technology is







**MC/ServiceGuard support**

HP's high power diagnostic, exerciser, and administrative software tools

Customer installable hardware and software

**10/100Base-T (Fast Ethernet)**

**MC/ServiceGuard support**

**Auto-Port Aggregation**

Sustains greater than 80 Mbps with 100Base-T

Auto-sensing of maximum line speed on 10/100Base-T adapters

**SNMP support**

STM - Support Tools Manager (Exerciser and Verifier)

**Dual Ultra2 SCSI**

Ultra2 LVD SCSI

Up to 80 MB/s max burst rate

**SCSI Mirroring support**

Multimode LVD (Low Voltage Differential) and SE (Single Ended)

Long cable lengths

Up to 15 devices in a daisy chain fashion

lower cost than FDDI or ATM.

- Wide Ultra2 LVD SCSI is the leading edge of SCSI performance and reliability.

- High availability through automatic switch-over to alternate path in the event of a path failure.

- Easy customer installation and configuration.
- Fast and easy LAN/SCSI management.
- Tools compatible with those of LAN/9000.

- Easy customer installation and configuration means less reliance on HP assistance.

- Automatic switch-over to a second LAN path if the first LAN path fails.
- High-availability LAN access to HP-UX Enterprise Servers means increased satisfaction and fewer calls to IT management.

- Extends existing Ethernet links into larger bandwidth pipes.

- Faster Internet, Intranet, data, file, and application access, especially for multimedia and high-end applications, increases end-user productivity and satisfaction.

- Immediate connection to existing 10Mbps links.
- Easy migration from 10Mbps Ethernet to 100Mbps Fast Ethernet.
- Easy connection of 100Base-T sub-networks to existing 10Mbps Ethernet networks, using 10/100Mbps Ethernet switch.

- Enables remote management.

- Easier, faster management of network testing, exercise, and verification.

- Leading edge of performance and reliability.

- High speed data transfer rates means faster access to data and files.
- Faster database queries and accesses.
- Faster backup.

**SCSI Mirroring support**

- Backwards compatibility to SE enables easy integration with existing environment.

- Up to 12 meters with LVD. Increased cable length provides greater flexibility in system configuration, especially in clustering and RAID applications.

- Meets need for large disk arrays.

**ordering information**

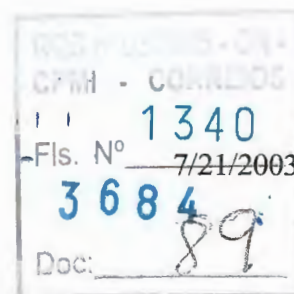
A5838A HP 2-Port 100Base-T / 2-Port Ultra2 SCSI Adapter

Option #0D1 Factory Integration

Option #AVN Release Notes

**ordering notes:**

<http://www.hp.com/cgi-bin/pf-new.cgi?in=referer>



Supported platforms (max units): Superdome (32), rp8400 (16), rp7410 (15), rp7400 (12), rp5400 series (6), rp2400 series (2). Connects to LVD or SE SCSI peripherals and 10/100BT Ethernet. Requires a SCSI terminator, not included. The terminator attaches to the last device in the SCSI chain. Order the appropriate terminator for that device. For High Density (HD) 68-pin LVD or SE: Order C2364A, for Very High Density (VHDCI) 68-pin LVD or SE: Order C2370A.

#### restrictions and limitations

- HVD (High Voltage Differential) devices not supported.
- 100Base-FX, 100VG-AnyLAN not supported.
- Internal SCSI connectors not supported.

**for more information** For additional information on this or other HP enterprise networking solutions, please visit us on the Web at [unix server connectivity section](#), or contact any of our worldwide sales offices or HP Channel Partners. (In the U.S., call 1 800 637 7740.)

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tachlite  
fibre  
channel  
adapters



## hp enhances lineup of fibre channel adapters

### hp tachlite fibre channel adapters now offer double the performance

It is truly the Information Age. Nothing but the best information management is acceptable for system-wide success. While many think computers process data into information, computers actually spend much more of their time organizing the data and managing the storage of information. This reality has been forming over time, but certainly graphical user interface programs have accelerated the trend, along with web page types of applications.

The early 1990s first saw massive disk farms created specifically to store data in very large disk arrays. Designers of storage systems quickly realized that centralized storage and retrieval of data makes information technology (IT) much more manageable. After all, when even the data that drives a meager spreadsheet on a desktop may be the decision maker for the next corporate merger or venture, it is quickly apparent that this data is too important to trust individuals to back it up regularly.

Storage area networks (SANs) are an emerging methodology for maintaining enterprise-level quantities of data. Data storage management, data integrity, cross-systems storage—all can be ensured by the use of a SAN, while they also ensure data retrieval and storage is quick and transparent to the end user. The appropriate architecture for connecting these gigantic arrays of disks becomes an important part of the decision of how to implement SANs.

## benefits of hp tachlite fibre channel host bus adapters (HBAs)

- maximum I/O performance
  - auto-negotiates 2Gb or 1Gb transfer rates (A6795A only)
- superior quality with next-generation functionality:
  - switched fabric capability enabled—supports sophisticated recovery and backup scenarios, eventually without server intervention
  - online add/replace (OLAR) capable
  - increased performance with 66% less CPU utilization for I/O operations
  - full switched fabric support on HP-UX, up to 14 million nodes on a SAN
  - existing Arbitrated Loop supported
- one-stop shopping through HP for SANs, with full support for mission-critical environments

## selecting your tachlite fibre channel HBA

- A6795A—PCI 2Gb Fibre Channel adapter
  - Superdome, rp8400, rp7410, rp7400, rp5400 series, rp2400 series
- A5158A—PCI 1Gb Fibre Channel adapter
  - V-class, Itanium™
  - legacy adapter for PCI-based systems
- A6685A—HSC 1Gb Fibre Channel adapter
  - K-class
- A6684A—HSC-eff 1Gb Fibre Channel adapter
  - D-class, R-class

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**fibre channel  
provides for SAN  
implementations**

The eventual promise of SAN technology is that regardless of where the data originates (Internet or intranet) or where it is processed (on UNIX® or Windows NT® or other operating systems), the economies of scale, ease of operations, data integrity, and performance characteristics of SANs makes them appropriate data storage/delivery architectures.

Therefore, the demand for Storage Area Networks is exploding. Through centralization, tradeoffs are made between ease of management and assurance of recovery, and, for example, more complex SAN wiring topologies.

Storage Area Networks offer flexible pools of secure storage, 100% data availability, and practically infinite scalability.

HP is committed to providing strategic technology for mass storage interconnects to its enterprise customers. For example, HP's Switched Fabric functionality allows up to 14 million nodes to be connected on a SAN. The technology usually chosen to deploy in SAN environments is Fibre Channel, which provides optimum levels of reliability, speed, and distance.

HP's Fibre Channel solution uses a standard SCSI protocol to provide a fast, robust connection to storage devices.

**improved performance  
and investment  
protection**

The HP PCI 2Gb Fibre Channel adapter—A6795A, available on HP-UX 11.0 and later operating systems—for Superdome, rp8400, rp7410, rp7400, rp5400 series, and rp2400 series systems, improves SAN performance and efficiency.

This adapter, also known as Tachlite, enhances HP servers' capabilities in the Storage Area Network. First, the A6795A offers data transfer rates up to 400 megabytes per second (full-duplex), effectively doubling performance over previous-generation Fibre Channel adapters. Next, the 2Gb Fibre Channel adapter auto-negotiates 1Gb or 2Gb transfer rates. This feature allows full legacy support for 1Gb SAN infrastructures, thus protecting your current SAN investment.

**optimizes functionality**

With all Tachlite adapters, HP delivers Switched Fabric Fibre Channel (FC-SW) functionality to HP-UX. The switched fabric functionality allows HP-UX servers to conveniently participate as a node in SAN environments.

The FC-SW functionality of Tachlite is supported on all current and future PCI platforms and offers the significant benefit of allowing servers to boot across switches. This FC-SW functionality is supported on the HP Surestore Director FC-64, FC switches 6164, 16B, and 8B, Brocade Switch 2800 and 2400, and EMC Connectrix switches.

Tachlite dramatically increases HP servers' SAN performance, resulting in 66% lower CPU utilization during I/O cycles. The new interface offers full support for peripherals and online add/replace (OLAR) in supported versions of the operating system.

HSC (K-, D-, and R-class) Switched Fabric Fibre Channel support is also available with A6685A and A6684A Tachlite adapters.

For more information, please visit the HP Web site:  
[www.hp.com/go/hp9000io](http://www.hp.com/go/hp9000io)

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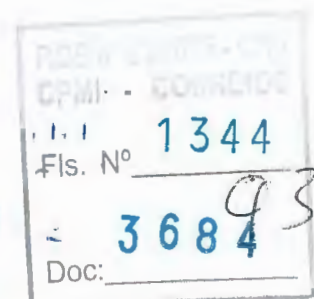


## tachlite features and benefits

| features                                              | benefits                                                                                                                                                                                                                                                          |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2Gb and 1Gb Fibre Channel technology                  | <ul style="list-style-type: none"> <li>highest I/O performance for faster accessibility of databases and media-rich data</li> <li>increased performance over previous-generation Fibre Channel adapters</li> </ul>                                                |
| full switched fabric Fibre Channel (FC-SW) capability | <ul style="list-style-type: none"> <li>support for sophisticated storage area network (SAN) configurations</li> <li>increases scalability of SAN infrastructure up to 14 million nodes</li> <li>customization of complex recovery and backup scenarios</li> </ul> |
| online add/replace (OLAR)                             | <ul style="list-style-type: none"> <li>maximizes server uptime with OLAR</li> <li>no need to bring down server to add new or replace failed adapter</li> </ul>                                                                                                    |
| arbitrated loop support                               | <ul style="list-style-type: none"> <li>flexibility to integrate into various SAN configurations</li> </ul>                                                                                                                                                        |
| less CPU usage                                        | <ul style="list-style-type: none"> <li>minimizes requirements of CPU utilization for I/O to allow for maximum cycles for other operations</li> </ul>                                                                                                              |

## product description

| product number                       | A6795A                                                                                                                                                                                                                                                                     | A5158A                                                                                                                                                                                                                                                                      | A6685A                                                                                                                                                                            | A6684A                                                                                                                                                                                     |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| description                          | PCI 2Gb Tachlite Fibre Channel Adapter                                                                                                                                                                                                                                     | PCI Tachlite Fibre Channel Adapter                                                                                                                                                                                                                                          | HSC Tachlite Fibre Channel Adapter                                                                                                                                                | HSC eff Tachlite Fibre Channel Adapter                                                                                                                                                     |
| form factor                          | <ul style="list-style-type: none"> <li>standard PCI</li> <li>64-bit PCI interface, compliant with PCI Specification v2.1</li> <li>compatible with 3.3V and 5V, 32-bit and 64-bit</li> <li>L=6.6 in (168 mm)</li> <li>W=3.5 in (89 mm)</li> <li>H=0.7 in (20 mm)</li> </ul> | <ul style="list-style-type: none"> <li>standard PCI</li> <li>64-bit PCI interface, compliant with PCI Specification v2.1</li> <li>compatible with 3.3V and 5V, 32-bit and 64-bit</li> <li>L=6.5 in (165 mm)</li> <li>W=4.7 in (120 mm)</li> <li>H=0.7 in (19 mm)</li> </ul> | <ul style="list-style-type: none"> <li>HP-HSC (3x5)</li> <li>HSC support (32-bit 40MHz)</li> <li>L=5.7 in (145 mm)</li> <li>W=3.2 in (82 mm)</li> <li>H=1.0 in (26 mm)</li> </ul> | <ul style="list-style-type: none"> <li>HSC EISA form factor</li> <li>HSC support (32-bit 40MHz)</li> <li>L=6.6 in (168 mm)</li> <li>W=4.2 in (107 mm)</li> <li>H=0.8 in (20 mm)</li> </ul> |
| transfer rate                        | 2Gb or 1Gb auto-negotiates                                                                                                                                                                                                                                                 | 1Gb                                                                                                                                                                                                                                                                         | 1Gb                                                                                                                                                                               | 1Gb                                                                                                                                                                                        |
| max transfer rate                    | 400 MB/s full duplex<br>200 MB/s half duplex                                                                                                                                                                                                                               | 200 MB/s full duplex<br>100 MB/s half duplex                                                                                                                                                                                                                                | 200 MB/s full duplex<br>100 MB/s half duplex                                                                                                                                      | 200 MB/s full duplex<br>100 MB/s half duplex                                                                                                                                               |
| systems supported (minimum adapters) | Superdome (96)<br>rp8400 (16)<br>rp7410 (12)<br>rp7400 (12)<br>rp5400 series (10)<br>rp2400 series (4)                                                                                                                                                                     | Superdome (96)<br>V-class (20)<br>N-class (12)<br>L-class (10)<br>A500 (4)/A400 (2)<br>rx9610 (16) Itanium<br>rx4610 (10) Itanium                                                                                                                                           | K-class (3-9)<br>Kx70/Kx80<br>Kx60<br>Kx50<br>Kx20                                                                                                                                | D-class (3)<br>R-class (3)<br>Dx70/Dx80/D390<br>Dx20/Dx30<br>R380/R390                                                                                                                     |
| boot support                         | yes                                                                                                                                                                                                                                                                        | yes                                                                                                                                                                                                                                                                         | Kx70/Kx80<br>Kx60                                                                                                                                                                 | D390<br>R390                                                                                                                                                                               |
| operating systems                    | HP-UX 11.0 and later                                                                                                                                                                                                                                                       | HP-UX 11.0 and later                                                                                                                                                                                                                                                        | HP-UX 11i, 11.0, 10.20                                                                                                                                                            | HP-UX 11i, 11.0, 10.20                                                                                                                                                                     |
| connector type                       | LC (SFF)                                                                                                                                                                                                                                                                   | SC                                                                                                                                                                                                                                                                          | SC                                                                                                                                                                                | SC                                                                                                                                                                                         |
| dc power characteristics             | draws 1.8 amps @ 5V                                                                                                                                                                                                                                                        | draws 1.8 amps @ 5V                                                                                                                                                                                                                                                         | draws 1.8 amps @ 5V                                                                                                                                                               | draws 1.8 amps @ 5V                                                                                                                                                                        |



hp server  
connectivity

tachlite  
fibre  
channel  
adapters



## environmental and regulatory specifications

| product number          | A6795A                                                                                                                                                                                            | A5158A                                                                                                                                                                                            | A6685A                                                                                                                                                                                            | A6684A                                                                                                                                                                                            |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| temperature             | <ul style="list-style-type: none"> <li>non-operating: -40° to +70° C (-40° to 158° F)</li> <li>operating: +5° to +40° C (41° to 104° F)</li> <li>recommended operating: +20° to +30° C</li> </ul> | <ul style="list-style-type: none"> <li>non-operating: -40° to +70° C (-40° to 158° F)</li> <li>operating: +5° to +40° C (41° to 104° F)</li> <li>recommended operating: +20° to +30° C</li> </ul> | <ul style="list-style-type: none"> <li>non-operating: -40° to +70° C (-40° to 158° F)</li> <li>operating: +5° to +40° C (41° to 104° F)</li> <li>recommended operating: +20° to +30° C</li> </ul> | <ul style="list-style-type: none"> <li>non-operating: -40° to +70° C (-40° to 158° F)</li> <li>operating: +5° to +40° C (41° to 104° F)</li> <li>recommended operating: +20° to +30° C</li> </ul> |
| humidity                | <ul style="list-style-type: none"> <li>operating humidity range @ 22° C: 15% to 80% RH</li> <li>recommended operating: 15% to 80% RH at 22° C (70° F)</li> </ul>                                  | <ul style="list-style-type: none"> <li>operating humidity range @ 22° C: 15% to 80% RH</li> <li>recommended operating: 15% to 80% RH at 22° C (70° F)</li> </ul>                                  | <ul style="list-style-type: none"> <li>operating humidity range @ 22° C: 15% to 80% RH</li> <li>recommended operating: 15% to 80% RH at 22° C (70° F)</li> </ul>                                  | <ul style="list-style-type: none"> <li>operating humidity range @ 22° C: 15% to 80% RH</li> <li>recommended operating: 15% to 80% RH at 22° C (70° F)</li> </ul>                                  |
| altitude                | <ul style="list-style-type: none"> <li>non-operating: 15,000 ft</li> <li>operating: 10,000 ft (3.1 km)</li> </ul>                                                                                 | <ul style="list-style-type: none"> <li>non-operating: 15,000 ft</li> <li>operating: 10,000 ft (3.1 km)</li> </ul>                                                                                 | <ul style="list-style-type: none"> <li>non-operating: 15,000 ft</li> <li>operating: 10,000 ft (3.1 km)</li> </ul>                                                                                 | <ul style="list-style-type: none"> <li>non-operating: 15,000 ft</li> <li>operating: 10,000 ft (3.1 km)</li> </ul>                                                                                 |
| radiated field immunity | • EN 55022 Class A                                                                                                                                                                                | • EN 55022 Class A                                                                                                                                                                                | • EN 55022 Class A                                                                                                                                                                                | • EN 55022 Class A                                                                                                                                                                                |

## ordering information

| product number      | A6795A        | A5158A        | A6685A        | A6684A        |
|---------------------|---------------|---------------|---------------|---------------|
| factory integration | • Option #0D1 | • Option #0D1 | • Option #0D1 | • Option #0D1 |
| release notes       | • Option #AVN | • Option #AVN | • Option #AVN | • Option #AVN |

## for more information

For additional information on this or other HP enterprise connectivity solutions, please visit us on the Web at [www.hp.com/go/hp9000io](http://www.hp.com/go/hp9000io), or contact any of our worldwide sales offices or HP Channel Partners. (In the U.S., call 1-800-637-7740.)

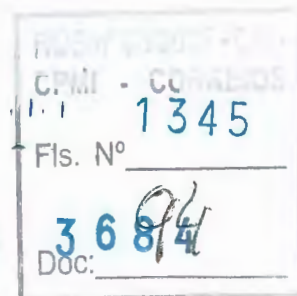
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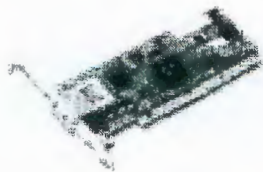
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5980-9011EN Rev. 1





hp server  
connectivity



Gigabit Ethernet  
LAN



hp Gigabit Ethernet  
LAN adapters—  
Gigabit performance  
at affordable costs

**comprehensive networking tools for the most demanding mission-critical and enterprise needs**

The demand for higher-speed network connections is growing at a tremendous rate in order to keep pace with the speed requirements of applications such as SAP R/3, database backups, medical, CAD/CAM, 3D modeling, animation, video, and more.

Internet data centers process terabytes of data daily. Processing, sharing, and distributing this data requires faster and faster networks.

Intelligent adapters, which take on more of the network processing from the server, are becoming critically important in helping servers cope with the onslaught of traffic running at Gigabit/second speeds. To maximize server CPU efficiency for an effective Gigabit Ethernet implementation, adapters should not only perform TCP/IP checksum, interrupt coalescing, and byte swapping, but also enable the reduction of host data copy operations.

The HP Gigabit Ethernet LAN solutions perform all of these functions and fully support the IEEE 802.3ab and 802.3z standards for Gigabit operations. These high-performance, standards-based, scalable network links allow customers to move large amounts of data quickly while leveraging their existing investments in Ethernet technology.

The HP Gigabit LAN adapters provide 1000 Mbps bandwidth over existing copper wire and fiber-optic cables, meeting the demands of e-commerce and data-intensive businesses that want to preserve their investment in existing Ethernet infrastructures. The 1000Base-T LAN adapter supports both the CAT 5 and CAT 5e (enhanced) cabling standards. This allows superior investment protection in the existing cabling infrastructure.

The 1000Base-T adapter automatically detects the speed of the associated device as 10-, 100-, or 1000Base-T so it may be deployed immediately in any Ethernet environment. All the Gigabit LAN adapters are based on the same Ethernet standards already widely deployed in the marketplace, and they allow migration from 10 Mbps to 100 Mbps to 1000 Mbps quickly and easily, with fast deployment and minimal training needed.

The Gigabit LAN adapters are also supported with HP Auto Port Aggregation (APA) software, J4240AA. Up to 4 Gigabit Ethernet links can be logically aggregated together to form a single, extremely high-bandwidth channel with one IP address, automatic link failover, and load balancing.

In addition, HP Gigabit Ethernet adapters support HP-UX VLANs (virtual LANs). This solution offers IT managers a powerful tool that simplifies the tasks of building, managing, and securing complex network infrastructures. Physical LANs can be segmented into smaller logical or "virtual" LANs, allowing broadcast traffic to be reduced, thereby improving overall network performance. Now a change to network topology no longer requires those dreaded trips to the wiring closet!

HP-UX VLAN is compliant with host-based IEEE 802.1Q VLAN tagging, IEEE 802.1p (later incorporated in IEEE 802.1D) priority encoding, and IP Type of Service (ToS)-802.1p priority conversion.

Other key features of HP-UX VLAN include:

- IP subnet-based, protocol-based, and port-based VLAN support
- supported on HP-UX 11i v1
- configuration using well-known HP-UX tools—*lanadmin* (CLI) and SAM (GUI)
- 1024 VLANs per NIC port
- designed to work seamlessly with HP high-availability products, such as MC/Serviceguard
- no changes to applications required
- preserve VLAN configuration across reboot

If you would like more information regarding HP-UX VLAN functionality, please refer to the "Planning and Implementing VLANs with HP-UX" white paper, located at [www.hp.com/go/vlan](http://www.hp.com/go/vlan).

HP-UX 11i v1  
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## customer benefits

- increase network performance—1000 Mbps
- lower networking management costs
- leverage existing Ethernet infrastructures—including widely deployed CAT 5 cabling for 1000Base-T
- maximize CPU efficiency, thus lowering total cost of ownership
- SNMP (MIB-II) support

## application areas

- Web-based Internet/intranet information distribution and transaction processing require both fast response times and high availability
- high productivity client/server systems require high-bandwidth, high-availability paths between the client, server, and data
- networking backbones—Gigabit aggregates 10/100Base-T traffic; the Gigabit links can also be aggregated with HP Auto Port Aggregation (APA) to create multi-Gigabit, high-bandwidth backbones
- database backup demands very high bandwidth and availability to ensure one-pass backup
- solutions requiring high-performance connections for voice, video, streaming, multimedia, and high-end applications
- network-attached storage

## features and benefits

| features                                                                                    | benefits                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000 Mbps (Gigabit speed)                                                                   | <ul style="list-style-type: none"><li>• high-performance, high-bandwidth Gigabit networking—1000 Mbps</li><li>• ideal for media-rich data, Internet applications, and high-speed data centers</li><li>• faster network backups and data access</li></ul> |
| 1000Base-T and 1000Base-SX Ethernet standards (IEEE 802.3ab and IEEE 802.3z)                | <ul style="list-style-type: none"><li>• seamlessly integrates into existing Ethernet infrastructures</li><li>• lower cost to implement and manage</li><li>• leverage current investments in Ethernet and cable infrastructure</li></ul>                  |
| auto-negotiation: tri-speed—10, 100, or 1000 Mbps for the 1000Base-T adapter                | <ul style="list-style-type: none"><li>• flexible, easy to deploy</li><li>• adapts for growing network bandwidth requirements</li></ul>                                                                                                                   |
| CPU offload (Internet checksum offload, byte swapping, interrupt coalescence and avoidance) | <ul style="list-style-type: none"><li>• increases performance</li><li>• maximizes server CPU efficiency</li></ul>                                                                                                                                        |
| HP-UX VLAN (virtual LAN)                                                                    | <ul style="list-style-type: none"><li>• enables logical connectivity separation of a network from physical connectivity</li><li>• isolates traffic and preserves bandwidth</li><li>• improves network manageability and performance</li></ul>            |
| MC/Serviceguard (MCSG) and Auto Port Aggregation (APA) support                              | <ul style="list-style-type: none"><li>• MCSG offers highest levels of high availability</li><li>• APA can aggregate up to 4 Gigabit links to create a "super" bandwidth connection</li></ul>                                                             |
| Online Addition and Replacement (OLAR)                                                      | <ul style="list-style-type: none"><li>• server uptime is maximized, since adapters can be added or replaced without the need to bring the system down</li></ul>                                                                                          |
| up to 550-meter cabling lengths (dependent on cable) for the 1000Base-SX adapter            | <ul style="list-style-type: none"><li>• ultimate flexibility in data center layouts, backbone implementations, or high-performance client networks</li></ul>                                                                                             |
| dual DMA channels for simultaneous read and write; embedded RISC processor                  | <ul style="list-style-type: none"><li>• enhanced performance for every type of networking task—downloading, uploading, file transfers, and intense bi-directional traffic</li></ul>                                                                      |

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**next-generation  
Gigabit Ethernet  
specifications**

| product number                 | A6825A                                                                                                                                                                         | A6847A                                                                                                                                                                         |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| description                    | PCI HP-UX 1000Base-T Gigabit Ethernet Adapter                                                                                                                                  | PCI HP-UX 1000Base-SX Gigabit Ethernet Adapter                                                                                                                                 |
| systems supported              | rp2400 series<br>rx2600 series<br>rp5400 series<br>rx5600 series<br>rp7400 series<br>rp8400<br>superdome                                                                       | rp2400 series<br>rx2600 series<br>rp5400 series<br>rx5600 series<br>rp7400 series<br>rp8400<br>superdome                                                                       |
| maximum number of active cards | rp2400 series: 4<br>rx2600 series: 4<br>rp5400 series: 10<br>rx5600 series: 9<br>rp7400: 12<br>rp7410: 15<br>rp8400: 16<br>superdome: 16, 32, or 64 (depends on configuration) | rp2400 series: 4<br>rx2600 series: 4<br>rp5400 series: 10<br>rx5600 series: 9<br>rp7400: 12<br>rp7410: 15<br>rp8400: 16<br>superdome: 16, 32, or 64 (depends on configuration) |
| release(s) supported           | HP-UX 11.0, 11i v1, and 11i v1.6                                                                                                                                               | HP-UX 11.0, 11i v1, and 11i v1.6                                                                                                                                               |
| VLAN supported                 | yes (for 11i v1 only)                                                                                                                                                          | yes (for 11i v1 only)                                                                                                                                                          |
| OLAR support                   | yes (for 11i v1 only)                                                                                                                                                          | yes (for 11i v1 only)                                                                                                                                                          |
| connector type                 | RJ-45                                                                                                                                                                          | duplex SC                                                                                                                                                                      |
| cabling                        | CAT 5, CAT 5e e CAT 6 unshielded twisted pair (UTP) copper cabling                                                                                                             | multi-mode fiber (62.5 or 50 micron)                                                                                                                                           |
| wavelength                     | NA                                                                                                                                                                             | 850 nm                                                                                                                                                                         |
| CPU offload features           | yes                                                                                                                                                                            | yes                                                                                                                                                                            |
| auto-sensing speed             | 10, 100, 1000 Mbps                                                                                                                                                             | 1000 Mbps only                                                                                                                                                                 |
| auto-negotiation               | yes                                                                                                                                                                            | yes                                                                                                                                                                            |
| duplex support                 | full duplex for 10/100/1000 Mbps<br>half duplex for 10/100 Mbps                                                                                                                | full duplex for 1000 Mbps<br>half duplex not supported for fiber                                                                                                               |
| jumbo frame support            | yes (at 1000 Mbps only)                                                                                                                                                        | yes                                                                                                                                                                            |
| MC/Serviceguard support        | yes                                                                                                                                                                            | yes                                                                                                                                                                            |
| Auto Port Aggregation support  | yes (for 11i v1 only)                                                                                                                                                          | yes (for 11i v1 only)                                                                                                                                                          |
| operating distance             | up to 100 meters                                                                                                                                                               | up to 550 meters (dependent on cable)                                                                                                                                          |
| Ethernet standard              | IEEE 802.3ab IEEE 802.3u                                                                                                                                                       | IEEE 802.3z                                                                                                                                                                    |
| form factor/host bus           | 64-bit/66 MHz PCI                                                                                                                                                              | 64-bit/66 MHz PCI                                                                                                                                                              |
| card size                      | 2.536 x 6.6 in (64.4 x 167.6 mm)                                                                                                                                               | 2.536 x 6.6 in (64.4 x 167.6 mm)                                                                                                                                               |

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**additional hp-ux  
Gigabit Ethernet  
features and  
specifications**

| feature                              | all hp-ux Gigabit Ethernet LAN adapters |
|--------------------------------------|-----------------------------------------|
| NIC to NIC connection                | yes                                     |
| link level and IP multi-cast support | yes                                     |
| promiscuous mode (link and SAP)      | yes                                     |
| SNMP (MIB-II) support                | yes                                     |
| activity and status LED indicators   | yes                                     |
| universal keyed, 3.3 and 5v tolerant | yes (for PCI cards only)                |
| SAM configurable                     | yes                                     |
| protocols                            | TCP/IP, UDP/IP, NFS                     |
| customer installable                 | yes (except on Superdome)               |
| hp MAC address                       | yes                                     |

**operating distance for  
1000Base-SX**

| 1000Base-SX<br>(850 nm SWL) | modal bandwidth<br>(classification of<br>fiber-optic cable) | operating distance                   |
|-----------------------------|-------------------------------------------------------------|--------------------------------------|
| 62.5-micron MMF cable       | 160 (MHz x km)<br>200 (MHz x km)                            | up to 220 meters<br>up to 275 meters |
| 50-micron MMF cable         | 400 (MHz x km)<br>500 (MHz x km)                            | up to 500 meters<br>up to 550 meters |

**environmental  
specifications  
for A6825A and  
A6847A**

|                                  |                                                                                                                                                                               |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| temperature                      | non-operating: -40° to 60° C (-40° to 140° F)<br>operating: 0° to 50° C (32° to 122° F)                                                                                       |
| humidity                         | non-operating: 5 to 95% RH non-condensing (20%/hour)<br>operating: 5 to 95% RH non-condensing at 40° C (104° F) (16-hour dwells at extremes)                                  |
| altitude                         | non-operating: 10.6 km (35,000 ft)<br>operating: 3.1 km (10,000 ft)                                                                                                           |
| electromagnetic<br>compatibility | USA: FCC, Class B<br>Europe: CISPR-22/EN55022, Class B<br>Australia: AS/NZS 3548 Class B<br>Japan: VCCI, Class B<br>harmonic: EN61000-3-2<br>flicker/fluctuation: EN61000-3-3 |

**10-gigabit Gigabit Ethernet ordering information**

**A6825A**—1000Base-T PCI Gigabit Ethernet LAN Adapter  
**Option #0D1**—Factory integration  
**Option #AVN**—Release notes

**A6847A**—1000Base-SX PCI LAN Adapter  
**Option #0D1**—Factory integration  
**Option #AVN**—Release notes

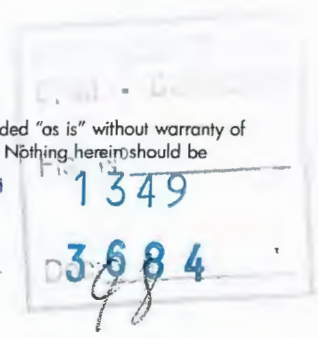
**for more information**

For additional information on this or other HP enterprise networking solutions, please visit us on the Web at [www.hp.com/go/hp9000io](http://www.hp.com/go/hp9000io), visit our technical documentation site at <http://docs.hp.com/hpux/netcom/index.html>, or contact any of our worldwide sales offices or HP Channel Partners. In the U.S., call 1-800-637-7740.

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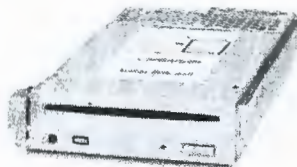
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software loading  
capability for the  
hp tape array  
5300



## hp surestore dvd-rom array module

The HP Surestore DVD-ROM Array Module further extends the versatility of HP's tape array solution. It provides DVD and CD reading functionality, and the ability to load software, all in a half-height form factor. This module is offline hot-swappable within an HP Surestore Tape Array 5300 for easy insertion and removal in a racked environment and offers the high performance (40x as a CD-ROM, 10x as a DVD-ROM) information services professionals need.

The HP Surestore Tape Array solutions provide a choice of rack enclosures in different heights to fit almost any data center. Available array modules encompass a wide range of tape drive technologies, as well as DVD-ROM, which can be mixed and matched in a single enclosure. The HP Surestore Tape Array 5300 offers upgrade options to enable SAF-TE remote manageability in a Windows® operating system environment and an additional power supply and fan kit for environments where redundancy is important.

### key features/benefits

- **fast:** delivers high data transfer rates (10x for DVD-ROM, 40x for CD-ROM) for performance.
- **manageable:** offline hot-swap capability for easy insertion and removal.
- **flexible:** DVD and CD read functionality in a racked environment.
- **adaptable:** provides a half-height array module for addition to an HP Tape Array 5300.

## specifications

|                                |                                                                                                                                                                                                                                                                                 |                                      |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Interface                      | Ultra SCSI LVDS. A fast, narrow, single-ended Ultra SCSI DVD-ROM with max throughput (burst rate) of 20 Mbps. Mounting in a Surestore DVD-ROM rack-ready module enables connection to an LVD SCSI bus for burst rates of 160 Mbps.                                              |                                      |
| Form Factor                    | 5.25 inch, half-height                                                                                                                                                                                                                                                          |                                      |
| Loading System                 | Slot disc loading system, long disc eject                                                                                                                                                                                                                                       |                                      |
| Insertion/Removal              | Offline hotswappable                                                                                                                                                                                                                                                            |                                      |
| Performance                    | DVD-ROM: CAV 10x                                                                                                                                                                                                                                                                | CD-ROM: CAV 40x                      |
| Access Time/Seek Time          | DVD: average 95 msec                                                                                                                                                                                                                                                            | CD: average 80 msec (random average) |
| Loading Time                   | Less than 3 sec (the period the disc starts to load and is clamped in the drive)                                                                                                                                                                                                |                                      |
| Unloading Time                 | Less than 4 sec (from eject button press to disc unload)                                                                                                                                                                                                                        |                                      |
| Disc Read Formats              | DVD single layer & dual layer, DVD-R <sup>1</sup> , DVD-RW <sup>1</sup> , CD-ROM mode 1, XA mode 2, Photo CD (single & multiple session), CD-DA, CD-Extra, CD-R, CD-RW, Video CD                                                                                                |                                      |
| Operating System Compatibility | Tape Array solutions are compatible with HP Servers running HP-UX, Windows®, Linux, and other industry-leading operating systems and software. For further information on system-specific compatibility visit: <a href="http://www.hp.com/go/connect">www.hp.com/go/connect</a> |                                      |
| Standard Warranty              | 3-years, next day <sup>2</sup> unit exchange, system matching on HP systems <sup>3</sup> (internal, external, and rack mountable units).                                                                                                                                        |                                      |

<sup>1</sup> DVD-RAM is not supported.

<sup>2</sup> Unit exchange next day is not available in some countries.

<sup>3</sup> The system matching period applies to the host system standard warranty period only. The drive warranty reverts to unit exchange for the remainder of its standard warranty period after the host warranty expires.

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## specifications (continued)

### Power

|                    |                                  |         |
|--------------------|----------------------------------|---------|
| Input voltage      | +5VDC (+/- 5%), +12VDC (+/- 10%) |         |
| Current draw:      | +5VDC:                           | +12VDC: |
| Stand-by (average) | 0.10A                            | 0.05A   |
| Read (average)     | 0.8A                             | 1.3A    |
| Maximum            | 1.2A                             | 1.8A    |

### Power Consumption

|                    |                 |
|--------------------|-----------------|
| Stand-by (average) | 1.1W            |
| Read (average)     | 19.6W           |
| Maximum            | 27.6W           |
| Includes           | Power save mode |

### Physical Characteristics

|                        |                                          |
|------------------------|------------------------------------------|
| Weight                 | 1.5 kg (3.3 lb)                          |
| Dimensions (H x W x D) | 42 x 165 x 320 mm (1.65 x 6.5 x 12.6 in) |

### Safety

|                |                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Certifications | USA-UL (safety), Germany-TUV (safety), Canada-CSA (safety), EU-CE (safety & EMC), Australia/New Zealand-C-Tick (EMC only), Korea (EMC), Taiwan (EMC) |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

## ordering information

### Accessories<sup>1</sup>

|                                     |            |
|-------------------------------------|------------|
| Rack-ready DVD-ROM array module     | C7499A     |
| Factory-racked DVD-ROM array module | C7499A-OD1 |

### HP Supportpacks

|                                                         |          |
|---------------------------------------------------------|----------|
| HP Surestore Tape Array 5300                            | C7508A   |
| <sup>1</sup> Cables and terminators ordered separately. |          |
| 3-year, Next-day, Onsite Response                       | H3155A/E |
| 3-year, Same day, Onsite Response                       | H4616A/E |

## more information

For more information on HP Tape Array products, contact any of our worldwide sales offices or visit the HP Storage Web site at [www.hp.com/go/storage](http://www.hp.com/go/storage)

For information about hardware and software compatibility, visit the HP Storage Compatibility Web site at [www.hp.com/go/connect](http://www.hp.com/go/connect)

HP offers an extensive portfolio of HP and mixed environment storage, special consulting and support services to assist with your IT storage needs. For additional information, please contact your local HP representative or a worldwide sales office, or visit our Web site at [www.hp.com/go/4service](http://www.hp.com/go/4service)



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Doc: 100





## hp tape array 5300



a 19" 3U enclosure  
holding up to four  
array modules

The HP Surestore Tape Array 5300 is a 3U rack enclosure that will hold two full-height array modules, four half-height modules, or one full-height and two half-height modules. The enclosure supports HP array modules, including Ultrium 230, Ultrium 215, DLT 80, DLT vs80, DAT 40 (DDS-4), and DAT 24 (DDS-3) tape drives, plus a DVD-ROM. The wide variety and interchangeability of array modules provides a truly flexible solution for use in a variety of different data storage situations.

For IT managers whose environments require added data security and accessibility, the Tape Array 5300 also has an optional upgrade kit—the PSU/fan kit provides a redundant fan and power supply.

### key features and benefits

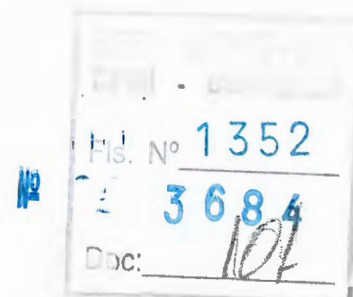
- **expandable:** holds up to four offline hot-swappable array modules on four independent SCSI buses
- **upgradable:** allows you to expand from one to four tape drives as your capacity requirements grow
- **flexible:** supports HP array modules: Ultrium 230, Ultrium 215, DLT 80, DLT vs80, DAT 40 (DDS-4), DAT 24 (DDS-3) and DVD-ROM
- **compact:** stores 800 GB of compressed data per array with four Ultrium 215 drives in 3U of rack space
- **high availability:** maximizes system uptime and performance with optional redundant components
- **rackable:** fits in standard 19" racks from HP, Apex, and Rittal

### tape drive comparison

| model          | form factor | capacity* | performance* |
|----------------|-------------|-----------|--------------|
| DAT 24m        | Half-height | 24 GB     | 7.2 GB/hour  |
| DAT 40m        | Half-height | 40 GB     | 21.6 GB/hour |
| DLT vs80m      | Half-height | 80 GB     | 21.6 GB/hour |
| DLT 80m**      | Full-height | 80 GB     | 43.2 GB/hour |
| Ultrium 215m   | Half-height | 200 GB    | 54 GB/hour   |
| Ultrium 230m** | Full-height | 200 GB    | 108 GB/hour  |

\*Capacity and performance are based on 2:1 data compression. Actual compression varies with data type.

\*\* These modules are also compatible with Tape Array 5500.





## hp tape array 5300

23 358  
Raula

### technical specifications

|                             |                                                                 |
|-----------------------------|-----------------------------------------------------------------|
| dimensions (h x w x d)      | 741 x 445 x 133 mm (29.2 x 17.5 x 5.25 in)                      |
| weight                      | 13 kg (28.71 lb)                                                |
| native capacity             | 400 GB with four Ultrium 215 drives                             |
| compressed capacity         | 800 GB* with four Ultrium 215 drives                            |
| external I/O ports          | Eight SCSI ports (one in and one out per half-height drive bay) |
| power supply/required       | 100–127V AC (+/-10%) or 200–240V AC (+/-10%)                    |
| operating temperature range | 5° to 40°C (41° to 104°F)                                       |
| storage temperature range   | -40° to 70°C (-40° to 158°F)                                    |
| operating humidity range    | 20% to 80% RH                                                   |
| non-operating humidity      | 5% to 95% RH                                                    |

\*Capacities and transfer rates assume 2:1 data compression. Actual compression may differ because compression varies with data type.

### ordering information

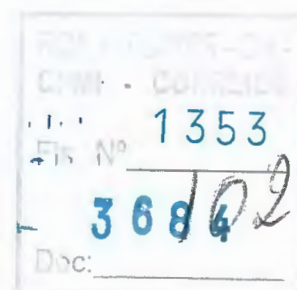
|                                 |                        |                                        |
|---------------------------------|------------------------|----------------------------------------|
| C7508A                          | Tape Array 5300        | Four-bay rack enclosure                |
| C7496A                          | Tape Array PSU/fan kit | Redundant power supply and fan         |
| <b>compatible array modules</b> |                        |                                        |
| C7456A                          | DLT 80m                | DLT 80 array module (full-height)      |
| C7507A                          | DLT vs80m              | DLT vs80 array module (half-height)    |
| C7470A                          | Ultrium 230m           | Ultrium 230 array module (full-height) |
| C7492A                          | Ultrium 215m           | Ultrium 215 array module (half-height) |
| C7497A                          | DAT 40m                | DAT 40 array module (half-height)      |
| C7498A                          | DAT 24m                | DAT 24 array module (half-height)      |
| C7499A                          | DVD-ROM                | DVD-ROM array module (half-height)     |

### additional information

|                                                                  |                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| target use                                                       | Providing a scalable, flexible means of racking standalone products or adding versatile storage capability to a local area network                                                                                                                                                   |
| target audience                                                  | IT managers of mid-sized companies who have a rack environment and require a scalable backup solution that supports a variety of tape technologies and DVD-ROM for software loading                                                                                                  |
| what's in the box                                                | Enclosure, mounting rails, rack-mounting kit (for HP & other racks), rack-mounting template, manuals, Surestore CD containing documentation, power cord, power supply unit (PSU), PSU bay filler panel, fan, fan bay filler panel, torx tool, drive bay filler panels, accessory kit |
| warranty features—<br>hp service and support<br>warranty options | 3-year, next-day onsite response; system matching on HP rack servers<br><br>H4618A / H4618E 3-year, same-day, onsite                                                                                                                                                                 |

### for more information

For more information on HP storage products, contact any of our worldwide sales offices or visit our Web site at:  
[www.hp.com/go/storage](http://www.hp.com/go/storage)





## About HP C/HP-UX

- ↑ HP C/HP-UX Reference Manual
- ↑ What is HP C?
- ← Compatibility Mode

HP C Online Help →

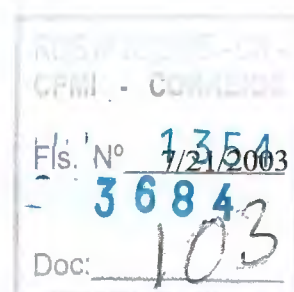
## About HP C/HP-UX

This manual presents ANSI C as the standard version of the C language. Where certain constructs are not available in compatibility mode, or would work differently, it is noted and the differences are described.

HP C/HP-UX, when invoked in ANSI mode, is a conforming implementation of ANSI C, as specified by American National Standard 9899-1990. This manual uses the terminology of that standard and attempts to explain the language defined by that standard, while also documenting the implementation decisions and extensions made in HP C/HP-UX. It is not the intent of this document to replicate the standard. Thus, you are encouraged to refer to the standard for any fine points of the language not covered here.

← Compatibility Mode

HP C Online Help →



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HP-UX operating system all

HP-UX | manageability | partitions

printable version



## HP-UX virtual partitions (vPars)<sup>1</sup>

### » hp-ux home

- » hp software index home
- » operating and embedded home
- » software strategy

### » hp-ux press room

- » technical support
- » buy online from hp
- » section map

HP-UX Virtual Partitions (vPars) enables you to run multiple instances (versions) of the HP-UX 11i Operating Environment (OE) simultaneously on one server with each OE instance hosting its own set of applications in a fully isolated environment. Created through software, virtual partitions provide application and operating systems isolation that run on single server nodes or within single-system hard partitions. Each virtual partition runs its own image of the operating system and can fully host its own applications—offering complete software isolation. The capability of CPU migration allows users to add and delete dynamically (without reboot) CPUs from one virtual partition to another. This enables applications to coexist in the same server while assuring complete privacy. In addition, functionality is provided to dynamically create, modify or even delete the isolated operating environments on a running server without interrupting non-related partitions.

In comparison to nPartitions, vPars provide greater flexibility and granularity while nPartitions provide greater fault isolation. Greater flexibility in vPars is achieved with the ability—using simple software commands—to add and delete dynamically (without reboot) CPUs from one virtual partition to another. In addition, multiple vPars can function within an nPartition providing greater granularity (1 CPU).

HP-UX Virtual Partitions (vPars) is available on the following HP servers running HP-UX Superdome, rp8400, rp7410, rp7405, rp7400, rp5470, rp5405.

### partitioning information

- » partitioning continuation
- » nPartitions
- » virtual partitions
- » information library

### related information

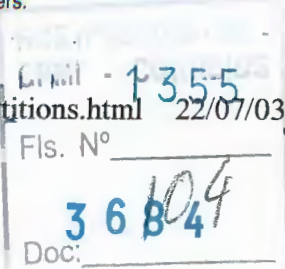
- » hyperplex
- » workload management
- » process resource
- » processor sets

### benefits

vPars provides the following benefits:

- **Increased system utilization** by partitioning previously unused portions of the server. Typically, a server is only using 50% of its capacity.
- **Greater flexibility** of resources through: 1) multiple but independent operating environments per server (with as low as 1 CPU granularity per partition) and 2) the movement of CPU power between vPars depending on workload requirements.
- **Increased isolation** of applications, their operating systems, and assigned resources (memory, and I/O), with individual reconfiguration and rebooting of the individual partitions without affecting other partitions and their applications.
- **Server consolidation** by running multiple workloads with their unique Operating configuration needs on the same server at the same time. They are excellent for creating test platforms without investing in more hardware.

<sup>1</sup>At this time, vPars is available only on HP-UX 11i on certain PA-RISC servers.





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# Ignite-UX Administration Guide

**HP Computers  
with HP-UX 10.x, 11.0 or 11i**



**Manufacturing Part Number : B2355-90772**

**Edition 10, March 2003  
Printed in U.S.A.**

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Fils. N° 1357  
Doc: 3684  
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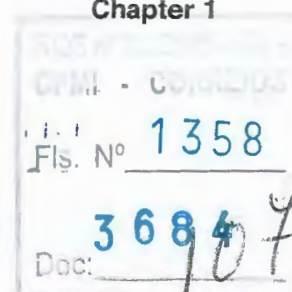


## Ignite-UX Commands and Online Documentation

Ignite-UX provides online information in the /opt/ignite/share/doc/ directory. Also see these Ignite-UX manpages:

Table 1-1

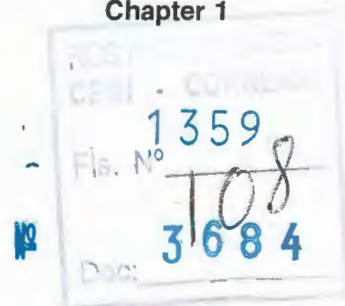
| Ignite-UX Manpage                                       | Description                                                                                           |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <i>ignite</i> (5)                                       | Ignite clients remotely from the Ignite-UX screen and provides an overview of all Ignite-UX commands. |
| <i>instl_adm</i> (1M)<br><i>instl_adm</i> (4)           | Manage Ignite-UX config files.                                                                        |
| <i>instl_combine</i> (1M),<br><i>make_medialif</i> (1M) | Construct custom, bootable install media.                                                             |
| <i>instl_dbg</i> (1M)                                   | Debug config files.                                                                                   |
| <i>instl_bootd</i> (1M)                                 | Boot protocol server for Ignite-UX client.                                                            |
| <i>bootsys</i> (1M)                                     | Reboot and install systems using Ignite-UX.                                                           |
| <i>make_bundles</i> (1M)                                | Package SD bundles into an SD Depot.                                                                  |
| <i>make_depots</i> (1M)                                 | Creates SD depots from media.                                                                         |
| <i>make_boot_tape</i> (1M)                              | Create a system boot tape.                                                                            |
| <i>make_net_recovery</i> (4)                            | Create recovery archives on a network system.                                                         |
| <i>make_tape_recovery</i> (1M)                          | Create recovery tapes. Replaces <i>make_recovery</i> available beginning with Ignite-UX A/B 3.2.      |
| <i>check_recovery</i> (1M)                              | Check recovery tape status since last <i>make_*_recovery</i> .                                        |
| <i>make_sys_image</i> (1M)                              | Create golden system images.                                                                          |
| <i>make_config</i> (1M)                                 | Generate config files for installing software in SD bundles.                                          |





Introducing Ignite-UX  
Ignite-UX Overview

- System recovery** You have consistent, reliable recovery in the event of a catastrophic failure of the system disk or root volume group using either the `make_tape_recovery` or `make_net_recovery` command.
- Support for ServiceControl Manager** Ignite-UX supports installing HP-UX client systems in an HP ServiceControl Manager environment. See the *ServiceControl Manager Installation and Configuration* guide for more details.





D-22



# HP System Partitions Guide

## Administration for nPartitions

Sixth Edition

Revision 6.0



Manufacturing Part Number: 5187-3603

April 2003

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Doc: 3684



## Virtual Partitions (vPars) Management on nPartitions

### Configuring Virtual Partition Resources and Attributes

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## Configuring Virtual Partition Resources and Attributes

When creating or reconfiguring a virtual partition, you manage **resources and attributes** that determine the virtual partition's configuration and capabilities.

Each virtual partition has three types of resources: `cpu`, `io`, and `mem`, which specify processor(s), I/O, and memory allocated exclusively for the virtual partition.

The virtual partition resource configuration determines which hardware is dedicated for the virtual partition's use, by indicating hardware paths, quantities, and limits.

Each virtual partition also has three types of attributes: general attributes, hardware attributes, and boot attributes.

---

### NOTE

To modify most virtual partition *hardware* resources or attributes, you must ensure that the virtual partition being modified is in a "Down" state.

Also note that some virtual partition attributes are required and some are optional.

See the *vparmodify* (1M) and *vparresources* (5) manpages for details.

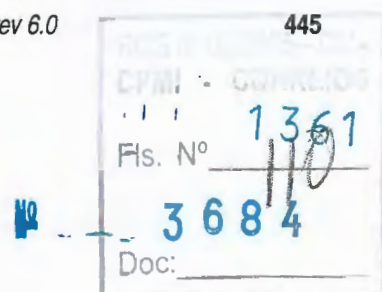
---

The following list includes details and command-line options for setting virtual partition attributes. Also see the *vparcreate* (1M) and *vparmodify* (1M) command manpages.

- **Virtual Partition General Attributes**

The **general virtual partition attributes** include the *name* of the virtual partition and the *static* attribute.

The *name* attribute (`-p` and `-P`) defines the virtual partition's name, which you use when referencing or managing the virtual partition using commands.







hp servers  
product brief

## hp rack-optimized servers can help you be always on, always there, always connected

### hp servers rp5430 and rp5470: smart, simple, stress-free

In today's economy, whether you're managing your own IT infrastructure or hosting someone else's, you have to operate with a faster time-to-solution, within budgetary constraints, and with the highest standards for customer service and operational efficiency.

To create and run an infrastructure for an always-on business, you need a computing platform that will support the way you—and your customers—do business. The HP Servers rp5430 and rp5470 give your business the fastest—and most reliable—means of succeeding in this new business environment.

The HP Servers rp5430 and rp5470 deliver the proven performance, scalability, and high-availability capabilities of UNIX—without high maintenance requirements and costs. And they give you plenty of room to grow. You can start at a low-price entry point and scale up to the leading 4-way UNIX performance—in the same rack-optimized form

factor, without penalty. And with its industry-leading solution partners, HP has developed business solutions surrounding these servers that are tested, easy to deploy, and easy to manage.

With HP Servers rp5430 and rp5470, owning and operating a UNIX server is smart, simple, and stress-free.

#### smart

HP Servers rp5430 and rp5470 offer leading entry-level server performance, dynamic scalability, and unmatched investment protection—all in a rack-optimized package—making them the smart choice for the most demanding applications.

#### leading performance— scalable functionality

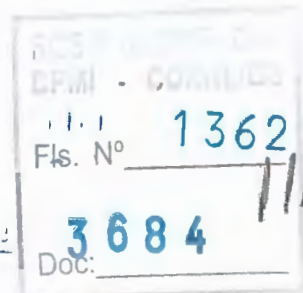
- industry-leading OLTP performance
- massive bandwidth for I/O-intensive applications

- 7U-height and packed with CPUs, memory, and I/O, plus the ability to scale subsystems without compromise
- rack-optimized to make the best use of valuable data-center floorspace

#### unparalleled investment protection

- industry's only in-box upgrade from 2-way to 4-way UNIX computing
- built-in growth path to the HP Server rx5670, featuring Intel® Itanium® 2 processors

hp servers rp5430  
and rp5470



# proven solutions for business-critical computing

## simple

### hp makes IT easy

With HP Servers rp5430 and rp5470, HP offers a unique combination of solutions designed to help you get started quickly and manage your IT environment effectively.

### hp-ux: robust, proven enterprise operating environment for mission-critical applications

- industry-leading performance, scalability, availability, manageability, and security
- pre-packaged, integrated, and production-ready operating environments
- industry-leading Windows® and Linux interoperability
- centralized software updates that are timely, simple, and efficient
- powerful alliances with industry-leading software vendors and systems integrators to deliver robust solutions from e-commerce to enterprise resource planning (ERP) and beyond

### leading-edge management capabilities with

#### hp-ux virtual partitions and hp-ux workload manager

- system resource optimization enabling multiple workloads to run simultaneously on the same server, each with their own instance of HP-UX
- improved security and server availability through complete software and operating system isolation
- HP-UX Virtual Partitions integrate with HP-UX Workload Manager for the most efficient resource distribution across partitions, in a single server
- base offering complementary with HP-UX 11i for your HP Server rp5470

### integrated management capabilities

- HP Servicecontrol Manager and integrated HP Secure Web Console capability for full remote management, including centralized configuration of multiple servers

## the right server for today's applications

### ERP (supply-chain management)

High availability, leading-edge manageability, and scalable performance support demanding end-to-end enterprise applications.

### broadband

The combination of leading performance, I/O throughput, and capacity and high availability with end-to-end solutions delivers more powerful, reliable broadband services.

### Internet infrastructure

Highly scalable, reliable, and manageable Web server, caching server, load balancing, e-commerce server, firewalls, or mail server.

### e-commerce

Leading performance and I/O bandwidth, in-box scalability, rack-optimized form factor (five per standard 2-meter rack), high availability, and Internet management features.

### technical computing

Leading performance and throughput, N+1 redundant components, extensive memory capabilities, and clustering solutions to meet the demands of computation, NFS file serving and product data management, and Web hosting.

## flexible financing

- operating leases with a variety of attractive terms
- the Tech Refresh program for cost-effective upgrades to stay on the leading edge of new technology
- bundled Solution Finance program to consolidate and simplify financing arrangements

## instant capacity on demand for your hp server rp5470

### iCOD

- instant activation of incremental CPU power when you need it
- pay only for the processing power you use

### temporary capacity for iCOD

- temporary activation of incremental CPU power for a limited period
- ideal for short-term, predictable processing demands

## stress-free

### make your business your focus

The HP Servers rp5430 and rp5470 handle the demands of users efficiently and reliably—so you can concentrate on running your business, not managing your IT resources.

### high availability for continuous operations

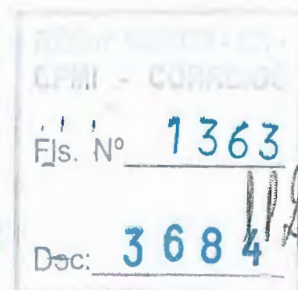
- a rich set of in-box high-availability features
- affordable high-availability clustering solutions based on industry-leading HP MC/Serviceguard
- self-healing capabilities, a first for entry-level servers—proactively avoid faults to improve uptime
- a critical building block for your always-on e-business needs

### total solution support

- options ranging from Web-based services to the industry's only 6-hour call-to-repair commitment
- "one-stop" solution support delivered with partners such as Cisco, Oracle®, SAP, i2, Inktomi, and many more

## best UNIX server family—top to bottom

The low-cost entry point to the two-way HP Server rp5430 through the more scalable HP Server rp5470 are part of the powerful HP UNIX server line—servers that set the standards for business-critical computing and total cost of ownership. Simple in-chassis upgrades let you move up the line as your business grows. HP UNIX servers provide the hardware foundation for an Internet infrastructure that is always on. Combining leading technology with proactive and reactive services, HP offers complete, end-to-end solutions that include hardware, software, applications, services, support, consulting, and an extensive portfolio of experienced partners, so you can get to market quickly with a single source of expertise. The HP UNIX server family is robust from the top to bottom—from the high-end HP Superdome; through the HP Servers rp8400 and rp7410, the midrange performance and price/performance leaders; and to the scalable entry-level HP Servers rp5430 and rp5470. Rounding out the family are the hyper-dense HP rp2400 series servers for Internet applications and branch offices.







## hp servers rp5430 and rp5470 features and benefits at-a-glance

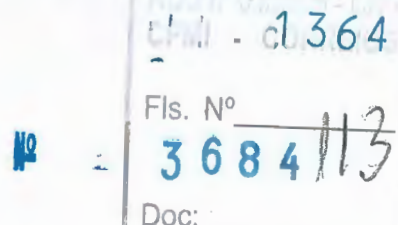
| features                                                                                                                                       | benefits                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>smart</b>                                                                                                                                   |                                                                                                                              |
| 1-4 (rp5470) or 1-2 (rp5430) 875MHz PA-8700+ CPUs with 2.25 MB on-chip cache per CPU or 750MHz PA-8700 CPUs with 2.25 MB on-chip cache per CPU | Superior performance over comparable systems, with plenty of headroom for growth                                             |
| Up to 16 GB (rp5470) or up to 8 GB (rp5430) SDRAM memory with advanced ECC protection                                                          | Fast and reliable processing power for frequently accessed data                                                              |
| Up to 10 (rp5470) or 6 (rp5430) PCI I/O slots with 3.2 GB/s (rp5470) or 2.3 GB/s (rp5430) I/O bandwidth                                        | Easily handles I/O-intensive applications and allows the system to scale I/O, CPUs, and memory without compromise            |
| Core I/O, including 10/100Base-T LAN with auto speed-sensing, a second 10/100Base-T support LAN, Ultra2 LVD SCSI, and RS-232                   | Provides easy, ready-to-go networking capabilities                                                                           |
| Up to 4 internal 36 GB, 73 GB, or 146 GB Ultra320 SCSI hot-plug high-uptime disks                                                              | Store critical data with massive internal capacity                                                                           |
| 1 internal DVD or DAT drive                                                                                                                    | Protects critical data                                                                                                       |
| 7U chassis with up to 5 servers per standard 2-meter rack; also available in 1U (pedestal) configuration                                       | Optimizes use of floor space and delivers high-performance density in a racked configuration                                 |
| Easy in-box upgrades from the rp5430 to the rp5470                                                                                             | Architectural scalability ensures these servers can grow with the business, maximizing flexibility and investment protection |
| Support of Intel Itanium Processor Family as well as PA-RISC processors                                                                        | Provides investment protection through dual growth paths                                                                     |

## simple

|                                                                                                                            |                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Built-in unlimited user license for proven 64-bit HP-UX 11i and 11.0                                                       | Proven, enterprise UNIX operating system for mission-critical applications                                                                    |
| HP Virtual Partitioning for the rp5470                                                                                     | Maximizes usage of computing resources                                                                                                        |
| Integrated HP Secure Web Console and Servicecontrol Manager for full local, Web, and remote control of servers             | Provide complete single-system and multisystem administration capabilities, including a range of security features, from any browser-based PC |
| Flexible financing programs                                                                                                | Make initial ownership and modular growth easy and affordable                                                                                 |
| Instant capacity on demand (iCOD); temporary capacity for iCOD                                                             | Immediate access to CPU power when you need it, either permanently or temporarily                                                             |
| HP global deployment and partner integration services                                                                      | Offer guaranteed error-free solution deployment to reduce implementation time and cost                                                        |
| HP On-site Solution consolidated manufacturing, streamlined product assembly and testing, and state-of-the-art integration | Ensure superior quality and faster delivery                                                                                                   |

## stress-free

|                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Error-correcting cache, parity checking on all buses, memory scrubbing and page de-allocation, dynamic processor resilience, and de-allocation of application processes                                            | Built-in high-availability features deliver superior levels of <ul style="list-style-type: none"><li>• error correction,</li><li>• error containment,</li><li>• data protection, and</li><li>• serviceability</li></ul> to help maximize uptime for business-critical workgroups and applications |
| Dual Ultra 2 SCSI buses and controllers for mirrored storage                                                                                                                                                       |                                                                                                                                                                                                                                                                                                   |
| Hot-swap, redundant power supplies and fans; redundant, hot-plug PCI; Ultra2 SCSI hot-plug disks                                                                                                                   |                                                                                                                                                                                                                                                                                                   |
| Integrated Event Monitoring Service (EMS)                                                                                                                                                                          | Provides superior system uptime through constant, proactive fault avoidance, detection, and notification; monitors power, cooling system hardware, processors, memory, HP-UX resources, and external storage                                                                                      |
| Built-in fault management system with separate support processor and bus                                                                                                                                           |                                                                                                                                                                                                                                                                                                   |
| Integrated with HP MC/Serviceguard, HP Tootools for Servers, and enterprise management software such as HP OpenView and CA Unicenter                                                                               |                                                                                                                                                                                                                                                                                                   |
| Pre-tested and pre-integrated workgroup clustering solutions based on HP MC/Serviceguard                                                                                                                           | Deliver complete, ready-to-go solutions for clustered high availability that eliminate all single points of failure, at an affordable price                                                                                                                                                       |
| 3-year on-site service warranty and HP services and support options ranging from Web-based support to mission-critical, 6-hour Call-to-Repair commitment; includes full solution support for hardware and software | Reduce risk through worldwide support for business-critical computing; provide "one-stop shopping" for support through partnerships with Cisco, Oracle, SAP, BroadVision, Inktomi, and others                                                                                                     |





## stay ahead of the curve

| configuration options          | hp server rp5430                                                                                                                                                                                                                                                                                                               | hp server rp5470                              |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| processor                      | 875MHz PA-8700+ or 750MHz PA-8700                                                                                                                                                                                                                                                                                              | 875MHz PA-8700+ or 750MHz PA-8700             |
| SMP configuration              | 1 to 2 CPUs                                                                                                                                                                                                                                                                                                                    | 1 to 4 CPUs                                   |
| supported OS versions          | HP-UX 11i PA-8700+<br>HP-UX 11.0, 11i PA-8700                                                                                                                                                                                                                                                                                  | HP-UX 11i PA-8700+<br>HP-UX 11.0, 11i PA-8700 |
| minimum/maximum memory         | 512 MB/8 GB                                                                                                                                                                                                                                                                                                                    | 512 MB/16 GB                                  |
| on-chip cache (data/instr)     | 1.5 MB/750 KB                                                                                                                                                                                                                                                                                                                  | 1.5 MB/750 KB                                 |
| total I/O slots                | 6                                                                                                                                                                                                                                                                                                                              | 10                                            |
| internal removable media bays  | 1                                                                                                                                                                                                                                                                                                                              | 1                                             |
| maximum internal disk capacity | 584 GB (4 disk bays)                                                                                                                                                                                                                                                                                                           | 584 GB (4 disk bays)                          |
| standard I/O features          | Ultra2 SCSI, 100Base-T LAN, 3 RS-232 ports, 100Base-T support LAN, and Web-based console                                                                                                                                                                                                                                       |                                               |
| supported I/O connectivity     | Ultra2 SCSI RAID, Ultra2 SCSI LVD (single- and dual-port), FWD SCSI (single- and dual-port), Fibre Channel, Gigabit Ethernet, 100Base-TX (single- and quad-port), 100Base-FX, ATM 155 Mb/s (MMF, UTP-5), ATM 622 Mb/s (MMF), FDDI dual-attach LAN, Token Ring 100 Mb/s; X.25/FR/SDLC (dual-port), multiplexer (8- and 16-port) |                                               |

| environmental specifications       |                                                                                                                                                                    |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| electromagnetic interference       | Complies with FCC Rules and Regulations, part 15, as a Class A digital device; Manufacturer's Declaration to EN 55022 Level A; VCCI Registered, Class I; Korea RLL |
| AC input power                     | 100-240V 50/60Hz                                                                                                                                                   |
| maximum current requirements       | 13.8A at 110V                                                                                                                                                      |
| maximum power dissipation          | 1283 watts                                                                                                                                                         |
| physical dimensions                | Depth: 774 mm (30.5 in)<br>Width: 482 mm (19.0 in)<br>Height: 368 mm (14.5 in)/7 EIA units<br>Weight: 68 kg (150 lb)                                               |
| operating temperature              | +5° to 35°C (41° to 95°F)                                                                                                                                          |
| nonoperating temperature           | -40° to 65°C (-40° to 149°F)                                                                                                                                       |
| maximum rate of temperature change | 20°C/hour                                                                                                                                                          |
| operating relative humidity        | 15% to 80%, noncondensing; max. wet bulb @ 26°C                                                                                                                    |
| nonoperating relative humidity     | 5% to 90%, noncondensing                                                                                                                                           |
| operating altitude                 | To 3.0 km (10,000 ft) above sea level                                                                                                                              |
| nonoperating altitude              | To 4.5 km (15,000 ft) above sea level                                                                                                                              |
| compliance model number            | RSVL-0105-A                                                                                                                                                        |

### for more information

Contact any of our worldwide sales offices or HP Channel Partners. In the U.S. call 1-800-637-7740 or visit the HP servers Web site at [www.hp.com/go/servers](http://www.hp.com/go/servers), [www.hp.com/go/rp5430](http://www.hp.com/go/rp5430), or [www.hp.com/go/rp5470](http://www.hp.com/go/rp5470).

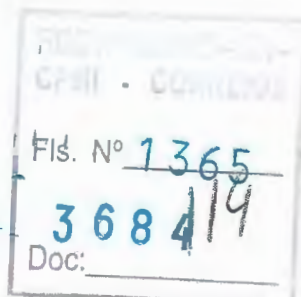
HP product information and technical documentation are available online. In addition, configuration tools and pricing information allow registered users to place orders online.

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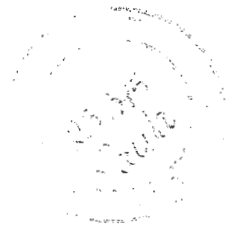
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Part 12345

HP-UX 11.0 Rev. 11







# User Guide

## rp5400 Family of Servers

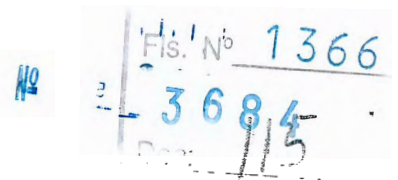
First Edition



**Manufacturing Part Number : A5191-96018**  
**November 2002**

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# Superdome Enterprise Server

## Safety and Regulatory Information

### Second Edition

Customer Order Number: A5201-90002



Manufacturing Part Number: A5201-96009

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|              |      |
|--------------|------|
| NCSF BUREAU  |      |
| CPMI + COWEN |      |
| Fis. No      | 1367 |
| No           | 3684 |
| Doc:         |      |

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| ROSA-CH-<br>CPMI - CONTINUED |
| Fils: N° 1368                |
| 3684                         |
| Doc: _____                   |



Республика Беларусь  
Грив - Комитет

Рис. № 1369

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№

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# 1 Safety and Regulatory Information



For your protection, this product has been tested to various national and international regulations and standards. The scope of this regulatory testing includes electrical/mechanical safety, radio frequency interference, acoustics, and known hazardous materials. Where applicable, approvals obtained from third-party test agencies are shown on the product label.

|                  |      |
|------------------|------|
| KDSM 04/17/18-19 |      |
| GPMI - CONVEIÇÃO |      |
| Fls. N°          | 1371 |
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## Notational Conventions

---

**WARNING** Warnings highlight procedures or information necessary to avoid injury to personnel. The warning should tell the reader exactly what will result from what actions and how to avoid them.

---

---

**CAUTION** A caution highlights procedures or information necessary to avoid damage to equipment, damage to software, loss of data, or invalid test results.

---

---

**NOTE** A note highlights supplemental information.

---

---

## Acronyms

Table 1-1 lists acronyms used in this document.

Table 1-1

Acronyms

| Acronym | Definition                             |
|---------|----------------------------------------|
| PE      | Protective earth                       |
| Class 1 | Grounded equipment                     |
| PDCA    | Power Distribution Controller Assembly |
| EPSS    | Electronic Performance Support Service |

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## Safety in Material Handling

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**WARNING** Do not lift the cabinet manually. To avoid physical injury you must use a mechanical lifting device.

---

---

**WARNING** Use care when lifting a cell board. Each cell board can weigh as much as 48 pounds (22kg).

---

---

**WARNING** Use care when working with hazardous voltages. This equipment may be configured with dual input line sources. Hazardous voltages and energy maybe present even after the removal of a single input source. Trained service personnel must follow the service guidelines.

---

---

**WARNING** Do not stand in front of the equipment as it is rolled off the pallet onto the ramps. When removing the equipment from the shipping pallet, follow the guidelines specified in the Installation Procedures section of the appropriate equipment guides (Superdome or I/O Expansion Cabinet).

---

IOX Only:

---

**WARNING** Attach stabilizer feet to both front and back before extending the equipment drawers. Failure to attach the stabilizer feet may result in a tip hazard.

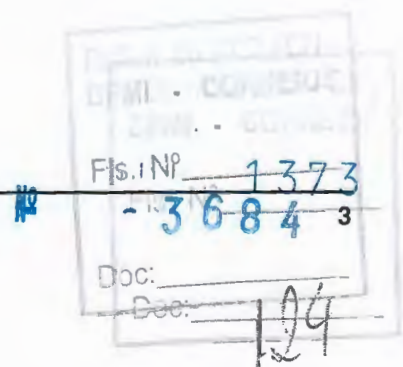
---

IOX Only:

---

**WARNING** Observe pinch hazard areas. Keep fingers away from closing parts.

---







---

## USA Radio Frequency Interference FCC Notice

The Federal Communications Commission (in 47 CFR Part 15 subpart B) has specified that the following notice be brought to the attention of the users of this product.

---

**NOTE** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

---

The user is cautioned that changes or modifications not expressly approved by Hewlett-Packard could result in the equipment being noncompliant with FCC Class A requirements and void the user's authority to operate the equipment.

---

## Japanese Radio Frequency Interference VCCI

This equipment is in the Class A category information technology equipment based on the rules of Voluntary Control Council For Interference by Information Technology Equipment (VCCI). When used in a residential area, radio interference may be caused. In this case, user may be required to take appropriate corrective actions.

**Figure 1-1**

この装置は、クラスA情報技術装置です。この装置を  
家庭環境で使用すると電波妨害を引き起こすことがあり  
ます。この場合には使用者が適切な対策を講ずるよう要  
求されることがあります。

VCCI-A

|                 |
|-----------------|
| CPMI - CONTROLS |
| 1374            |
| Fts. N°         |
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10/10

## Korean RFI Statement

1. Equipment Name (Model Name):
2. Certification No:
3. Name of Certification Recipient:
4. Date of Manufacture:
5. Manufacturer/Nation:

Figure 1-2

|                                                                                   |                           |
|-----------------------------------------------------------------------------------|---------------------------|
|  | 1. 명 칭 (모델명) :            |
|                                                                                   | 2. 인 증 번 호 :              |
|                                                                                   | 3. 인 증 자 상 호 : 한국휴렛팩커드(주) |
|                                                                                   | 4. 제 조 년 월 일 : 별도표기       |
|                                                                                   | 5. 제 조 자/제 조 국 :          |

Certification Number: E - AAAAA - BB - CCCC

- E: EMC registration
- AAAAA: equipment codes (RRL notice, 2000.10.26)
- BB: certification year
- CCCC: registration number

## European Union RFI Statement

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

## Canada RFI Statement

This Class A digital apparatus complies with Canadian ICES-003.

|                |      |
|----------------|------|
| ICES-003       |      |
| CPMI - COMPTON |      |
| Fils No        | 1375 |
| No             | 3684 |
| Doc:           | 5    |





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## Notice relative aux interférences radioélectriques (Canada)

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

---

### BSMI (Taiwan)

This product is fully compliant to CNS 13438 (CISPR 22: 1993) Class A. The EMC label is in the form shown in Figure 1-3. The eight # signs represent an eight-character, alpha-number string.

Figure 1-3

檢磁 #####

Figure 1-4

警告使用者：  
這是甲類的資訊產品。在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

|          |      |
|----------|------|
| Doc. No. | 1376 |
| Chapter  | 1    |
| Doc. No. | 3684 |
| Doc. No. | 127  |

---

## Acoustics (Germany)

Acoustic Noise (A-weighted Sound Pressure Level  $L_{pA}$ ) measured at the bystander position, normal operation, to ISO 7779:  $L_{pA} = 65.1$  dB.

---

## Geräuschemission (Deutschland)

Lärmangabe (Schalldruckpegel  $L_{pA}$ ) gemessen am fiktiven Arbeitsplatz bei normalem Betrieb nach DIN 45635, Teil 19:  $L_{pA} = 65.1$  dB.





---

## IT Power System

This product has not been evaluated for connection to an IT power system (an AC distribution system having no direct connection to earth according to IEC 60950).

---

## TT, TN-C, and TN-C-S Power Systems

These products should not be connected to power systems that switch open the return lead when the return lead also functions as the protective earth.

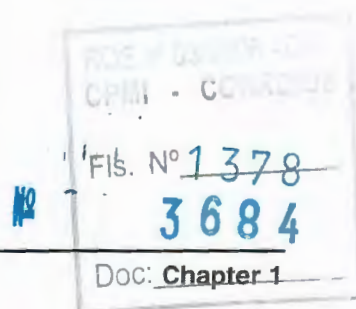
---

## High Leakage Current

---

**WARNING** High leakage current. Ground (earth) connection essential before connecting the supply.

---



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## Installation Conditions

See installation instructions before connecting this equipment to the input supply.

Voir la notice d'installation avant de raccorder au réseau.

### **WARNING** Please note the following conditions of installation:

**Install a PE (protective earthing) conductor that is identical in size, insulation material, and thickness to the branch-circuit supply conductors. The PE conductor insulation must be green with yellow stripes. The earthing conductor is to be connected from the unit to the building installation earth or, if supplied by a separately derived system, at the supply transformer or motor-generator set grounding point.**

### **WARNING** NORDIC Class 1 Equipment

**Denmark: Før tilslutning af de øvrige ledere, se medfølgende installationsvejledning.**

### **WARNING** NORDIC Class 1 Equipment

**Sweden: Apparaten skall anslutas till jordat uttag, när den ansluts till ett nätverk.**

## Recommended Wire Sizes

Table 1-2 shows the wire size requirements for conductors in power supply cords (Extracted from IEC 60950, Table 11).

**NOTE** Specific countries require a derating factor for the wire size when running multiple conductors in the same power cord. It is Hewlett-Packards recommendation to use only power cord conductors sized for this derating factor.

**Table 1-2 Recommended Wire Sizes**

| Current    | Wire Size       | Derating Factor |
|------------|-----------------|-----------------|
| 0-25 Amps  | 2.5 mm (14 AWG) | 4 mm (12 AWG)   |
| 25-32 Amps | 4 mm (12 AWG)   | 6 mm (10 AWG)   |
| 32-40 Amps | 6 mm (10 AWG)   | 10 mm (8 AWG)   |
| 40-63 Amps | 10 mm (8 AWG)   | 16 mm (6 AWG)   |

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Table 1-2 Recommended Wire Sizes

| Current    | Wire Size     | Derating Factor |
|------------|---------------|-----------------|
| 63-80 Amps | 16 mm (6 AWG) | 25mm (4 AWG)    |

## Disconnect Devices

Disconnect devices or circuit breakers must be used to protect the system against abnormal hazards. Table 1-3 details the circuit breaker specifications.

Table 1-3 Wall Disconnect Device Circuit Breaker Specification

|                      |                                                       |
|----------------------|-------------------------------------------------------|
| Agency approvals:    | UL, CSA, VDE                                          |
| Interrupt capacity   | 5,000A minimum                                        |
| Breaker type         | Magnetic trip                                         |
| Voltage rating       | Delta 250V minimum, WYE 420V minimum                  |
| Input Source         | Delta 3 pole + PE, WYE 4 pole + PE                    |
| Circuit Interruption | Simultaneous trip of all poles                        |
| Ground               | The PE (Protective Earth Ground) wire is not switched |

**WARNING** Provide a disconnect device to protect against abnormal hazards.

Systems configured with a full complement of cells, memory, and I/O and connected to a 5-wire source must have a maximum 24A 3-phase with neutral (4-pole) circuit breaker installed as part of the building installation.

Systems configured with a full complement of cells, memory, and I/O and connected to a 4-wire source must have a maximum 44A 3-phase (3-pole) circuit breaker installed as part of the building installation.

**CAUTION** Refer to Table 1-4 to select the appropriate size circuit breaker for systems configured without a full complement of cells, memory, and I/O.

Table 1-4 shows Superdome power requirements by configuration (i.e. number of cell boards, amount of memory per cell, and number of I/O chassis). This requirement applies to 32-way-capable systems with PA8600 or PA8700 processors.

There are two columns of power numbers (Watts). The Power Breaker column shows the power used to size the wall breaker at the installation site. The Typical Power column shows typical power. Typical power numbers are for PA8600 systems and may be used to assess average utility cost of cooling and electrical

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power. Expect these typical numbers to be about 18% less for PA8700 systems.

Table 1-4 Typical Superdome Configurations

| Cell Boards | Memory Per Cell Board | I/O Chassis Modules | Breaker Power <sup>a</sup> | Recommended Delta 3-pole Breaker Size <sup>a</sup> | Recommended WYE 4-pole Breaker Size <sup>a</sup> | Typical Power | Typical Cooling |
|-------------|-----------------------|---------------------|----------------------------|----------------------------------------------------|--------------------------------------------------|---------------|-----------------|
| Qty.        | GBytes                | Qty.                | Watts                      | Amps (min.)                                        | Amps (min.)                                      | Watts         | BTU/HR          |
| 8           | 16                    | 4                   | 10660                      | 40                                                 | 25                                               | 8460          | 28,850          |
| 8           | 16                    | 2                   | 9600                       | 40                                                 | 25                                               | 7780          | 26,530          |
| 8           | 8                     | 4                   | 9220                       | 40                                                 | 25                                               | 7340          | 25,030          |
| 8           | 8                     | 2                   | 8160                       | 30                                                 | 20                                               | 6660          | 22,710          |
| 8           | 4                     | 4                   | 8500                       | 35                                                 | 20                                               | 6780          | 23,120          |
| 8           | 4                     | 2                   | 7440                       | 30                                                 | 20                                               | 6100          | 20,800          |
| 6           | 16                    | 4                   | 9040                       | 35                                                 | 20                                               | 7140          | 24,350          |
| 6           | 16                    | 2                   | 7980                       | 30                                                 | 20                                               | 6460          | 22,030          |
| 6           | 8                     | 4                   | 7960                       | 30                                                 | 20                                               | 6300          | 21,480          |
| 6           | 8                     | 2                   | 6900                       | 30                                                 | 20                                               | 5620          | 19,160          |
| 6           | 4                     | 4                   | 7420                       | 30                                                 | 20                                               | 5880          | 20,050          |
| 6           | 4                     | 2                   | 6360                       | 30                                                 | 20                                               | 5200          | 17,730          |
| 4           | 16                    | 4                   | 7420                       | 30                                                 | 20                                               | 5820          | 19,850          |
| 4           | 16                    | 2                   | 6360                       | 30                                                 | 20                                               | 5140          | 17,530          |
| 4           | 8                     | 4                   | 6700                       | 30                                                 | 20                                               | 5260          | 17,940          |
| 4           | 8                     | 2                   | 5640                       | 25                                                 | 20                                               | 4580          | 15,620          |
| 4           | 4                     | 4                   | 6340                       | 30                                                 | 20                                               | 4980          | 16,980          |
| 4           | 4                     | 2                   | 5280                       | 25                                                 | 20                                               | 4300          | 14,660          |
| 2           | 16                    | 2                   | 4740                       | 20                                                 | 20                                               | 3820          | 13,030          |
| 2           | 8                     | 2                   | 4380                       | 20                                                 | 20                                               | 3540          | 12,070          |
| 2           | 4                     | 2                   | 4200                       | 20                                                 | 20                                               | 3400          | 11,600          |

a. These numbers are valid only for the specific configurations shown. Any upgrades may require a change to the breaker size. A 5-wire WYE source utilizes a 4 pole breaker and a 4-wire Delta source utilizes a 3 pole breaker. *The PE (Protective Earth) ground wire is not switched.*



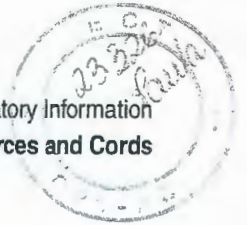
Safety and Regulatory Information  
**Installation Conditions**



---

**CAUTION** For supply connections, use wires suitable for at least 105 °C.  
Utiliser des fils convenant à une température de 105 °C pour les connexions d'alimentation.

---



---

## IOX Multiple Power Sources and Cords

This equipment may be configured with dual-input line sources. Hazardous voltages and energy may be present even after the removal of a single input source. Trained service personnel must follow the guidelines stipulated in the *Service Guidelines* section of the Superdome EPSS.

### IOX Only:

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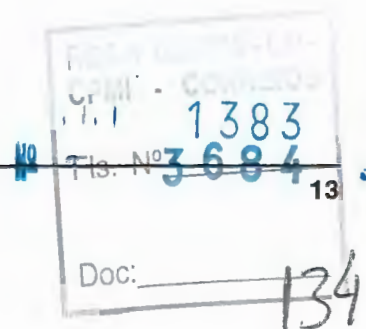
**WARNING** Remove both input power sources before replacing an internal fuse.

---

---

**WARNING** If the system has two PDCA installed, ensure that power is removed from both PDCA before removing fuses.

---







---

## Fuse Warnings

Superdome Only:

---

**WARNING**    Disconnect power before changing fuse.

---

---

**CAUTION**    For continued protection against risk of fire, replace fuses only with same type and rating.

---

|                           |           |
|---------------------------|-----------|
| FUSE WARNING - CORRECTION |           |
| CPM                       | 1384      |
| FIS. N°                   | Chapter 1 |
| 3684                      |           |
| Doc:                      | 135       |



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## Lithium Battery Caution

**WARNING** Observe the correct polarity when changing the lithium battery. There is a danger of explosion if battery is installed incorrectly.

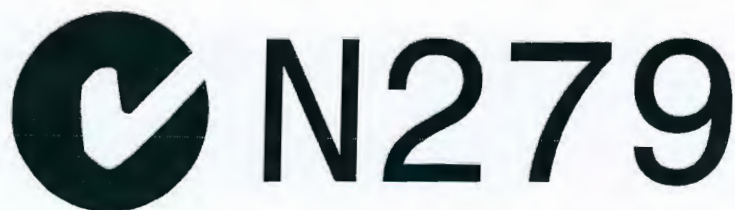
Replace only with the same or equivalent type recommended by the manufacturer.  
Dispose of used batteries according to the manufacturer's instructions and local disposal requirements.

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## Australian C-Tick Label

Figure 1-5



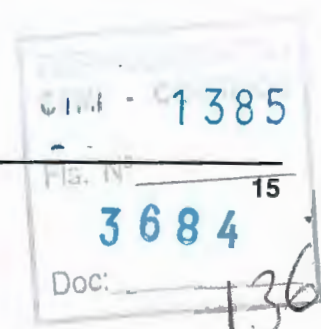
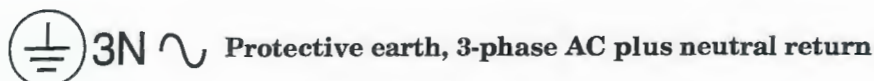
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## International Symbols (IEC335-1)

Figure 1-6 Four Wire Connection



Figure 1-7 Five Wire Connection







---

## Associated Documents

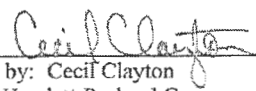
The following documents provide more details on the topics presented in this manual:

- *Standard for the Protection of Electronic Computer Data Processing Equipment*, (NFPA75) National Fire Protection Association
- EIA Standard RS-232-C, Electronic Industries Association
- *Electrostatic Discharge Failures of Semiconductor Devices*, Unger, B.A. 1981, Bell Laboratories
- IEC 60950, EN 60950, UL 60950, CSA 22.2 No. 950 *Standards for Safety of Information Technology Equipment*
- IEC 60417, IEC 335-1, ISO 3864, IEC 617-2 International Symbols

REGISTRATION  
EPMI - COMBIS  
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Figure 1-8

Superdome Declaration of Conformity Page 1

| DECLARATION OF CONFORMITY                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------|-----------------------------------------|---------------------|-------------------------------------------|------------------|---------------|-----|------------------------------------|-------------------|--------------------------------------------------|--|----------------------------|--|----------------------------|--|------------------------------------|-------------------|-------------------------------------------------------|-----|-----------------------------------|-------|------------------------------------------------------------------|--------------------|--------------------------------|-------------------|-----------------------------------------------------------------------------------------------------|---------------------------|
| according to ISO/IEC Guide 22 and EN 45014                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Manufacturer's Name:</b>                                                                                                                                                                                          | Hewlett-Packard Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Address:</b>                                                                                                                                                                                                      | 3000 Waterview Parkway<br>Richardson, TX 75080, USA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| declares that the product                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Product Name:</b>                                                                                                                                                                                                 | SUPERDOME (HP High Performance SMP Server)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Model Number(s):</b>                                                                                                                                                                                              | SPP5, [Marketing nomenclature: Model 16, SD16000, Model 32, SD32000, Model 64, SD64000]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Base Product Number(s):</b>                                                                                                                                                                                       | A5200A, A5201A, A5202A, A6113A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Product Option(s):</b>                                                                                                                                                                                            | All                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| conforms to the following Product Specifications:                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Safety:</b>                                                                                                                                                                                                       | IEC 60950:1991 + A1+A2+A3+A4 (with national differences for the countries listed on page 2)<br>EN 60950:1992 + A1+A2+A3+A4+A11<br>UL 1950, 3 <sup>rd</sup> edition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>EMC:</b>                                                                                                                                                                                                          | <table border="0"> <tr> <td>CISPR 22:1993 + A1 / EN 55022:1994 + A1+A2 Class A</td> <td>Radiated Emissions</td> </tr> <tr> <td>EN 55022:1994, Class A, 30 MHz to 5 GHz</td> <td>Conducted Emissions</td> </tr> <tr> <td>EN 55022:1994, Class A, 150 kHz to 30 MHz</td> <td>Immunity for ITE</td> </tr> <tr> <td>EN 55024:1998</td> <td>ESD</td> </tr> <tr> <td>EN 61000-4-2:1995, 8kV CD / 8kV AD</td> <td>Radiated Immunity</td> </tr> <tr> <td>EN 61000-4-3:1996, 100kHz-30MHz, 10 V/m, 1kHz AM</td> <td></td> </tr> <tr> <td>30MHz-80MHz, 3V/m, 1kHz AM</td> <td></td> </tr> <tr> <td>80MHz-1GHz, 10V/m, 1kHz AM</td> <td></td> </tr> <tr> <td>ENV 50204:1995, 900MHz, PM, 10 V/m</td> <td>Radiated Immunity</td> </tr> <tr> <td>EN 61000-4-4:1995, 1kV Powerline, 0.5kV signal cables</td> <td>EFT</td> </tr> <tr> <td>EN 61000-4-5:1995, 2kV CM, 1kV DM</td> <td>Surge</td> </tr> <tr> <td>EN 61000-4-6:1996, 150MHz - 400MHz, 3 V<sub>rms</sub>, 1kHz AM</td> <td>Conducted Immunity</td> </tr> <tr> <td>EN 61000-4-8:1993, 3 A/m, 50Hz</td> <td>Magnetic Immunity</td> </tr> <tr> <td>EN 61000-4-11:1994, 11V<sub>rms</sub> (10ms), 161V<sub>rms</sub> (0.5s), 11 V<sub>rms</sub> (5s)</td> <td>Voltage Dips &amp; Interrupts</td> </tr> </table> | CISPR 22:1993 + A1 / EN 55022:1994 + A1+A2 Class A | Radiated Emissions | EN 55022:1994, Class A, 30 MHz to 5 GHz | Conducted Emissions | EN 55022:1994, Class A, 150 kHz to 30 MHz | Immunity for ITE | EN 55024:1998 | ESD | EN 61000-4-2:1995, 8kV CD / 8kV AD | Radiated Immunity | EN 61000-4-3:1996, 100kHz-30MHz, 10 V/m, 1kHz AM |  | 30MHz-80MHz, 3V/m, 1kHz AM |  | 80MHz-1GHz, 10V/m, 1kHz AM |  | ENV 50204:1995, 900MHz, PM, 10 V/m | Radiated Immunity | EN 61000-4-4:1995, 1kV Powerline, 0.5kV signal cables | EFT | EN 61000-4-5:1995, 2kV CM, 1kV DM | Surge | EN 61000-4-6:1996, 150MHz - 400MHz, 3 V <sub>rms</sub> , 1kHz AM | Conducted Immunity | EN 61000-4-8:1993, 3 A/m, 50Hz | Magnetic Immunity | EN 61000-4-11:1994, 11V <sub>rms</sub> (10ms), 161V <sub>rms</sub> (0.5s), 11 V <sub>rms</sub> (5s) | Voltage Dips & Interrupts |
| CISPR 22:1993 + A1 / EN 55022:1994 + A1+A2 Class A                                                                                                                                                                   | Radiated Emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 55022:1994, Class A, 30 MHz to 5 GHz                                                                                                                                                                              | Conducted Emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 55022:1994, Class A, 150 kHz to 30 MHz                                                                                                                                                                            | Immunity for ITE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 55024:1998                                                                                                                                                                                                        | ESD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 61000-4-2:1995, 8kV CD / 8kV AD                                                                                                                                                                                   | Radiated Immunity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 61000-4-3:1996, 100kHz-30MHz, 10 V/m, 1kHz AM                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| 30MHz-80MHz, 3V/m, 1kHz AM                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| 80MHz-1GHz, 10V/m, 1kHz AM                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| ENV 50204:1995, 900MHz, PM, 10 V/m                                                                                                                                                                                   | Radiated Immunity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 61000-4-4:1995, 1kV Powerline, 0.5kV signal cables                                                                                                                                                                | EFT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 61000-4-5:1995, 2kV CM, 1kV DM                                                                                                                                                                                    | Surge                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 61000-4-6:1996, 150MHz - 400MHz, 3 V <sub>rms</sub> , 1kHz AM                                                                                                                                                     | Conducted Immunity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 61000-4-8:1993, 3 A/m, 50Hz                                                                                                                                                                                       | Magnetic Immunity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| EN 61000-4-11:1994, 11V <sub>rms</sub> (10ms), 161V <sub>rms</sub> (0.5s), 11 V <sub>rms</sub> (5s)                                                                                                                  | Voltage Dips & Interrupts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| <b>Supplementary Information:</b>                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| The product as stated above complies with the requirements of the Low Voltage Directive 73/23/EEC, and the EMC Directive 89/336/EEC, as amended by 93/68/EEC.                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| September 26, 2000<br>Date                                                                                                                                                                                           | <br>by: Cecil Clayton<br>Hewlett-Packard Company<br>Product Regulations Manager                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |
| European Contact: Your Local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE / Standards<br>Europe, Herrenberger Strasse 130, D-71034 Boeblingen, Germany (FAX +49-7031-14-3143) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                    |                                         |                     |                                           |                  |               |     |                                    |                   |                                                  |  |                            |  |                            |  |                                    |                   |                                                       |     |                                   |       |                                                                  |                    |                                |                   |                                                                                                     |                           |

1 of 2



**Figure 1-9 Superdome Declaration of Conformity Page 2**

### FCC Regulations (USA Only)

The Federal Communications Commission (in 47 CFR Part 15) has specified that the following notice be brought to the attention of the users of this product.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance (Hewlett-Packard) could result in the equipment being non-compliant with the FCC Class A requirements and void the user's authority to operate the equipment.

### Additional International Approvals

AS/NZS 3548:1995 C-Tick & Supplier Code (N279)  
ICES-003 Issue 3  
VCCI Class A  
BSMI, CNS-13438 11/94(Rev. 5/97)  
MIC No. 1996-18, Class A  
GB4943-1995  
GB9254-1988

Australia/New Zealand  
Canada  
Japan  
Taiwan  
Korean  
China  
China

### IEC 60950 Evaluated Country National Differences

CENELEC, AT= Austria, AU= Australia, BE= Belgium, CA= Canada, CH= Switzerland, CN= China, CZ= Czech Republic, DE= Germany, DK= Denmark, ES= Spain, FI= Finland, FR= France, GB= United Kingdom, GR= Greece, HU= Hungary, IE= Ireland, IL= Israel, IN= India, IT= Italy, JP= Japan, KR= Republic of Korea, NL= The Netherlands, NO= Norway, PL= Poland, RU= Russia, SE= Sweden, SG= Singapore, SI= Slovenia, SK= Slovakia, TR= Turkey, UA= Ukraine, US= United States, ZA= South Africa

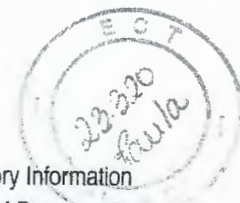


Figure 1-10

I/O Expansion Cabinet Declaration of Conformity Page 1

| DECLARATION OF CONFORMITY                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| according to ISO/IEC Guide 22 and EN 45014                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Manufacturer's Name:</b>                                                                                                                                                                                          | Hewlett-Packard Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Address:</b>                                                                                                                                                                                                      | 3000 Waterview Parkway<br>Richardson, TX 75080, USA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Declares that the product:</b>                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Product Name:</b>                                                                                                                                                                                                 | I/O Expansion (IOX) cabinet for SuperDome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Model Number(s):</b>                                                                                                                                                                                              | SPP6:IOX, SPP6-1:XPC, SPP6-2:XUC/RDM, SPP6-3:ICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Base Product Number(s):</b>                                                                                                                                                                                       | A5861A:IOX, A5861-26001:XPC, A5861-26002:XUC, A5861-26003:RDM,<br>A5862A:ICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Product Option(s):</b>                                                                                                                                                                                            | All                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Conforms to the following Product Specifications:</b>                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Safety:</b>                                                                                                                                                                                                       | IEC 60950:1999 (with national differences for the countries listed on page 2)<br>EN 60950:2000<br>UL 60950:2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>EMC:</b>                                                                                                                                                                                                          | CISPR 22 3rd edition:1997/ EN 55022:1998<br>EN 55022:1998, Class A, 30 MHz to 5 GHz<br>EN 55022:1998, Class A, 150 kHz to 30 MHz<br>CISPR 24:1997/EN 55024:1998<br>EN 61000-4-2:1995, 8kV CD / 15kV AD<br>EN 61000-4-3:1996, 100kHz-1GHz, 10V/m, 1kHz AM<br><br>ENV 50204:1995, 900MHz/1.89GHz, PM, 10 V/m<br>EN 61000-4-4:1995, 1kV Power line, 0.5kV signal cables<br>EN 61000-4-5:1995, 2kV CM, 1kV DM<br>EN 61000-4-6:1996, 150kHz - 400MHz, 3V <sub>rms</sub> , 1kHz AM<br>EN 61000-4-8:1993, 3 A/m, 50Hz<br>EN 61000-4-11:1994, 11V <sub>ms</sub> (10ms), 161V <sub>ms</sub> (0.5s), 11 V <sub>ms</sub> (5s)<br>EN61000-3-2; '95 +A14<br>EN61000-3-3; '95 |
|                                                                                                                                                                                                                      | Class A<br>Radiated Emissions<br>Conducted Emissions<br>Immunity for ITE<br>ESD<br>Radiated Immunity<br><br>Radiated Immunity<br>EFT<br>Surge<br>Conducted Immunity<br>Magnetic Immunity<br>Voltage Dips & Interrupts<br>Power line Harmonics<br>Voltage Flicker                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Supplementary Information:</b><br>The product as stated above complies with the requirements of the Low Voltage Directive 73/23/EEC, and the EMC Directive 89/336/EEC, as amended by 93/68/EEC.                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <u>May 31, 2001</u><br>Date                                                                                                                                                                                          | <br>by: Cecil Clayton<br>Hewlett-Packard Company<br>Product Regulations Manager                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| European Contact: Your Local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE / Standards<br>Europe, Herrenberger Strasse 130, D-71034 Boeblingen, Germany (FAX +49-7031-14-3143) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |





Figure 1-11 I/O Expansion Cabinet Declaration of Conformity Page 2

### FCC Regulations (USA Only)

The Federal Communications Commission (in 47 CFR Part 15) has specified that the following notice be brought to the attention of the users of this product.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance (Hewlett-Packard) could result in the equipment being non-compliant with the FCC Class A requirements and void the user's authority to operate the equipment.

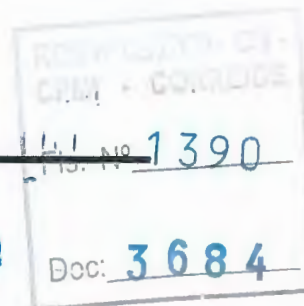
### Additional International Approvals

AS/NZS 3548:1995 C-Tick & Supplier Code (N279)  
CSA C22.2 No. 60950:2000  
ICES-003 Issue 3  
VCCI Class A  
BSMI, CNS-13438 11/94(Rev. 5/97)  
MIC No. 1996-18, Class A  
GB4943-1995  
GB9254-1988

Australia/New Zealand  
Canada  
Canada  
Japan  
Taiwan  
Korean  
China  
China

### IEC 60950 Evaluated for Country National Differences

CENELEC, AT = Austria, AU = Australia, BE = Belgium, CA = Canada, CH = Switzerland,  
CN = China, CZ = Czech Republic, DE = Germany, DK = Denmark, ES = Spain, FI = Finland,  
FR = France, GB = United Kingdom, GR = Greece, HU = Hungary, IE = Ireland, IL = Israel,  
IN = India, IT = Italy, JP = Japan, KR = Republic of Korea, NL = The Netherlands, NO = Norway,  
PL = Poland, RU = Russia, SE = Sweden, SG = Singapore, SI = Slovenia, SK = Slovakia,  
TR = Turkey, UA = Ukraine, US = United States, ZA = South Africa





building your  
always-on  
infrastructure with  
hp servers



## powerful, flexible Internet server solutions for an always-on infrastructure

The Internet data center is the critical enabler for the next generation of business. And as you design and implement your Internet solution, your first concern is finding technology products and services that are built right the first time. Your next concern is making sure that what works today will also address your future needs as new opportunities—and new challenges—present themselves.

Going forward, the right technology infrastructure is one that's always on whenever and however you need it. That's what HP can help you build—and it's unprecedented in the industry.

HP Superdome servers give you a tailored combination of technology and services. Built with key components such as HP's proven data center capabilities, e-services expertise, and utility computing strengths, your always-on infrastructure will deliver an exceptional customer experience that ensures ease, speed, and effectiveness.



hp superdome

### your always-on infrastructure

Addressing the many difficult challenges you face in building and running an Internet business, HP provides:

- industry-leading HP Superdome UNIX servers
- utility building blocks—only from HP
- the industry's broadest offering of partitioning capabilities with HP's partitioning continuum
- Intel® Itanium™ architecture and multi-OS capabilities

### always there

HP is also always there for you, beginning with your first contact. HP provides:

- closed-loop solution management
- up-front assessments
- pre-integration and testing
- needs-based training
- migration services

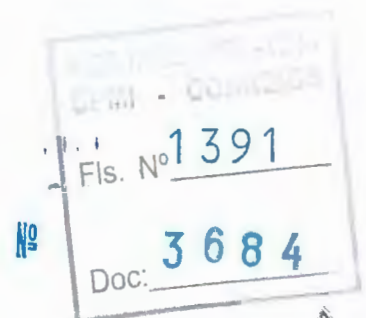
And we ensure your infrastructure continuously runs with:

- proactive services
- repair commitments

### an exceptional customer experience

Successful data center implementations require much more than technology. That's why always-on is always there with you—every step of the way.

- **invent it:** ease of planning and design for a solution that is tailored to fit your business immediately
- **build it:** speed of integration and installation of a ready-to-run infrastructure
- **run it:** mission-critical services and technologies that enable continuous operations, flexible capacity, and efficient management to ensure ongoing operational excellence
- **evolve it:** future-proof roadmap, utility computing, and continuous care to meet your needs throughout the life of your business







# three hp superdome configurations to match your needs

Large implementations often do not live up to expectations as a result of inadequate skills being applied to the design and implementation. With Superdome, HP assures you of an exceptional computing experience via industry-leading services from HP and select channel partners, available in three predefined configurations. With all configurations, financing solutions are also available to meet your budget requirements.

## foundation configuration

Building the right foundation dramatically reduces problems and speeds time-to-production, so all Superdome solutions will include the foundation configuration as the base for optimal performance. The foundation configuration is intended for companies whose applications have lower-priority needs for availability, or who have the in-house expertise to run and manage their own IT environments.

- closed-loop project management using process-based methodologies and measures to ensure your success and satisfaction
- consulting services for a detailed architecture design to ensure it's right the first time
- skills assessment and superdome-specific education to provide IT staff with the skills needed
- comprehensive site/environmental preparation to help you understand and address the demands on your physical location
- hp factory integration and testing to ensure that the system is properly configured and arrives ready to run
- ongoing response center support, available 24 x 7, with a 4-hour response commitment

## critical systems configuration

For a high level of system availability, HP's industry-recognized expertise provides mission-critical support as the basis for the critical systems

## your always-on infrastructure empowers robust solutions for today's top applications

**enterprise resource planning:** the fundamental backbone for new areas of competitive advantage: supply chain, e-commerce, and product development

**mission-critical computing:** high-availability products and solutions to help you reach the availability levels you need to serve your customers

**e-intelligence:** drive maximum value from your data assets—both internal and external—utilizing cutting-edge analysis tools, business intelligence, and applications from HP

**e-commerce:** manage the cost of e-commerce sites by tailoring computing resources to meet changing needs, and ensure that your critical e-commerce site is available and has the capacity it needs

**technical computing:** technical computing applications cannot get enough raw power; the extremely high levels of performance and scalability offered by an always-on infrastructure meet these needs head-on

**systems consolidation:** reduce cost; increase flexibility, availability, and performance; and improve management of IT infrastructures with the reduced complexity and increased availability of always-on configurations

configuration. This configuration is the minimum service level for mission-critical environments. It increases the priority of reactive services and adds proactive support services with availability monitoring.

It includes the foundation configuration, plus:

- a support plan that details the account-specific requirements and the hp response commitment
- assigned account engineers
- superdome readiness analysis to help you meet your high-availability and performance requirements
- technical consulting topics to choose from
- high-speed remote diagnostics and critical data collection to track system performance and prevent problems before they occur
- 6-hour call-to-repair hardware commitment
- priority system recovery
- business recovery services (optional)

## business continuity configuration

The business continuity configuration delivers a lot more than a list of services. It delivers a different way to approach availability planning. Business continuity is a collaboration between HP and the customer, creating a plan to proactively address all of the elements in the IT environment that affect business availability. It is designed and built with the goal of maximum availability, and its focus is on optimum business operation. Business continuity provides sophisticated, proactive services and the industry's best support service.

It includes the foundation and critical systems configurations, plus:

- a dedicated account team and customized proactive services plan
- top-priority response from trained specialists
- highly detailed change management processes
- monthly account reviews
- the industry's only 4-hour call-to-restoration hardware and software commitment
- a permanent software solution within 14 days

## new operating environments for the Internet age

The HP-UX 11i operating environment provides the best platform for always-on Internet businesses.

- **today's most friendly high-end server for Microsoft® Windows NT® and Linux operating systems** with a Linux open-source development environment and support for WebGain Studio
- **the best end-to-end Internet-critical functionality**, single-system high availability, manageability, security, and UNIX/Windows® integration
- **ultimate performance and scalability** with instant capacity-on-demand, partitioning support, strong Java™ performance, and 64-way symmetric multiprocessing (SMP) scalability
- **the best investment protection and longevity** through binary compatibility with both PA-RISC and the Itanium processor family
- **choice of three hp-ux servicecontrol manageability suites** for cost-effective, centralized control and optimized capacity
- **choice of three complete operating environments** tailored for Internet, enterprise, or mission-critical computing needs

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3684  
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## hp superdome at-a-glance

### benefits

#### availability

Online addition and replacement of PCI I/O cards, I/O cardcages,\* and cells (CPU/memory\*)  
6 or 12 fans and 4, 6, or 12 power supplies; all hot-swap, N+1 included  
Error checking and correction on all CPU and memory paths  
Parity-protected I/O data paths  
Dual power source

Built-in high-availability features deliver superior levels of

- reliability
- supportability
- repairability
- single-system availability
- multi-system availability

to help maximize uptime for mission-critical applications

nPartitions (up to 16)

Provide hard partitioning capability

HP Virtual Partitions (up to 64)

Supports server consolidation

Support for MC/Serviceguard and MC/Lockmanager in a Superdome cluster

Complete solutions for clustered high availability to eliminate single points of failure

#### capacity

Single node: 16, 32, or 64 750MHz, 4-way superscalar PA-8700 CPUs with 2.25MB on-chip cache per CPU

Superior performance and scalability for enterprise and Internet applications

Leadership performance

World-record, industry-standard and application benchmarks

Partitioning capability (1 to 16 nPartitions) for resource allocation, multiple operating environments, or application scaling

Allows system manager to optimize the allocation of resources between competing workloads; runs multiple operating systems, including different platforms for test, development, and deployment; can scale resources to optimize application performance and protect hardware investment

Up to 64 virtual partitions

Increased memory subsystem performance for fast, reliable processing of high-performance applications

Up to 256GB memory (512MB DIMMs)

Peak memory bandwidth 64GB/s per 64-way cabinet

64-bit 33MHz (2x) or 66MHz (4x) industry-standard PCI

Easily handles I/O-intensive applications and scales quickly to accommodate higher demands

Up to 16 265MB/s (33MHz PCI) or 530MB/s (66MHz PCI) I/O channels

Up to 192 (with I/O expansion cabinet) hot-swap PCI I/O slots

Storage options including JBOD, Fibre Channel, or HP Surestore disk arrays; HP AutoRAID, HP Fibre-Channel-to-SCSI Multiplexer, and tape drives and libraries

Flexible, high-capacity storage that protects critical data

#### connectivity

Core I/O including 10/100Base-T LAN

Easy, ready-to-go networking capabilities

Network connectivity: for Token Ring, 1000Base-SX, 1000Base-T, 10/100Base-TX, Terminal MUX, PKC, HIPPI, X.25, ATM, Hyperfabric, and FDDI

Complete end-to-end connectivity solutions for e-services

Storage connectivity: Ultra2 SCSI, F/W SCSI, Fibre Channel

Broad range of high-speed storage connectivity options

Nokia WAP server support

Connectivity for wireless applications

#### security

Host-based intrusion detection

Ultimate security and protection from attacks

IPSec end-to-end virtual private network capability

Application-independent network-layer security

#### manageability

Support Management Station

Centralized, remote access to firmware and scan diagnostic tools for use across all Superdome systems in the data center

Partition Manager (partmgr)

Intuitive GUI interface to easily manage and modify all partitions on a Superdome system

Extended Fault Management System

Console to display system status (local and remote), reset system; control power to turn on/off

Integrated HP WebQoS Peak

Stabilizes Web site performance under heavy loads to improve site reliability and transaction throughput

Integrated HP Servicecontrol Manager

Cost-effective, rapid central control of server resources for the highest degree of efficiency in system administration

HP-UX Workload Manager

First goal-based resource management in the UNIX industry. Automatically reconfigures CPU allocations based on customers' service-level objectives (SLOs).

#### investment protection and flexibility

Designed for future upgrades to multiple generations of PA-RISC and Itanium processor family

Superior investment protection and longevity

Built-in unlimited license for Internet HP-UX 11i operating environment; options to upgrade to Enterprise or Mission-Critical HP-UX

Choice of three operating environments with all the fundamental operating system components needed for Internet, enterprise, or mission-critical environments

Future support for Windows NT and Linux

Offers a choice of environments with easy transition to production on the robust HP-UX 11 platform

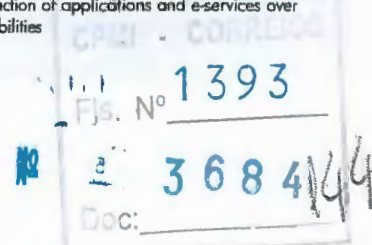
Choice of integrated Web server options: industry standard for faster, more scalable performance

Ease of deployment for emerging Web sites or optimized for high-traffic Web sites

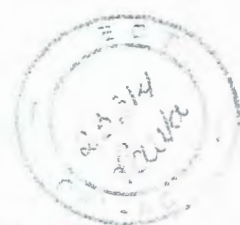
E-speak open software platform for developing and deploying e-services

Enables dynamic discovery and interaction of applications and e-services over the Internet, including brokering capabilities

\*Available with future HP-UX releases







## helping you build an always-on infrastructure for your Internet data center

| configuration options                                 | hp superdome 16-way                                 | hp superdome 32-way                                    | hp superdome 64-way                                      |
|-------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------|
| SMP configuration                                     | 1 to 16 CPU                                         | 1 to 32 CPU                                            | 8 to 64 CPU                                              |
| 4-CPU cell boards <sup>1</sup>                        | 1-4                                                 | 1-8                                                    | 8-16                                                     |
| minimum/maximum memory<br>(with 512MB DIMMs)          | 2GB/64GB                                            | 2GB/128GB                                              | 16GB/256GB                                               |
| total hot-swap PCI I/O slots                          | 48 slots<br>(32 slots @ 33MHz,<br>16 slots @ 66MHz) | 48/96 slots<br>(64 slots @ 33MHz,<br>32 slots @ 66MHz) | 96/192 slots<br>(128 slots @ 33MHz,<br>64 slots @ 66MHz) |
| hot-swap, redundant power<br>supplies (N+1 included)  | 4                                                   | 6                                                      | 12                                                       |
| I/O fans                                              | 6                                                   | 6                                                      | 12                                                       |
| hot-swap, redundant blowers or<br>fans (N+1 included) | 4                                                   | 4                                                      | 8                                                        |
| nPartitions                                           | 4                                                   | 4/8                                                    | 8/16                                                     |
| crossbar bandwidth (peak)                             | 16GB/s                                              | 32GB/s                                                 | 64GB/s                                                   |
| cell controller to I/O subsystem<br>bandwidth (peak)  | 2.0GB/s                                             | 2.0GB/s                                                | 2.0GB/s                                                  |
| I/O bandwidth (peak)                                  | 8GB/s                                               | 16GB/s                                                 | 32GB/s                                                   |
| memory bandwidth (peak)                               | 16GB/s                                              | 32GB/s                                                 | 64GB/s                                                   |
| operating system                                      | HP-UX 11i                                           | HP-UX 11i                                              | HP-UX 11i                                                |
| average power dissipation (watts)                     | 3,756                                               | 5,740                                                  | 11,480                                                   |
| physical dimensions:                                  |                                                     |                                                        |                                                          |
| height                                                | 1960mm (77.2in)                                     | 1960mm (77.2in)                                        | 1960mm (77.2in)                                          |
| width                                                 | 762mm (30in)                                        | 762mm (30in)                                           | 1,524mm (60in)                                           |
| depth                                                 | 1220mm (48in)                                       | 1220mm (48in)                                          | 1220mm (48in)                                            |
| weight                                                | 500kg (1,102lb)                                     | 598kg (1,318lb)                                        | 1,196kg (2,636lb)                                        |
| operating temperature                                 | 20°C to 30°C                                        | 20°C to 30°C                                           | 20°C to 30°C                                             |
| nonoperating temperature                              | -40°C to 70°C                                       | -40°C to 70°C                                          | -40°C to 70°C                                            |
| maximum rate of temperature<br>change                 | 20°C/hr                                             | 20°C/hr                                                | 20°C/hr                                                  |
| operating relative humidity                           | 15% to 80% @ 30°C                                   | 15% to 80% @ 30°C                                      | 15% to 80% @ 30°C                                        |
| nonoperating relative humidity                        | 90% @ 65°C                                          | 90% @ 65°C                                             | 90% @ 65°C                                               |
| operating altitude                                    | 0-3100m (10,000ft)                                  | 0-3100m (10,000ft)                                     | 0-3100m (10,000ft)                                       |
| nonoperating altitude                                 | 0-4600m (15,000ft)                                  | 0-4600m (15,000ft)                                     | 0-4600m (15,000ft)                                       |

<sup>1</sup>Online replacement and addition capability offered with a future HP-UX release.

### for more information

Contact any of our worldwide sales offices or  
HP Channel Partners (in the U.S. call 1-800-637-7740)  
or visit our HP Superdome servers Web site at  
<http://www.hp.com/go/superdome>

### order online now

HP product information and technical documentation  
is available online at [www.docs.hp.com](http://www.docs.hp.com)



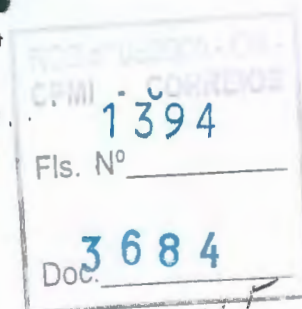
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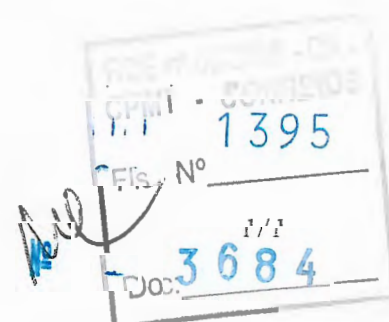
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## ANEXO GERENCIAMENTO DE LAN E WAN







## Announcing CiscoWorks LAN Management Solution (LMS) 2.2 and Updates to LMS 1.X and 2.X

Cisco Systems® announces availability of the CiscoWorks LAN Management Solution (LMS) 2.2 for Windows and Solaris. Minor update kits for existing LMS 1.X and 2.X customers are also being released (updates will not be posted for Web download).

CiscoWorks LAN Management Solution (LMS) provides a robust set of applications for maintaining, monitoring, and troubleshooting Cisco Campus networks. This solution complements the Cisco AVVID architecture by addressing the management needs of converged data, voice, and video networks.

Key features of LMS 2.2 and the update kits are:

- Enhancements to the CiscoWorks Server replacing its CD One naming with "Common Services"
- Support for new devices, Cisco IOS® releases and roll up of past incremental device updates (IDUs)
- Support for Windows 2000 Advanced Server and updates to existing operating system support
- Minor updates and improvements made in all LMS applications
- Combined update kit for LMS 1.X and 2.X users

### Availability

The CiscoWorks LAN Management Solution 2.2 and the LMS 1.X and 2.X updates begin shipping on May 1, 2003.

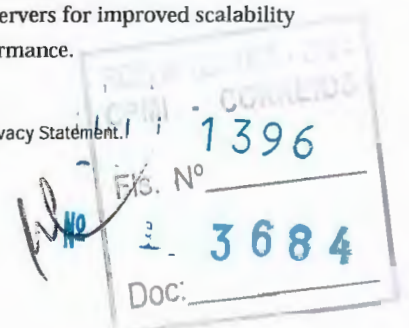
Customers interested in purchasing these products can place orders through their normal sales channels (see below for ordering information) beginning April 18, 2003.

Existing LMS 1.X and 2.X customers with current Software Application Support (SAS) contracts can request the LMS May 2003 update kit using their service contract number at <http://www.cisco.com/upgrade> beginning May 8, 2003. This single kit updates both existing LMS 1.X and 2.X installations. Customers who have not previously purchased the LMS 1.x upgrade to DFM (see PN# CWLMS-2.2-UP-K9) will be able to update each of their existing LMS 1.x products (RME, CM, RTM, CS/CV). The updates to Device Fault Manager 1.X (DFM) require the previous installation of LMS 2.x containing DFM 1.X. Existing DFM licensing is checked by the maintenance kit during installation.

Existing LMS 1.X customers can also upgrade to LMS 2.2 (not covered by SAS). This major version upgrade to LMS 2.2 includes DFM 1.2.

The LAN Management Solution 2.2 new product and update kits ship with both sets of the Windows and Solaris product CDs.

The CiscoWorks Server component of the product is licensed for installation on only one server platform per purchased copy but licensing provisions allow some of the LMS subcomponent applications to be loaded on separate servers for improved scalability and performance.





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### Ordering Information

The following table provides part number information for ordering the LAN Management Solution:

| Part Number       | Description                                                                                                                                                                                                                                                                                          |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CWLMS-2.2-K9      | LAN Management Solution 2.2 for Windows and Solaris; Includes Campus Manager (CM) 3.3, Device Fault Manager (DFM) 1.2 updated for Common Services 2.2, Resource Manager Essentials (RME) 3.5, nGenious Real Time Monitor (RTM) 1.4 with Service Pack 6, Common Services 2.2 with Cisco View (CV) 5.5 |
| CWLMS-2.2-UP-K9   | Upgrade to LMS 2.2 for Windows and Solaris from LMS 1.X; Includes right to use for Device Fault Manager (DFM) 1.2                                                                                                                                                                                    |
| CWLMS-2.2-P1-K9   | Cross Bundle Discount LMS 2.2 for WIN/SOL; Available to customers who have previously purchased RWAN and want to add LMS                                                                                                                                                                             |
| CWLMS-MAY03-MR-K9 | May 2003 minor update kit for customers on LMS 1.X and 2.X for Windows and Solaris; Includes CM 3.3, RME 3.5, RTM 1.4 SP6, DFM 1.2 with IDU 1.2.3, CV 5.5 and Common Services 2.2; Customers with LMS 1.X will not be able to install DFM 1.2. (use PN# CWLMS-2.2-UP-K9 to purchase DFM)             |
| CON-SAS-CWLMS-1.X | Software Application Support; TAC support, minor update, CCO access for LMS 1.X products                                                                                                                                                                                                             |
| CON-SAS-CWLMS-2.X | Software Application Support; TAC support, minor update, CCO access for LMS 2.X products                                                                                                                                                                                                             |

### Existing Products Effectuated

With the availability of the LAN Management Solution version 2.1, Cisco is announcing the End of Sale for the following products:

| Part Number     | Description                                                        | End of Sale Date |
|-----------------|--------------------------------------------------------------------|------------------|
| CWLMS-2.1-K9    | LAN Management Solution 2.1 for WIN/SOL                            | May 15, 2003     |
| CWLMS-2.1-P1-K9 | Promotion for RWAN users adding LMS 2.1 Win/Sol                    | May 15, 2003     |
| CWLMS-2.1-UP-K9 | Upgrade to LMS 2.1 for WIN/SOL from LMS 1.X, SNMS 1.X and CWSI 2.x | May 15, 2003     |
| CWLMS-2.1-MR-K9 | Minor update kit for LMS 2.0 for WIN/SOL                           | May 15, 2003     |
| CWLMS-1.2-MR-K9 | Minor update kit for LMS 1.X for WIN/SOL                           | May 15, 2003     |

### Product Information

For installation documentation please refer to:

[http://www.cisco.com/univercd/cc/td/doc/product/rtrmgmt/cw2000/cw2000\\_b/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/rtrmgmt/cw2000/cw2000_b/index.htm)

For additional product information please refer to: <http://www.cisco.com/go/lms>

For more information or questions please send e-mail to the product-marketing group at [ciscoworks@cisco.com](mailto:ciscoworks@cisco.com)

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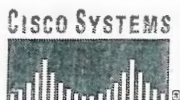
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## Announcing CiscoWorks Routed WAN Management Solution (RWAN) 1.3 and Updates to RWAN 1.X

Cisco Systems® announces availability of the CiscoWorks Routed WAN Management Solution (RWAN) 1.3 for Windows and Solaris. A minor update kit for customers running RWAN 1.X will be released on Windows and Solaris (updates will not be posted for Web-download).

The RWAN Management Solution is a collection of powerful management applications to configure, administer, monitor, and troubleshoot a routed WAN environment. RWAN provides increased visibility into network behavior, assists in quickly identifying performance bottlenecks and long-term performance trends, and provides early detection in optimizing bandwidth and utilization across expensive and critical links in the network.

Key features of RWAN 1.3 and the update kit are:

- Enhancements to the CiscoWorks Server replacing its CD One naming with "Common Services"
- Support for new devices, Cisco IOS® releases and roll up of past incremental device updates (IDUs)
- Support for Windows 2000 Advanced Server and updates to existing operating system support
- Minor updates and improvements made in all RWAN applications

For existing RWAN 1.0 and 1.1 customers using past versions of nGenius Real-Time Monitor solution, we are providing a minor

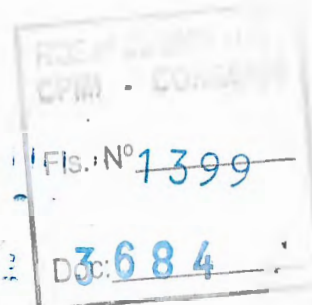
update kit containing RTM 1.4 SP6 updates. The LAN Management Solution (LMS) package includes RTM, providing support for our Cisco 6500 Network Analysis Module (NAM). New RWAN 1.3 customers interested in obtaining RTM may purchase LMS 2.2.

### Availability

The CiscoWorks Routed WAN Management Solution 1.3 and the RWAN 1.3 update begins shipping May 15, 2003. Customers interested in purchasing these products can place orders through their normal sales channels (see below for ordering information) beginning April 25, 2003.

Existing RWAN 1.X customers with current Software Application Support (SAS) contracts can request the RWAN 1.3 update kit using their service contract number at <http://www.cisco.com/upgrade> beginning May 15, 2003.

RWAN 1.3 product and update kit will ship with both sets of the Windows and Solaris product CDs. The CiscoWorks Server component of the product is licensed for installation on only one server platform per purchased copy but licensing provisions allow some RWAN subcomponent applications to be loaded on separate servers for improved scalability and performance.







The following table provides part number information for ordering the Routed WAN Management Solution:

| Part Number      | Description                                                                                                                                                    |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CWRW-1.3-K9      | RWAN 1.3 for Windows and Solaris; Includes ACL 1.5, IPM 2.5, RME 3.5, Common Services 2.2 with CV 5.5                                                          |
| CWRW-1.3-P1-K9   | Cross Bundle Discount RWAN 1.3 for WIN/SOL; Available to customers who have previously purchased LMS and want to add RWAN.                                     |
| CWRW-1.3-MR-K9   | May 2003 maintenance updates for customer on RWAN 1.X for Windows and Solaris; Includes ACL 1.5, IPM 2.5, RME 3.5, RTM 1.4 SP6, CV 5.5 and Common Services 2.2 |
| CON-SAS-CWRW-1.X | Software Application Support; TAC support, minor updates, CCO access for RWAN 1.X products                                                                     |

#### Existing Products Effected

With the availability of the Routed WAN Management Solution Version 1.2, Cisco is announcing the End of Sale (EoS) for the following products:

| Part Number    | Description                                                                | End of Sale Date |
|----------------|----------------------------------------------------------------------------|------------------|
| CWRW-1.2-K9    | RWAN Management Solution 1.2 for WIN/SOL                                   | May 15, 2003     |
| CWRW-1.2-P1-K9 | Cross Bundle Discount Promotion, for LMS users adding RWAN 1.2 for WIN/SOL | May 15, 2003     |
| CWRW-1.2-MR-K9 | May 2002 update release for customers with RWAN 1.X for WIN/SOL            | May 15, 2003     |

#### Product Information

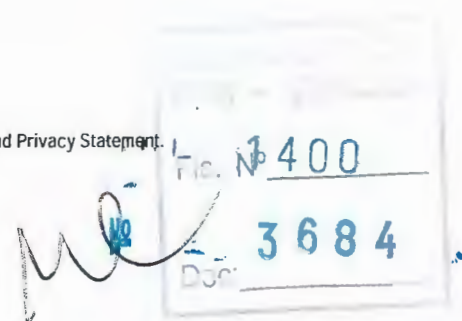
For installation documentation please refer to:

[http://www.cisco.com/en/US/products/sw/cscowork/ps2426/prod\\_technical\\_documentation.html](http://www.cisco.com/en/US/products/sw/cscowork/ps2426/prod_technical_documentation.html)

For additional product information please refer to: <http://www.cisco.com/go/rwan>

#### Additional Information

For additional information or questions please send e-mail to the product-marketing group at [ciscoworks@cisco.com](mailto:ciscoworks@cisco.com)



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## End-of-Sale and End-of-Life Announcement for the Cisco Security Agent Manager

Cisco Systems® announces the end of life of the Cisco Security Agent Manager. The last day to order the Cisco Security Agent Manager is June 30, 2003. Customers will continue to receive support from the Cisco Technical Assistance Center (TAC) until June 30, 2006. Table

1 describes the end-of-life milestones, definitions, and dates for the Cisco Security Agent Manager. Note that this announcement is for the Cisco Security Agent Manager only. The Cisco Security Server and Desktop Agents are still available for purchase and are not affected by this announcement.

Customers are encouraged to migrate to the CiscoWorks VPN/Security Management Solution (VMS) 2.2, or later, which includes the Management Center for Cisco Security Agents. The Management Center for Cisco Security Agents provides the replacement management and monitoring functions for the Cisco Security Agent product line and supports CiscoWorks Management Center for Security Agents 4.0. The Security Agent Manager will not support CiscoWorks Management Center for Security Agents 4.0. Information about the CiscoWorks VMS 2.2 is available at:

<http://www.cisco.com/en/US/products/sw/cscowork/ps2330/index.html>

In addition, the promotional inclusion of the Okena StormFront product with the Cisco Security Agent Manager will be discontinued with the end of sale of the Cisco Security Agent Manager. Customers will have to purchase the new Cisco Security Agent Profiler product to obtain the StormFront functions.

Table 3 provides relevant information for migrating from the Cisco Security Agent Manager to the CiscoWorks VMS 2.2.





Table 1 End-of-Life Milestones and Dates for the Cisco Security Agent Manager

| Milestone                                 | Definition                                                                                                                                                                                                                            | Date               |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| End-of-life announcement date             | The date the end-of-sale and end-of-life announcement is distributed to the general public.                                                                                                                                           | May 22, 2003       |
| End-of-sale date                          | The last date to order the product through Cisco point-of-sale mechanisms. The product is no longer for sale.                                                                                                                         | June 30, 2003      |
| Last shipment date                        | The last possible date that Cisco and/or its contract manufacturers will ship the affected product.                                                                                                                                   | September 16, 2003 |
| End of software maintenance releases date | The last date that Cisco Engineering may release any final software maintenance releases or bug fixes. After this date, Cisco Engineering will no longer develop, repair, maintain, or test the product software.                     | June 30, 2004      |
| End of new service attachment date        | For equipment and software that is not covered by a service-and-support contract, this is the last date to order a new service-and-support contract or add the equipment and/or software to an existing service-and-support contract. | June 30, 2004      |
| End of service contract renewal date      | The last date to extend or renew a service contract for the product. The extension or renewal period cannot extend beyond the last date of support.                                                                                   | June 30, 2005      |
| Last date of support                      | The last date to receive service and support for the product. After this date, all support services for the product are unavailable, and the product becomes obsolete.                                                                | June 30, 2006      |

Table 2 Product Part Numbers Affected by This Announcement

| End-of-Sale Product Part Number | Product Description                                                              |
|---------------------------------|----------------------------------------------------------------------------------|
| CSA-MANAGER-K9                  | Cisco Security Agent Manager with StormFront, which was included as a promotion. |

#### Replacement Product Part Numbers for New Orders

The recommended replacement for the Cisco Security Agent Manager is the CiscoWorks VMS 2.2 and the Cisco Security Agent Profiler (Table 3).

Table 3 Replacement Product Part Numbers for New Orders

| End-of-Sale Cisco Security Agent Manager Part Numbers  | Replacement CiscoWorks VMS and the Cisco Security Agent Profiler |
|--------------------------------------------------------|------------------------------------------------------------------|
| CSA-MANAGER-K9                                         | CWVMS-2.2-WINR-K9 or CWVMS-2.2-UR-K9                             |
| StormFront included as a promotion with CSA-MANAGER-K9 | CSA-PROFILER-K9                                                  |

#### Upgrading to CiscoWorks VMS 2.2

Cisco Security Agent Manager customers with a valid Software Application Support (SAS) contract are entitled to a no-cost upgrade to CiscoWorks VMS 2.2 and the Cisco Security Agent Profiler. Customers requesting the upgrade will receive the Restricted version of CiscoWorks VMS 2.2. The upgrade can be requested using the Product Upgrade Tool on Cisco.com at:

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<http://www.cisco.com/upgrade>

beginning in July 2003. A valid SAS contract number is required to request the upgrade through the Product Upgrade Tool. Customers must also upgrade their Cisco Security Desktop and Server Agents to the 4.0 version to have their agents managed by CiscoWorks VMS 2.2. Agent upgrades can also be requested through the Product Upgrade Tool using the agent SAS contract number.

#### Additional Information

For more information about Cisco products, contact your Cisco account manager and/or Cisco Channel Partner.

For more information about the Cisco End-of-Life Policy, go to:

[http://www.cisco.com/en/US/products/prod\\_end\\_of\\_life.html](http://www.cisco.com/en/US/products/prod_end_of_life.html)



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## Announcing CiscoWorks VPN/Security Management Solution 2.2

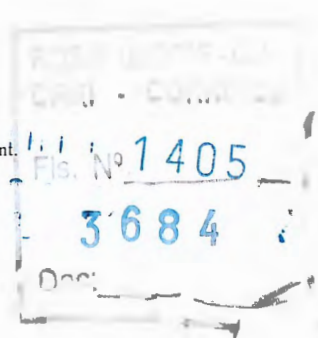
Cisco Systems® announces the availability of CiscoWorks VPN/Security Management Solution (VMS) 2.2. This suite of network security applications combines Web-based tools for configuring, monitoring, and troubleshooting enterprise VPNs, firewalls, and network- and host-based intrusion detection systems (IDSs).

CiscoWorks VMS 2.2 includes the following features:

- New technology for intrusion prevention—this provides industry-leading, superior protection of both servers and desktops from network security threats. This technology is distributed and is composed of:
  - Management Center for Cisco Security Agents—A console providing centralized policy definitions, distribution, and software updates with constant communications to primary agents.
  - Cisco Security Agents—Endpoint software that resides on servers, desktops, or laptops and autonomously enforces local policies that prevent unauthorized access. Three server agents are provided to protect CiscoWorks VMS 2.2. Additional server or desktop agents are sold separately.

CiscoWorks Management Center updates include:

- CiscoWorks Management Center for Firewalls 1.1 and CiscoWorks Auto Update Server Software 1.1 support large deployments of firewall service modules and Cisco PIX® firewalls. They feature device hierarchy and policy inheritance as well as user-defined device and customer groups, including nesting. Now supports the firewall service module.
- CiscoWorks Management Center for IDS Sensors 1.2 centrally configures multiple network and switch IDS sensors using group security profiles. Now supports IDS 4.1.
- CiscoWorks Management Center for VPN Routers 1.1 provides centralized multidevice administration for large-scale, site-to-site VPN connections in a hub-and-spoke topology. Allows the configuration and deployment of Internet Key Exchange (IKE) and IP Security (IPSec) tunnel policies. Now supports the VPN service module.
- CiscoWorks Monitoring Center for Security 1.2 identifies potential network attacks by capturing, storing and reporting on events from Cisco network IDSs, switch IDSs, host IDSs, firewalls, and routers.
- CiscoWorks Resource Manager Essentials 3.5 provides detailed inventory information, device configurations tools,







change audit reports, and syslog analysis for notification of VPN and security operational problems.

- CiscoWorks VPN Monitor 1.2 collects, stores, and displays information on IPSec VPN connections for remote-access or site-to-site VPN terminations. Multiple devices can be viewed from an easy-to-use dashboard that is configured using a Web browser.

#### Availability

CiscoWorks VPN/Security Management Solution 2.2 and associated minor release update kits will start shipping early July, 2003. Customers can purchase these new products through their regular sales channels beginning May 12, 2003.

Existing CiscoWorks VMS 2.X customers with current Software Application Services (SAS) contracts can request a CiscoWorks VMS 2.2 minor update kit using their contract number at [www.cisco.com/upgrade](http://www.cisco.com/upgrade) beginning July 1, 2003.

On March 19, 2003, Cisco announced the end of sale of the Cisco IDS Host Sensor Console product line, based on technology licensed from Entercept Security Technologies. Cisco IDS Host Sensor Console will no longer be sold standalone or as part of the CiscoWorks VMS bundle.

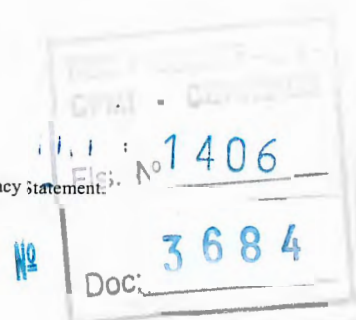
The Cisco IDS Host Sensor Console products are being replaced with the Management Center for Cisco Security Agents, which is based on recently acquired Okena technology. CiscoWorks VMS 2.0, 2.1, standalone Entercept and standalone Okena customers are eligible to migrate to the Management Center for Cisco Security Agents in CiscoWorks VMS 2.2 using their SAS contract at: [www.cisco.com/upgrade](http://www.cisco.com/upgrade) or the following update and upgrade part numbers in the Ordering Information section of this bulletin.

Cisco has also announced the end of sale of the Cisco Secure Policy Manager. Cisco Secure Policy Manager will no longer be sold as a standalone product or part of the CiscoWorks VMS bundle. Cisco Secure Policy Manager functions will increasingly be offered within the management centers for firewalls and other tools within CiscoWorks VMS.

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## Ordering Information

Table 1 contains part numbers commonly used to order CiscoWorks VMS 2.2. Some components include strong encryption technologies, which are restricted for some types of U.S. export.

**Table 1** Ordering Information for CiscoWorks VMS 2.2

| Part Number        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CWVMS-2.2-UR-K9    | CiscoWorks VMS 2.2 for Windows or Solaris, with Unrestricted Device Usage and one server installation license. Includes CiscoWorks Management Center for Firewalls 1.1*, for IDS Sensors 1.2*, for Cisco Security Agents 4.0*, and for VPN Routers 1.1*; CiscoWorks Auto Update Server Software 1.1; CiscoWorks Monitoring Center for Security 1.2*; CiscoWorks VPN Monitor 1.2; CiscoWorks Resource Manager Essentials (RME) 3.5; and CiscoWorks Common Services Software 2.2. |
| CWVMS-2.2-WINR-K9  | CiscoWorks VMS 2.2 for Windows, with 20-device Restricted Usage and one server installation license. Includes CiscoWorks Management Center for Firewalls 1.1, for IDS Sensors 1.2, for Cisco Security Agents 4.0; and for VPN Routers 1.1; CiscoWorks Auto Update Server Software 1.1; CiscoWorks Monitoring Center for Security 1.2; CiscoWorks VPN Monitor 1.2; CiscoWorks RME 3.5; and CiscoWorks Common Services Software 2.2.                                              |
| CWVMS-2.2-UPGUR-K9 | Upgrade from Cisco Secure Policy Manager 2.x standalone or CiscoWorks VMS 1.x or VMS2.x. Unrestricted or convert from CiscoWorks VMS 1.x Restricted to VMS 2.2 for Windows and Solaris; Unrestricted Device Usage; one server installation license.                                                                                                                                                                                                                             |
| CWVMS-2.2-WUPGR-K9 | Upgrade from Cisco Secure Policy Manager 2.x or CiscoWorks VMS 2.x Restricted to CiscoWorks VMS 2.2 for Windows; 20-device Restricted Usage; one server installation license.                                                                                                                                                                                                                                                                                                   |
| CWVMS-2.2-UR-MR-K9 | Minor update kit for existing CiscoWorks VMS 2.X Unrestricted Device Usage customers; includes updates for Windows and Solaris to existing components; includes management and monitoring centers**                                                                                                                                                                                                                                                                             |
| CWVMS-2.2-R-MR-K9  | Minor update kit for existing CiscoWorks VMS 2.X; 20-device Restricted Usage; includes updates for Windows to existing components; includes management and monitoring centers.**                                                                                                                                                                                                                                                                                                |
| CON-SAS-CWVMS22UR  | SAS for CiscoWorks VMS 2.2 for Windows and Solaris (Unrestricted Device License); provides Cisco Technical Assistance Center (TAC) support, Cisco.com Software Center access, and minor updates.                                                                                                                                                                                                                                                                                |
| CON-SAS-CWVMS22K9  | SAS for CiscoWorks VMS 2.2 for Windows (20-device Restricted License); provides Cisco TAC support, Cisco.com Software Center access, and minor updates.                                                                                                                                                                                                                                                                                                                         |
| CON-SAS-CWVMS22UP  | SAS for CiscoWorks VMS 2.2 Upgrade Kit for Windows and Solaris (Unrestricted Device License); provides Cisco TAC support, Cisco.com Software Center access, and minor updates.                                                                                                                                                                                                                                                                                                  |
| CON-SAS-CWVMS2220  | SAS for CiscoWorks VMS 2.2 Upgrade Kit for Windows (20-device Restricted License); provides Cisco TAC support, Cisco.com Software Center access, and minor updates.                                                                                                                                                                                                                                                                                                             |

\*Indicates Windows-only support. Please check the VMS 2.2 Q&As document for details on future Solaris support

\*\* Minor upgrade kits are for existing CiscoWorks VMS 2.x customers only. They do not provide licenses needed to move from CiscoWorks VMS 1.x or a standalone Cisco Secure Policy Manager 2.x

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**Table 2** VMS 2.X to 2.2 Minor Update Options

| Currently Own      | Type of previous license | You want | Desired License | Update Kit to Order                                                                                                                                               |
|--------------------|--------------------------|----------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VMS 2.0<br>VMS 2.1 | Restricted               | VMS 2.2  | Restricted      | CWVMS-2.2-R-MR-K9 or SAS customers can request update kits from Cisco's Product Upgrade Tool<br><a href="http://www.cisco.com/upgrade">www.cisco.com/upgrade</a>  |
| VMS 2.0<br>VMS 2.1 | Unrestricted             | VMS 2.2  | Unrestricted    | CWVMS-2.2-UR-MR-K9 or SAS customers can request update kits from Cisco's Product Upgrade Tool<br><a href="http://www.cisco.com/upgrade">www.cisco.com/upgrade</a> |

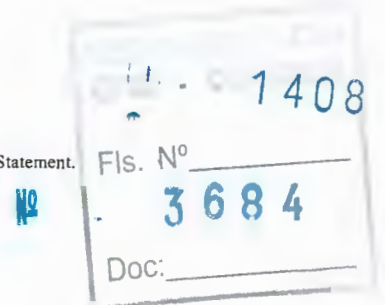
**Table 3** Standalone Entercept and Okena releases to VMS 2.2 Upgrade Options

| Currently Own                                                                                                                                                              | You want | Desired License | Update Kit to Order                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Please refer to Product Bulletin No. 2066 at the link below for eligible Entercept and Okena products:<br><a href="http://www.cisco.com/upgrade">www.cisco.com/upgrade</a> | VMS 2.2  | Restricted      | CWVMS-2.2-WUPGR-K9 or SAS customers can request upgrade kits from Cisco's Product Upgrade Tool<br><a href="http://www.cisco.com/upgrade">www.cisco.com/upgrade</a> |

**Table 4** VMS and CSPM Upgrade Options

| Currently Own       | Type of previous license | You want | Desired License | Upgrade to Order   |
|---------------------|--------------------------|----------|-----------------|--------------------|
| VMS 1.0             | Restricted               | VMS 2.2  | Restricted      | CWVMS-2.2-WUPGR-K9 |
| VMS 1.0             | Unrestricted             | VMS 2.2  | Unrestricted    | CWVMS-2.2-UPGUR-K9 |
| CSPM 2.X            | Restricted*              | VMS 2.2  | Restricted*     | CWVMS-2.2-WUPGR-K9 |
| CSPM 2.X            | Unrestricted             | VMS 2.2  | Unrestricted    | CWVMS-2.2-UPGUR-K9 |
| VMS 2.X             | Restricted               | VMS 2.2  | Unrestricted    | CWVMS-2.2-UPGUR-K9 |
| VMS 1.0 or CSPM 2.X | Restricted               | VMS 2.2  | Unrestricted    | CWVMS-2.2-UPGUR-K9 |

\*Also covers upgrades from SEC-POL-MGR-2.3-R





### Existing Products Affected

With the availability of CiscoWorks VMS 2.2, Cisco is announcing the end of sale for the following products. Earlier versions will continue to have extended support offered for them as indicated below.

**Table 5** Product End-of-Sale Dates

| Part Number        | Description                                                                                                                  | End of Sale   | End of Support |
|--------------------|------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|
| CWVMS-2.1-UR-K9    | CiscoWorks VMS 2.1 (Windows) (Unrestricted License)                                                                          | June 20, 2003 | June 2006*     |
| CWVMS-2.1-WINR-K9  | CiscoWorks VMS 2.1 (Windows) (20-device Restricted License)                                                                  | June 20, 2003 | June 2006*     |
| CWVMS-2.1-URC-K9   | Conversion from CiscoWorks VMS 2.1 (20-device Restricted) to Unrestricted                                                    | June 20, 2003 | June 2006*     |
| CWVMS-2.1-UPGUR-K9 | Upgrade from Cisco Secure Policy Manager 2.X (Unrestricted) to CiscoWorks VMS 2.1(Unrestricted)                              | June 20, 2003 | June 2006*     |
| CWVMS-2.1-WUPGR-K9 | Upgrade from CiscoWorks VMS 1.X or Cisco Secure Policy Manager 2.x (Restricted) to CiscoWorks VMS 2.1 (20-device Restricted) | June 20, 2003 | June 2006*     |

\* Note: Support may require customers to move to a later product version for resolution.

### Product Information

For installation documentation, please refer to:

[www.cisco.com/en/US/partner/products/sw/cscowork/ps2330/prod\\_technical\\_documentation.html](http://www.cisco.com/en/US/partner/products/sw/cscowork/ps2330/prod_technical_documentation.html)

additional product information refer to:

[www.cisco.com/go/vms/](http://www.cisco.com/go/vms/)

### Additional Information

For additional information or questions, send an e-mail message to the Product Marketing group at [ciscoworks@cisco.com](mailto:ciscoworks@cisco.com).

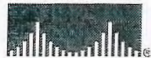


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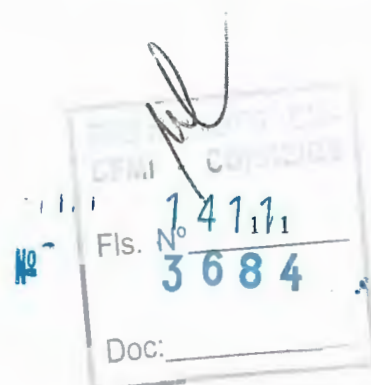
## **ANEXO INTEL**

**SERVIDOR INTEL TIPO 1**

**SERVIDOR INTEL TIPO 2**

**SERVIDOR INTEL TIPO 3**

**SWITCH TIPO 4 (KVM)**





# COMPROVAÇÃO DAS ESPECIFICAÇÕES EXIGIDAS NO EDITAL

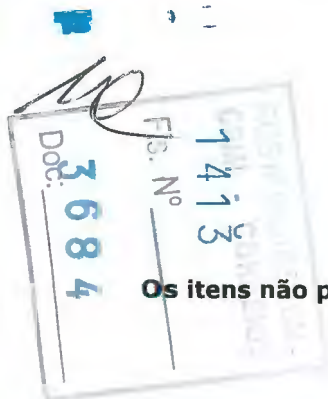
## 2.1. ASPECTOS GERAIS

| REQUISITO                                                                               | ATRIBUTOS OFERTADOS                                                                                       | ATRIBUTOS OFERTADOS ADICIONALMENTE                                            | CONFIRMA ATENDIMENTO (SIM / NÃO) | PÁGINA DA DOCUMENTAÇÃO TÉCNICA      |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|-------------------------------------|
| 2.1 – Comprovação de Performance para os Equipamentos RISC                              |                                                                                                           |                                                                               |                                  |                                     |
| 2.2 – Comprovação de Performance para os Equipamentos Intel                             | Servidores Tipo 1 – 115.025,75<br>Servidores Tipo 2 – 77.905,18<br>Servidores Tipo 3 – 43.231,00          |                                                                               | SIM                              | Anexo Intel pág. 133, 136, 128, 132 |
| 2.3 – Requisitos Gerais                                                                 |                                                                                                           |                                                                               | Intel - OK                       |                                     |
| 2.4 – Garantia                                                                          | Intel – 4 anos                                                                                            |                                                                               | Intel - OK                       |                                     |
| 2.5 – Alimentação Elétrica                                                              | CCD Brasília – 70 servidores<br>CCD S P – 37 servidores                                                   | Transformador elevador de tensão p/ CCD - SP                                  | Intel - OK                       | Anexo Intel pág. 36, 46, 91, 187    |
| 2.6 – Assistência Técnica                                                               | Serviços de Assistência Técnica nos locais de instalação                                                  |                                                                               | SIM                              | Anexo Intel pág. 261, 262           |
| 2.7 – Recursos Mínimos de Particionamento para Servidores RISC                          |                                                                                                           |                                                                               |                                  |                                     |
| 2.8 – Recursos Mínimos de Gerenciamento do Hardware requeridos para os Servidores Intel | Recurso de pré-falha implementado nos servidores<br>Agentes de gerenciamento implementados nos servidores | Ambiente de gerenciamento implementado com 1 Srv no CCD-BSB e outro no CCD-SP | SIM                              | Anexo Intel pág. 188, 191           |
| 2.9 – Recursos Mínimos de hardware e software para os servidores Intel                  | 12 servidores adicionais                                                                                  | Placa de rede NC7770 e Fonte de alimentação Redundante                        | SIM                              | Anexo Intel pág. 154,               |
| 2.10 – Recursos Mínimos de hardware e software para os servidores RISC adicionais       |                                                                                                           |                                                                               |                                  |                                     |
| 2.11 – Comprovação dos Requisitos Técnicos                                              | Manuais – Prospectos Técnicos e Páginas da Internet                                                       |                                                                               | SIM                              | Anexo Intel pág. 1 a 255            |
| 2.12 – Organização da Documentação Técnica                                              | Documentação Técnica dos equipamentos e software                                                          |                                                                               | SIM                              | Anexo Intel pág. 1 a 255            |
| 2.13 – Suporte Remoto                                                                   |                                                                                                           |                                                                               |                                  |                                     |
| 2.14 – Configuração das Ferramentas de Gerenciamento                                    | Instalação e configuração dos softwares e agentes                                                         |                                                                               |                                  |                                     |

Os itens não preenchidos estão comprovados nos demais anexos

### 3.4. SWITCH TIPO 4 (KVM)

| REQUISITO                                                   | ATRIBUTOS OFERTADOS                    | ATRIBUTOS OFERTADOS ADICIONALMENTE | CONFIRMA ATENDIMENTO (SIM / NÃO) | PÁGINA DA DOCUMENTAÇÃO TÉCNICA      |
|-------------------------------------------------------------|----------------------------------------|------------------------------------|----------------------------------|-------------------------------------|
| 1 – Descrição                                               | Switch KVM Black Box AFFINITY          |                                    | SIM                              | Anexo Intel pág. 172, 175, 182, 184 |
| 2 – Quantidade de Portas                                    | BSB – 160<br>SP – 96                   |                                    | SIM                              | Anexo Intel pág. 172, 175, 182, 184 |
| 3 – Consoles                                                | Monitor de 17" – S7500<br>Teclado ABNT |                                    | SIM                              | Anexo Intel pág. 185, 186, 256, 259 |
| 4 – Solução Alternativa para comutação dos Servidores Intel | -----                                  | -----                              | -----                            | -----                               |
| 5 – Gerais                                                  | Conforme Proposta                      |                                    | SIM                              | Anexo Intel pág. 184                |



Os itens não preenchidos estão comprovados nos demais anexos



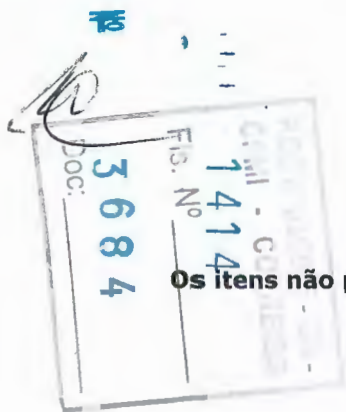


#### 4.1. SERVIDORES INTEL

##### 4.1.1. SERVIDORES INTEL TIPO 1

| REQUISITO                                            | ATRIBUTOS OFERTADOS                      | ATRIBUTOS OFERTADOS ADICIONALMENTE | CONFIRMA ATENDIMENTO (SIM / NÃO) | PÁGINA DA DOCUMENTAÇÃO TÉCNICA         |
|------------------------------------------------------|------------------------------------------|------------------------------------|----------------------------------|----------------------------------------|
| 1 – CPU e Performance                                | 115.025,75                               |                                    | SIM                              | Anexo Intel pág. 133, 136              |
| 2 – Barramento                                       | 400 MHZ                                  |                                    | SIM                              | Anexo Intel pág. 142, 143              |
| 3 – Memória Cache                                    | 2 MB                                     |                                    | SIM                              | Anexo Intel pág. 1, 2                  |
| 4 – Memória RAM                                      | 8 GB                                     |                                    | SIM                              | Anexo Intel pág. 1                     |
| 5 – Controladora e Unidade de Disco Rígido - Interno | Controladora “on board”<br>HD de 72,8 GB |                                    | SIM                              | Anexo Intel pág. 2, 32, 150            |
| 6 – Interface de Vídeo                               | 8 MB – 64 bits                           |                                    | SIM                              | Anexo Intel pág. 3, 137, 138, 139, 140 |
| 7 – Unidade de CD/DVD-ROM                            | CD-24 X                                  |                                    | SIM                              | Anexo Intel pág. 1                     |
| 8 – Controladora de I/O ( por equipamento )          | FCA 2355<br>3 X NICs NC7770              |                                    | SIM                              | Anexo Intel pág. 38, 153, 154, 156     |
| 9 – Ambiente Operacional                             |                                          |                                    |                                  |                                        |
| 10 – Fonte de Alimentação                            | 1150 W – ( Redundante )                  |                                    | SIM                              | Anexo Intel pág. 36                    |

Os itens não preenchidos estão comprovados nos demais anexos



#### 4.1.2. SERVIDORES INTEL TIPO 2

| REQUISITO                                            | ATRIBUTOS OFERTADOS                      | ATRIBUTOS OFERTADOS ADICIONALMENTE | CONFIRMA ATENDIMENTO (SIM / NÃO) | PÁGINA DA DOCUMENTAÇÃO TÉCNICA          |
|------------------------------------------------------|------------------------------------------|------------------------------------|----------------------------------|-----------------------------------------|
| 1 – CPU e Performance                                | 77.905,18                                |                                    | SIM                              | Anexo Intel pág. 128                    |
| 2 – Barramento                                       | 400 MHZ                                  |                                    | SIM                              | Anexo Intel pág. 41, 145                |
| 3 – Memória Cache                                    | 2 MB                                     |                                    | SIM                              | Anexo Intel pág. 41                     |
| 4 – Memória RAM                                      | 4 GB                                     |                                    | SIM                              | Anexo Intel pág. 40                     |
| 5 – Controladora e Unidade de Disco Rígido - Interno | Controladora "on board"<br>HD de 72,8 GB |                                    | SIM                              | Anexo Intel pág. 40, 76, 150            |
| 6 – Interface de Vídeo                               | 8 MB – 64 bits                           |                                    | SIM                              | Anexo Intel pág. 42, 137, 138, 139, 140 |
| 7 – Unidade de CD/DVD-ROM                            | CD – 24 X                                |                                    | SIM                              | Anexo Intel pág. 39, 42                 |
| 8 – Controladora de I/O ( por equipamento )          | FCA 2355<br>2 X NIC NC7770               |                                    | SIM                              | Anexo Intel pág. 40, 85, 153, 154, 156  |
| 9 – Ambiente Operacional                             |                                          |                                    |                                  |                                         |
| 10 – Fonte de Alimentação                            | 2 X 800 W ( Redundante)                  |                                    | SIM                              | Anexo Intel pág. 46                     |

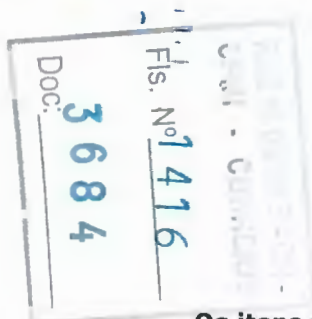
Os itens não preenchidos estão comprovados nos demais anexos





#### 4.1.3. SERVIDORES INTEL TIPO 3

| REQUISITO                                            | ATRIBUTOS OFERTADOS                      | ATRIBUTOS OFERTADOS ADICIONALMENTE | CONFIRMA ATENDIMENTO (SIM / NÃO) | PÁGINA DA DOCUMENTAÇÃO TÉCNICA          |
|------------------------------------------------------|------------------------------------------|------------------------------------|----------------------------------|-----------------------------------------|
| 1 – CPU e Performance                                | 43.231                                   |                                    | SIM                              | Anexo Intel pag. 132                    |
| 2 – Barramento                                       | 533 MHZ                                  |                                    | SIM                              | Anexo Intel pag. 87, 147                |
| 3 – Memória Cache                                    | 512 KB                                   |                                    | SIM                              | Anexo Intel pag. 87                     |
| 4 – Memória RAM                                      | 1,5 GB                                   |                                    | SIM                              | Anexo Intel pag. 86                     |
| 5 – Controladora e Unidade de Disco Rígido - Interno | Controladora "on board"<br>HD de 72,8 GB |                                    | SIM                              | Anexo Intel pag. 88, 160, 161, 150      |
| 6 – Interface de Vídeo                               | 8 MB – 64 bits                           |                                    | SIM                              | Anexo Intel pag. 89, 137, 138, 139, 140 |
| 7 – Unidade de CD/DVD-ROM                            | CD – 24 X                                |                                    | SIM                              | Anexo Intel pag. 87                     |
| 8 – Controladora de I/O ( por equipamento )          | 2 X NIC NC7770                           |                                    | SIM                              | Anexo Intel pag. 153, 154               |
| 9 – Ambiente Operacional                             |                                          |                                    |                                  |                                         |
| 10 – Fonte de Alimentação                            | 2 X 500 W ( Redundante )                 |                                    | SIM                              | Anexo Intel pag. 91                     |



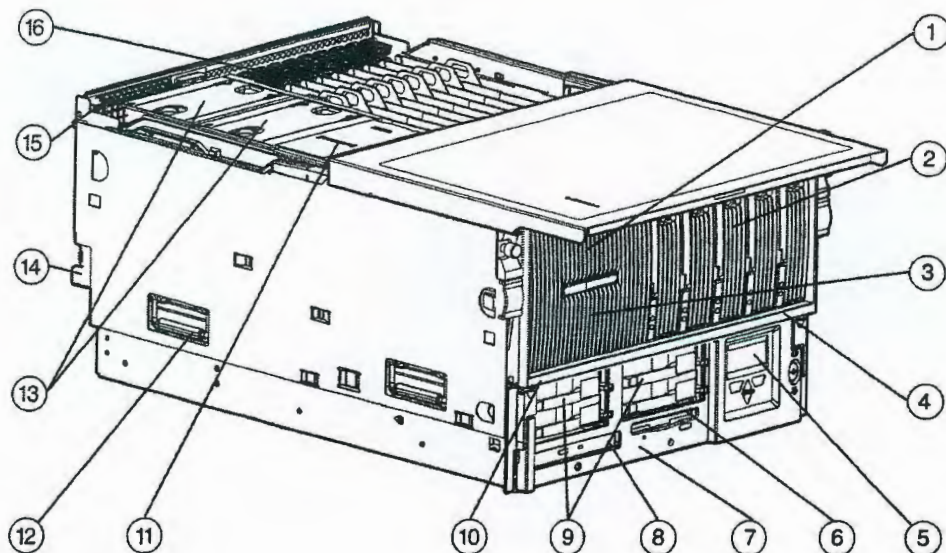
Os itens não preenchidos estão comprovados nos demais anexos



# QuickSpecs

HP ProLiant DL760 Generation 2

## Overview



- |                                                                                        |                                                                                                           |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 1. Processor/Memory Module                                                             | 9. Four 1" Ultra320 SCSI Hot Plug Drive Bays (running U3 speeds)                                          |
| 2. Hot Plug RAID Memory Cartridge                                                      | 10. Attention LED Indicators                                                                              |
| 3. Four or Eight Intel Xeon™ Processors MP with fault tolerant processor power modules | 11. System Interconnect Status Indicator                                                                  |
| 4. DIMM Status LED                                                                     | 12. Integrated Lift Handles                                                                               |
| 5. Integrated Management Display                                                       | 13. Redundant Hot Plug Fans                                                                               |
| 6. Integrated 1.44-MB Diskette Drive                                                   | 14. Two Redundant Hot Plug Power Supplies                                                                 |
| 7. Media Module                                                                        | 15. I/O Modules                                                                                           |
| 8. Integrated 24X IDE CD-ROM Drive, Low Profile                                        | 16. Eleven 64-bit PCI-X and PCI I/O expansion slots, all Hot Plug (10 x 100 MHz PCI-X and 1 x 33 MHz PCI) |

## What's New

- Intel® Xeon Processor MP 1.5 GHz/1MB or 2.0GHz/2MB Processors (eight processor capability)
- Hot Plug RAID Memory using XOR & ECC-protected memory and user-friendly diagnostics
- The ultimate high-density data center server delivering breakthrough 8-way scalable performance for 7 x 24 multi-server rack environments
- ProLiant 8500 & DL760 to DL760G2 upgrade option
- Tool less chassis for enhanced serviceability
- 133 MHz SDRAM DIMM memory that is expandable to 64 GB addressable memory (+16GB for full redundancy)
- Integrated Smart Array Si Controller (Ultra3 support) (supports RAID 0, 1, 1+0, and 5 across internal hard disk drives)
- (10) 64b/100MHz capable PCI-X slots & (1) 64-bit/33-MHz PCI slot
- Full RILOE II support
- Integrated Compaq NC7770 PCI-X Gigabit Server Adapter
- Internal Hot Plug Drive Storage of 587.2 GB (4 x 1" 146.8-GB Ultra 320 hard drives running U3)
- Robust set of hot plug and redundant features including Hot Plug RAID Memory, PCI/PCI-X Hot Plug, hot plug drive bays, redundant hot plug fans and power supplies and support for redundant NICs, ASR-2, Remote-Flash Redundant ROM
- Protected by HP Services, including a three-year, Next Business Day on-site, limited, Global warranty and extended Pre-Failure Warranty that covers processors, memory and disk drives - Certain restrictions and exclusions apply. Consult the HP Customer Support Center at 1-800-345-1518 for details.





# QuickSpecs

HP ProLiant DL760 Generation 2

## Standard Features

Processor (4) Intel Xeon Processor MP 2.0 GHz  
One of the following depending on Model: (4) Intel Xeon Processor MP 1.5 GHz

Cache Memory 2-MB integrated level 3 cache (per processor)  
One of the following depending on Model: (NOTE: Available with 2.0 MHz.)  
1-MB integrated level 3 cache (per processor)  
(NOTE: Available with 1.5 MHz.)

Upgradability Upgradable to eight processors

Chipset HP developed F8 chipset

Memory Standard 4096 MB addressable protected 133MHz ECC SDRAM DIMMs  
One of the following depending on Model: (2.0MHz Models)  
Maximum 64 GB (80 GB total)  
Standard 2048MB addressable protected 133MHz ECC SDRAM DIMMs  
(1.5 MHz Models)  
Maximum 64 GB (80 GB total)  
NOTE: All models come standard with all five memory cartridges populated and Hot Plug RAID Memory enabled.  
NOTE: In standard Hot Plug RAID Memory mode, addressable memory refers to the portion of memory that is addressable by the OS. Total memory consists of addressable memory plus the redundant memory (stored in the dedicated parity memory cartridge.)

Network Controller Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot

Expansion Slots I/O (11 Total – 64-bit PCI-X and PCI, all Hot Pluggable) PCI Voltage:  
PCI-X 100-MHz (Hot Plug) 10 3.3 Volt (keyed for 3.3 Volt or universal PCI-X/PCI cards)  
PCI 33MHz (Hot Plug) 1 5 Volt (keyed for 5V)  
NOTE: For more information regarding PCI-X, please see the following URL: <http://www.compaq.com/pci-x>

Storage Controllers Smart Array 5i Controller (integrated on system board) supports (Ultra3) (supports RAID 0, 1, 1+0, and 5 across internal hard-disk drives)  
Optional support for Ultra3 storage controller in an I/O slot to internal drives via array bypass cable

Storage Diskette Drives Integrated 1.44 MB Floppy Drive  
CD-ROM Integrated 24x IDE CD-ROM drive Low-Profile  
Hard Drives None  
Maximum Internal Storage 587.2 GB (4 x 146.8 GB Ultra320 1" Drives) (internal hot plug cage only)  
(Ultra320 drives run U3.)



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# QuickSpecs

HP ProLiant DL760 Generation 2

## Standard Features

|            |                         |   |
|------------|-------------------------|---|
| Interfaces | Serial                  | 1 |
|            | Pointing Device (Mouse) | 1 |
|            | Graphics                | 1 |
|            | Keyboard                | 1 |
|            | Network RJ-45           | 1 |

Graphics Integrated ATI RAGE XL Video Controller with 8-MB SDRAM Video Memory

Form Factor 7U Rack Form Factor; Ships with sliding rack rails and cable management arm; Standard 19" rack-mountable

### Upgrade Kit

The ProLiant 8500/DL760 Supported Upgrade Option Kit (PN 190756-B21) is supported in any ProLiant 8500 and ProLiant DL760 (700/900MHz).

NOTE: This upgrade kit (190756-B21) enables customers to upgrade from a ProLiant 8500 or a ProLiant DL760 to ProLiant DL760 G2 technology.

NOTE: The upgrade kit includes the following:

- ProLiant DL760 G2 Processor & Memory module with...
  - 4 x Intel Xeon Processor MP 2.0GHz/2MB
  - 4096 MB addressable protected 133MHz ECC SDRAM DIMMs (All five memory cartridges are populated and Hot Plug RAID Memory is enabled.)
- ProLiant DL760 G2 I/O Module with...
  - Integrated NC7770 PCI-X Gigabit Server Adapter in a slot
  - Smart Array 5i Controller (embedded)
  - ProLiant DL760 G2 I/O lid with label
- ProLiant DL760 G2 system midplane
- ProLiant DL760 G2 front hood label
- Two ProLiant DL760 G2 service number labels
- Two IEC to IEC 220V power cables
- HP ProLiant Essentials Foundation Pack
- HP ProLiant DL760 G2 Server Documentation

LIMITED WARRANTY AND TECHNICAL SUPPORT INFORMATION NOTE: Certain restrictions and exclusions may apply. The terms of the warranty may vary by geographic region.

NOTE: The ProLiant DL760 G2 server upgrade kit is an option and carries a warranty that covers replacement of defective parts, labor costs, and next-business-day onsite repair charges for the first year of ownership or the remainder of the warranty on the server it is upgrading, whichever is longer.



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# QuickSpecs

HP ProLiant DL760 Generation 2

## Standard Features

### ProLiant Essentials Foundation Pack Software

#### Insight Manager 7

Insight Manager 7 helps maximize system uptime and performance and reduces the cost of maintaining the IT infrastructure by providing proactive notification of problems before those problems result in costly downtime and reduced productivity. Insight Manager 7 is easy to set up and provides rapid access to detailed fault and performance information gathered by the Management Agents. One-click access to the Integrated Lights-Out or Remote Insight Lights Out Edition board allows systems administrators to take full graphical control of ProLiant servers in remote locations or lights-out data centers. Finally, Insight Manager 7 in concert with the Version Control Agents and Version Control Repository Manager enables systems administrators to version manage and update system software across groups of ProLiant servers.

#### SmartStart

SmartStart is a tool that simplifies server setup, providing a rapid way to deploy reliable and consistent server configurations. For more information, please visit the SmartStart Web site at <http://www.hp.com/servers/smartstart>. SmartStart version supported (minimum): SmartStart 5.00.

#### Management Agents

The Management Agents form the foundation for HP's Intelligent Manageability strategy. They provide direct, browser-based access to in-depth instrumentation built into HP servers, workstations, desktops, and portables, and send alerts to Insight Manager 7 and other enterprise management applications in case of subsystem or environmental failures. For additional information about the Management Agents and other management products from HP, please visit the management Web site at <http://www.hp.com/servers/manage>.

#### ActiveUpdate

Active Update is a web-based application that keeps IT managers directly connected to HP for proactive notification and delivery of the latest software updates.

#### ROMPaq, support software, and configuration utilities

The latest software, drivers, and firmware fully optimized and tested for your ProLiant server and options.

#### Survey Utility and diagnostics utilities

The most advanced configuration analysis, reporting and troubleshooting utilities used by HP and at your fingertips.

#### Optional ProLiant Essentials Value Packs

Optional software offerings that selectively extend the functionality of an Adaptive Infrastructure to address specific business problems and needs:

- Rapid Deployment Pack – an automated solution for multi-server deployment and provisioning, enabling companies to quickly and easily adapt to changing business demands.
- Workload Management Pack – provides easier management of complex environments, improving overall server utilization and enabling Windows® 2000 customers for the first time to confidently deploy multiple applications on a single multiprocessor ProLiant Server.
- Performance Management Pack – a performance management solution that identifies and explains hardware performance bottlenecks on ProLiant servers and attached options enabling users to better utilize their valuable resources.

NOTE: Flexible and volume quantity license kits are available for ProLiant Essentials Value Packs. Refer to <http://www.hp.com/servers/proliantessentials> or the various ProLiant Essentials Value Pack product QuickSpecs for more information.

NOTE: For more information regarding ProLiant Essentials Software, please see the following URL:  
<http://www.hp.com/servers/proliantessentials>

### Industry Standard Compliance

ACPI 1.0b Compliant  
PCI-X and PCI 2.2 Compliant  
PAE Support  
Microsoft® Logo certifications



# QuickSpecs

HP ProLiant DL760 Generation 2

## Standard Features

### Manageability

Insight Manager 7  
Remote Insight Lights-Out Edition II (optional)  
ROM-Based Setup Utility (RBSU)  
Integrated Management Display (IMD)  
Server Health logging  
Automatic Server Recovery-2 (ASR-2)  
System Interconnect Status Indicators  
Remote-Flash Redundant ROM  
Hot Spare Boot (NOTE: Upon the event of a failed processor or VRM in a multi-processing environment, the system will automatically reboot and use the remaining good processor(s).)  
Power Down Utility  
Power Supply Viewer  
Pre-Failure Warranty (covers processors, as well as hard drives and memory)

### Availability

Hot Plug RAID Memory using Industry Standard ECC Memory  
PCI-X/PCI Hot Plug with push button functionality  
Redundant Hot Plug Fans  
Smart Array 5300 Controller (optional)  
Dynamic sector repairing and drive parameter tracking (with Smart Array controllers)  
Fault Tolerant Processor Power Modules  
Redundant/adaptive load balancing NIC Support  
Redundant Hot Plug Power Supplies

### Security

Power-on password  
Diskette drive control  
Diskette boot control  
Network server mode  
Security provision  
Parallel and serial interface control  
Administrator's password  
Disk configuration lock  
Hot plug access security

### Server Power Cords

Two Highline IEC to IEC power cords (PDU adapters) ships standard

### Power Supply

Two Redundant Hot Plug 1150/500-Watt power supplies per system. Power supplies are load sharing and provide 1150 Watts of Redundant power for 220 volt input or 500 Watts of Redundant power for 110 volt input.  
NOTE: To ensure redundancy of server power, HP requires that 200-240 VAC power be used for all deployments. This will ensure that both power supplies can support up to their maximum configurations, and remain in a redundant power supply state.  
NOTE: A maximum of two power supplies are supported and ship standard with each server.

### System Fans

Two Hot-Plug redundant fans ship standard. Two maximum supported.

### Required Cabling

For required cabling information, refer to the Web site at:  
<http://hp.com/products/servers/ProLiantDL760>.





### Standard Features

#### OS Support

Microsoft Windows 2000  
Microsoft Windows 2000 Advanced Server  
Microsoft Windows Server 2003 (Standard and Enterprise)  
SCO UnixWare  
Linux (Red Hat, SuSE)

NOTE: For a more complete and up-to-date listing of supported OS's and versions, please visit our OS Support Matrix at:  
[ftp://ftp.compaq.com/pub/products/servers/os-support-matrix-310.pdf](http://ftp.compaq.com/pub/products/servers/os-support-matrix-310.pdf).

NOTE: For an up-to-date listing of the latest drivers available for the ProLiant DL760 G2, please see:  
<http://www.compaq.com/support/files/server/us/index.html>.

#### Data Center

Data Center services and support offerings are available with Data Center solutions.

#### Rack Airflow Requirements

- Rack 9000 and 10000 series Cabinets

The increasing power of new high-performance processor technology requires increased cooling efficiency for rack-mounted servers. The 9000 and 10000 Series Racks provide enhanced airflow for maximum cooling, allowing these racks to be fully loaded with servers using the latest processors.

- Rack 7000 series Cabinets

When installing a server with processors running at speeds of 550 MHz or greater in Compaq Rack 7000 series racks with glass doors (165753-001 (42U), and 163747-001 (22U)), the new processor technology requires the installation of High Airflow Rack Door Inserts (327281-B21 (42U), 327281-B22 (42U 6 pack), or 157847-B21 (22U)) to promote enhanced airflow for maximum cooling.

CAUTION: If a third-party rack is used, observe the following additional requirements to ensure adequate airflow and to prevent damage to the equipment:

- Front and rear doors: If your 42U server rack includes closing front and rear doors, you must allow 830 square inches (5,350 sq cm) of hole evenly distributed from top to bottom to permit adequate airflow (equivalent to the required 64 percent open area for ventilation).
- Side: The clearance between the installed rack component and the side panels of the rack must be a minimum of 2.75 inches (7 cm).

CAUTION: Always use blanking panels to fill all remaining empty front panel U-spaces in the rack. This arrangement ensures proper airflow. Using a rack without blanking panels results in improper cooling that can lead to thermal damage.

NOTE: For additional information, refer to the Setup and Installation Guide or the Documentation CD provided with the server, or to the server documentation located in the Support section at the following URL:

<http://www5.compaq.com/products/servers/ProLiantDL760/index.html>.

NOTE: Allow a minimum of 48" (121.92 cm) clearance beyond the front of your rack to permit server installation and removal. This applies to both individual rack installations as well as when aligning rack rows so that the front doors are facing each other.

# QuickSpecs

HP ProLiant DL760 Generation 2

## Standard Features

### Service and Support

HP Services provides a three-year, limited warranty, including Pre-Failure Warranty (coverage of hard drives, memory and processors) fully supported by a worldwide network of resellers and service providers. HP technical assistance is available 7x24, toll free in the United States and Canada. Telephone support services may be covered under warranty or available for an additional fee.

NOTE: Limited Warranty includes 3 year Parts, 3 year Labor, 3-year on-site support.

A full range of Care Pack packaged hardware and software services:

- Installation and start up
- Extended coverage hours and enhanced response times
- System management and performance services
- Availability and recovery services

NOTE: For more information, customer/resellers can contact <http://www.compaq.com/services>.

Please see the following URL regarding Warranty Information For Your HP Products:

[http://www.compaq.com/support/warranty\\_upgrades/web\\_statements/176738.html](http://www.compaq.com/support/warranty_upgrades/web_statements/176738.html).

For additional information regarding Worldwide Limited Warranty and Technical Support, please see the following URL:

<ftp://ftp.compaq.com/pub/supportinformation/ejourney/176738.pdf>.

NOTE: Certain restrictions and exclusions may apply. Consult the Customer Support Center for details.



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# QuickSpecs

## HP ProLiant DL760 Generation 2

### Models

|                                                         |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model DL760R02 X2000-<br>2MB, 4096MB (4P)<br>171206-B21 | Processor(s)<br>Cache Memory<br>Memory<br>Network Controller<br>Storage Controller<br>Hard Drives<br>Internal Storage<br>Cache Accelerator<br>Optical Drive<br>I/O Slots<br>Form Factor | (4) Intel Xeon Processors MP at 2.0 GHz standard (up to 8 supported)<br>2-MB integrated Level 3 cache (per processor)<br>4096 MB (Standard) to 64 GB (Maximum) addressable protected 133MHz ECC SDRAM DIMM (5120 MB total)<br>Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot<br>Integrated Smart Array 5i Controller (Ultra 3 support) (supports RAID 0, 1, 1+0, and 5 across internal hard disk drives)<br>None<br>587.2 GB maximum (with optional hard drives)<br>2-MB Cache coherency accelerator embedded on host board<br>24x IDE CD-ROM Drive<br>PCI and PCI-X<br>7U Rack Form Factor |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

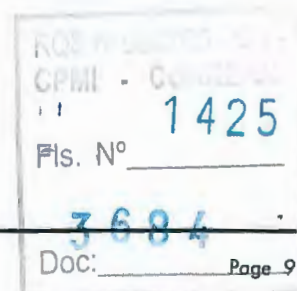
|                                                         |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model DL760R02 X1500-<br>1MB, 2048MB (4P)<br>171202-B21 | Processor(s)<br>Cache Memory<br>Memory<br>Network Controller<br>Storage Controller<br>Hard Drives<br>Internal Storage<br>Cache Accelerator<br>Optical Drive<br>I/O Slots<br>Form Factor | (4) Intel Xeon Processors MP at 1.50 GHz standard (up to 8 supported)<br>1-MB integrated Level 3 cache (per processor)<br>2048 MB (Standard) to 64 GB (Maximum) addressable protected 133MHz ECC SDRAM DIMM (2560 MB total)<br>Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot<br>Integrated Smart Array 5i Controller (Ultra 3 support) (supports RAID 0, 1, 1+0, and 5 across internal hard disk drives)<br>None<br>587.2 GB maximum (with optional hard drives)<br>2-MB Cache coherency accelerator embedded on host board<br>24x IDE CD-ROM Drive<br>PCI and PCI-X<br>7U Rack Form Factor |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                        |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Upgrade Kit                                 | ProLiant 8500/DL760 Supported Upgrade Option Kits<br>NOTE: This option kit is supported in any ProLiant 8500 and ProLiant DL760 (700/900MHz).<br>NOTE: This upgrade kit (PN 190756-B21) enables customers to upgrade from a ProLiant 8500 or a ProLiant DL760 to ProLiant DL760 G2 technology.<br>LIMITED WARRANTY AND TECHNICAL SUPPORT INFORMATION NOTE: Certain restrictions and exclusions may apply. The terms of the warranty may vary by geographic region.<br>NOTE: The ProLiant DL760 G2 server upgrade kits are an option and carries a warranty that covers replacement of defective parts, labor costs, and next-business-day onsite repair charges for the first year of ownership or the remainder of the warranty on the server it is upgrading, whichever is longer.                                                                                                                                                                                | 190756-B21                             |
| ProLiant Essentials Value Pack Software     | ProLiant Essentials Performance Management Pack Single Server License<br>ProLiant Essentials Workload Management Pack (Featuring Compaq Resource Partitioning Manager version 2.0)<br>NOTE: Flexible and volume quantity license kits are available for ProLiant Essentials Value Packs. Refer to <a href="http://www.hp.com/servers/proliantessentials">http://www.hp.com/servers/proliantessentials</a> or the various ProLiant Essentials Value Pack product QuickSpecs for more information.<br>NOTE: For more information regarding ProLiant Essentials Software, please see the following URL: <a href="http://www.hp.com/servers/proliantessentials">http://www.hp.com/servers/proliantessentials</a> .<br>NOTE: These Web sites are available in English only.                                                                                                                                                                                              | 306696-B21<br>303284-B21               |
| Software                                    | HP digital asset protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 302316-001                             |
| NetServer to ProLiant integrations services | HP NetServer to ProLiant integration and assessment service<br>NOTE: HP identifies current levels of NetServer support, services, and management. This service helps maximize customer's ability to add ProLiant platforms into their current environment.<br>HP TopTools to Insight Manager 7 installation and startup service<br>NOTE: Provides on-site review, installation and configuration services for Insight Manager 7. HP will also re-create, as closely as possible, the views and reports from the customer's current TopTools configuration. This service assures a smooth transition to the ProLiant Essentials software.<br>HP NetServer to ProLiant Essentials Rapid Deployment Pack installation and startup service<br>NOTE: Install and configure Rapid Deployment Pack in a test environment, then deploy a server image to a maximum of 250 systems in the production environment. This service helps to assure successful system deployment. | 304164-002<br>304163-002<br>304162-002 |
| Processor                                   | NOTE: Intel Xeon 2.0GHz and 1.50 GHz processors cannot be mixed in the same server. They all have to be of the same speed.<br>(4) Intel Xeon MP 2.0GHz -2MB Processor Option Kit<br>NOTE: This processor option kit (PN 287520-B21) supports the ProLiant DL760 G2 and the ProLiant DL740 servers. This option kit contains 4 x Intel Xeon MP 2.0GHz-2MB processors.<br>(4) Intel Xeon MP 1.5GHz-1MB Processor Option Kit<br>NOTE: This processor option kit (PN 287519-B21) supports the ProLiant DL760 G2 and ProLiant DL740 servers. This option kit contains 4 x Intel Xeon MP 1.5GHz-1MB processors.                                                                                                                                                                                                                                                                                                                                                           | 287520-B21<br>287519-B21               |





# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

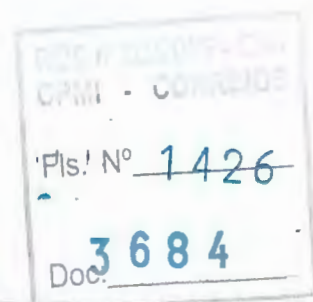
|                                                                                                                                          |                                                                     |            |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|------------|
| Memory<br>(SDRAM DIMMs)                                                                                                                  | 2048MB 133MHz ECC SDRAM Memory Option Kit (1x2048MB)                | 317093-B21 |
|                                                                                                                                          | NOTE: A ROM dated later than 2/14/2003 is needed to use 2 GB DIMMs. |            |
|                                                                                                                                          | 1024MB 133MHz ECC SDRAM Memory Option Kit (1x1024MB)                | 236854-B21 |
|                                                                                                                                          | 512MB 133MHz ECC SDRAM Memory Option Kit (1x512MB)                  | 236853-B21 |
|                                                                                                                                          | 256MB 133MHz ECC SDRAM Memory Option Kit (1x256MB)                  | 236852-B21 |
| NOTE: Memory must be populated in banks of 10. (2 per memory cartridge x 5 cartridges.) All DIMMs in a bank must be the same sku number. |                                                                     |            |

|                                                                                                                                                                                                  |                                                   |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------|
| Hard Drives                                                                                                                                                                                      | <i>Ultra 320 SCSI – Universal Hot Plug</i>        |            |
|                                                                                                                                                                                                  | 36.4GB 10,000 rpm, U320 Universal Hard Drive, 1"  | 286713-B22 |
|                                                                                                                                                                                                  | 72.8GB 10,000 rpm, U320 Universal Hard Drive, 1"  | 286714-B22 |
|                                                                                                                                                                                                  | 146.8GB 10,000 rpm, U320 Universal Hard Drive, 1" | 286716-B22 |
|                                                                                                                                                                                                  | 18.2GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286775-B22 |
|                                                                                                                                                                                                  | 36.4GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286776-B22 |
|                                                                                                                                                                                                  | 72.8GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286778-B22 |
| NOTE: All U320 Universal Hard Drives are backward compatible to U2 or U3 speeds.                                                                                                                 |                                                   |            |
| NOTE: Please see the Hard Drive QuickSpecs for Technical Specifications such as capacity, height, width, interface, transfer rate, seek time, physical configuration, and operating temperature: |                                                   |            |
| U320 Hard Drive QS:                                                                                                                                                                              |                                                   |            |
| <a href="http://www5.compaq.com/products/quickspecs/11531_na/11531_na.HTML">http://www5.compaq.com/products/quickspecs/11531_na/11531_na.HTML</a>                                                |                                                   |            |

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NO



# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                     |                                                                                                                                                                                                                                                                                                  |            |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Storage Controllers | Smart Array 532 Controller                                                                                                                                                                                                                                                                       | 225338-B21 |
|                     | Smart Array 5302/128 Controller                                                                                                                                                                                                                                                                  | 283552-B21 |
|                     | Smart Array 5304/256 Controller                                                                                                                                                                                                                                                                  | 283551-B21 |
|                     | Smart Array 5312 Controller                                                                                                                                                                                                                                                                      | 238633-B21 |
|                     | Smart Array 641 Controller                                                                                                                                                                                                                                                                       | 291966-B21 |
|                     | Smart Array 642 Controller                                                                                                                                                                                                                                                                       | 291967-B21 |
|                     | 64-MB BBWC Module for Smart Array 641/642 Controllers                                                                                                                                                                                                                                            | 291969-B21 |
|                     | Ultra3 Channel Expansion Module for Smart Array 5300 Controller                                                                                                                                                                                                                                  | 153507-B21 |
|                     | 128-MB Cache Module for Smart Array 5302 Controller                                                                                                                                                                                                                                              | 153506-B21 |
|                     | RAID ADG Upgrade for Smart Array 5302                                                                                                                                                                                                                                                            | 288601-B21 |
|                     | 256-MB Battery-Backed Cache Module                                                                                                                                                                                                                                                               | 254786-B21 |
|                     | NOTE: This 256-MB Battery-Backed Cache Module supports the Smart Array 5300 series controllers, MSA 1000 and the Smart Array Cluster Storage.                                                                                                                                                    |            |
|                     | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>(The 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter (154457-B21) will default to Wide Ultra2 when not used with the Wide Ultra3 hard drives.)                                                                                    | 154457-B21 |
|                     | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>(The 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter (129803-B21) will default to Wide Ultra2 when not used with the Wide Ultra3 hard drives.)                                                                                        | 129803-B21 |
|                     | 64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter<br>(The 64-bit/133-MHz Dual Channel Wide Ultra320 SCSI Adapter (268351-B21) will default to Wide Ultra2 when not used with the Wide Ultra3 hard drives.)                                                                                        | 268351-B21 |
|                     | NOTE: Please see the following Controller or SCSI Adapter QuickSpecs for Technical Specifications such as PCI Bus, PCI Peak Data Transfer Rate, SCSI Protocols supported, SCSI Peak Data Transfer Rate, Channels, SCSI Ports, Drives supported, Cache, RAID support, and additional information: |            |
|                     | <a href="http://www5.compaq.com/products/quickspecs/10851_na/10851_na.HTML">http://www5.compaq.com/products/quickspecs/10851_na/10851_na.HTML</a> (Smart Array 532)                                                                                                                              |            |
|                     | <a href="http://www5.compaq.com/products/quickspecs/10640_na/10640_na.HTML">http://www5.compaq.com/products/quickspecs/10640_na/10640_na.HTML</a> (Smart Array 5300 Series)                                                                                                                      |            |
|                     | <a href="http://www5.compaq.com/products/quickspecs/11328_na/11328_na.HTML">http://www5.compaq.com/products/quickspecs/11328_na/11328_na.HTML</a> (Smart Array 5312)                                                                                                                             |            |
|                     | <a href="http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML">http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML</a> (Smart Array 641)                                                                                                                              |            |
|                     | <a href="http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML">http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML</a> (Smart Array 642)                                                                                                                              |            |
|                     | <a href="http://www5.compaq.com/products/quickspecs/10429_na/10429_na.HTML">http://www5.compaq.com/products/quickspecs/10429_na/10429_na.HTML</a> (SCSI Adapter)                                                                                                                                 |            |
|                     | <a href="http://www5.compaq.com/products/quickspecs/11555_na/11555_na.HTML">http://www5.compaq.com/products/quickspecs/11555_na/11555_na.HTML</a> (U320 Adapter)                                                                                                                                 |            |
| Communications      | Compaq NC3134 Fast Ethernet NIC 64 PCI Dual Port 10/100                                                                                                                                                                                                                                          | 138603-B21 |
|                     | Compaq NC3135 Fast Ethernet Upgrade Module                                                                                                                                                                                                                                                       | 138604-B21 |
|                     | Compaq NC6132 Gigabit Module 1000 SX Upgrade Module for NC3134 and NC3131                                                                                                                                                                                                                        | 338456-B23 |
|                     | Compaq NC6136 Gigabit Server Adapter, 64-bit/66-MHz, PCI, 1000 SX                                                                                                                                                                                                                                | 203539-B21 |
|                     | HP NC6770 PCI-X Gigabit Server Adapter, 1000-SX                                                                                                                                                                                                                                                  | 244949-B21 |
|                     | Compaq NC7132 10/100/1000-T Upgrade Module for NC3134 and NC3131                                                                                                                                                                                                                                 | 153543-B21 |
|                     | Compaq NC7770 PCI-X Gigabit Server Adapter                                                                                                                                                                                                                                                       | 244948-B21 |
| Redundant Options   | 1150/500-Watt Hot Plug N 1 redundant power supply                                                                                                                                                                                                                                                | 401231-001 |
|                     | NOTE: A maximum of two power supplies are supported by the ProLiant DL760 G2 (shipped standard with each server).                                                                                                                                                                                |            |
| Management Options  | Remote Insight Lights-Out Edition II                                                                                                                                                                                                                                                             | 227251-001 |





# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|          |                                                                             |            |
|----------|-----------------------------------------------------------------------------|------------|
| Security | HP/Atalla AXL600L SSL Accelerator Card for ProLiant Servers                 | 524545-B21 |
|          | Compaq AXL300 Accelerator PCI Card (HW SSL Encryption) for ProLiant Servers | 227933-B21 |

## Monitors

### Essential Series

|                                                            |            |
|------------------------------------------------------------|------------|
| Compaq S9500 CRT Monitor (19-inch, Carbon/Silver)          | 261615-003 |
| Compaq S7500 CRT Monitor (17-inch, Carbon/Silver)          | 261606-001 |
| Compaq S5500 CRT Monitor (15-inch Carbon/Silver)           | 261602-001 |
| Compaq TFT1501 Flat Panel Monitor (15-inch, Carbon/Silver) | 301042-003 |
| Compaq TFT1701 Flat Panel Monitor (17-inch, Carbon/Silver) | 292847-003 |

### Advantage Series

|                                                                                                      |            |
|------------------------------------------------------------------------------------------------------|------------|
| Compaq V7550 CRT Color Monitor (17-inch, Carbon/Silver)                                              | 261611-003 |
| Compaq TFT1720 Flat Panel Monitor (17-inch, Carbon/Silver)                                           | 295926-003 |
| Compaq FT1720M Flat Panel Monitor<br>(17-inch, Carbon/Silver, includes speaker, USB port, headphone) | 301958-003 |
| Compaq TFT1520 Flat Panel Monitor (15-inch, Carbon/Silver)                                           | 295925-003 |
| Compaq TFT1520M Flat Panel Monitor<br>(15-inch, Carbon/Silver includes speaker, USB port, headphone) | 301957-003 |

### Performance Series

|                                                            |            |
|------------------------------------------------------------|------------|
| HP P930 CRT Monitor (19-inch, Flat-screen, Carbon/Silver)  | 302268-003 |
| HP P1130 CRT Monitor (21-inch, Flat-screen, Carbon/Silver) | 302270-003 |
| HP L1825 Flat Panel Monitor (18-inch, Carbon/Silver)       | 303486-003 |
| HP L2025 Flat Panel Monitor (20-inch, Carbon/Silver)       | 303102-003 |
| Compaq TFT1825 Flat Panel Monitor (18-inch, Carbon/Silver) | 296751-003 |
| Compaq TFT2025 Flat Panel Monitor (20-inch, Carbon/Silver) | 285550-003 |

### Rackmount Flat Panel Monitors

|                                                          |            |
|----------------------------------------------------------|------------|
| TFT5110R Flat Panel Monitor (Carbon) (1U rack mountable) | 281683-B21 |
| TFT5010R Flat Panel Monitor (2U rack mountable)          | 217248-001 |

NOTE: Monitors larger than 17" may be too heavy for use in rack systems.

## Tape Drives

### Internal and External DAT Tape Drives

|                                                                  |            |
|------------------------------------------------------------------|------------|
| HP StorageWorks 20/40-GB DAT DDS-4 Tape Drive, External (Carbon) | 157770-002 |
| HP StorageWorks Internal 20/40-GB DAT, Hot Plug (Carbon)         | 215488-B21 |

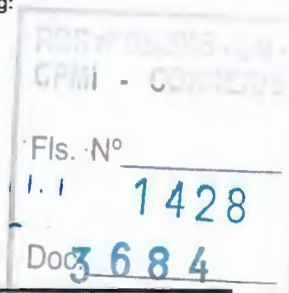
NOTE: Please see the 20/40-GB DAT Tape Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/10426\\_na/10426\\_na.html](http://h18006.www1.hp.com/products/quickspecs/10426_na/10426_na.html)

|                                                                   |        |
|-------------------------------------------------------------------|--------|
| HP StorageWorks DAT 72 tape drive for ProLiant, Internal (Carbon) | Q1525A |
| HP StorageWorks DAT 72 tape drive for ProLiant, External (Carbon) | Q1527A |

NOTE: Please see the hp StorageWorks DAT 72 Tape Drive QuickSpecs for additional options such as cassettes and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11597\\_na/11597\\_na.HTML](http://www5.compaq.com/products/quickspecs/11597_na/11597_na.HTML)



### Options

#### Internal and External AIT Tape Drives

|                                                             |            |
|-------------------------------------------------------------|------------|
| HP StorageWorks External AIT 35-GB, LVD Tape Drive (Carbon) | 216885-001 |
| HP StorageWorks Internal AIT 35-GB, LVD Hot Plug (Carbon)   | 216886-B21 |

NOTE: Please see the AIT 35 GB, LVD Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/10712\\_na/10712\\_na.html](http://h18006.www1.hp.com/products/quickspecs/10712_na/10712_na.html)

|                                                         |            |
|---------------------------------------------------------|------------|
| HP StorageWorks AIT 50-GB Tape Drive, External (Carbon) | 157767-002 |
| HP StorageWorks Internal AIT 50-GB, Hot Plug (Carbon)   | 215487-B21 |
| HP StorageWorks AIT 50GB Tape Drive, 3U Rackmount       | 274333-B21 |

NOTE: Please see the AIT 50-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/10425\\_na/10425\\_na.html](http://h18006.www1.hp.com/products/quickspecs/10425_na/10425_na.html)

|                                                         |            |
|---------------------------------------------------------|------------|
| HP StorageWorks External AIT 100-GB Tape Drive (Carbon) | 249160-001 |
| HP StorageWorks Internal AIT 100-GB, Hot Plug (Carbon)  | 249161-B21 |

NOTE: Please see the AIT 100-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/11062\\_na/11062\\_na.html](http://h18006.www1.hp.com/products/quickspecs/11062_na/11062_na.html)

#### External DLT/SDLT Tape Drives

|                                                                       |            |
|-----------------------------------------------------------------------|------------|
| HP StorageWorks 40/80-GB DLT Tape Drive, External (Carbon)            | 146197-B22 |
| HP StorageWorks Rackmount DLT 40/80, 3U (Single Drive)                | 274332-B21 |
| HP StorageWorks Rackmount DLT 40/80, Dual Drive 3U (Two Drives)       | 274335-B21 |
| HP StorageWorks Rackmount DLT 40/80, Tape Array III, 5U (Four Drives) | 274337-B21 |

NOTE: Please see the 40/80-GB DLT Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/10658\\_na/10658\\_na.html](http://h18006.www1.hp.com/products/quickspecs/10658_na/10658_na.html)

#### External DLT VS Tape Drives

|                                                            |            |
|------------------------------------------------------------|------------|
| HP StorageWorks DLT VS 40/80 Tape Drive, External (Carbon) | 280129-B22 |
|------------------------------------------------------------|------------|

NOTE: Please see the DLT VS 40/80 Tape Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/11403\\_na/11403\\_na.html](http://h18006.www1.hp.com/products/quickspecs/11403_na/11403_na.html)

|                                                                          |            |
|--------------------------------------------------------------------------|------------|
| HP StorageWorks SDLT 110/220, External (carbon)                          | 192103-002 |
| HP StorageWorks SDLT 110/220, External (carbon)                          | 192103-B32 |
| HP StorageWorks Rackmount SDLT 110/220, 3U (Single Drive)                | 274331-B21 |
| HP StorageWorks Rackmount SDLT 110/220, Dual-Drive, 3U (Two Drives)      | 274334-B21 |
| HP StorageWorks Rackmount SDLT 110/220, Tape Array III, 5U (Four Drives) | 274336-B21 |
| HP StorageWorks SDLT 160/320, External (carbon)                          | 257319-001 |

NOTE: Please see the SDLT 110/220-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and media, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/10772\\_na/10772\\_na.html](http://h18006.www1.hp.com/products/quickspecs/10772_na/10772_na.html)

#### External SuperLoader

|                       |            |
|-----------------------|------------|
| DLT1 1280 SuperLoader | 268664-B21 |
|-----------------------|------------|

NOTE: Please see the StorageWorks DLT1 1280 SuperLoader QuickSpecs for additional options and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/11406\\_na/11406\\_na.html](http://h18006.www1.hp.com/products/quickspecs/11406_na/11406_na.html)



### Options

#### External Ultrium Tape Drives

HP StorageWorks Ultrium 230 Tape Drive, External (Carbon)

Q1516A

NOTE: Please see the HP StorageWorks Ultrium Tape Drive QuickSpecs for additional options such as controllers, and other related items, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/11415\\_na/11415\\_na.html](http://h18006.www1.hp.com/products/quickspecs/11415_na/11415_na.html)

HP StorageWorks Ultrium 460 Tape Drive for ProLiant, External (Carbon)

Q1519A

NOTE: Please see the HP StorageWorks Ultrium 460 Tape Drives for ProLiant QuickSpecs for additional options such as data and cleaning cartridges, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/11530\\_na/11530\\_na.html](http://h18006.www1.hp.com/products/quickspecs/11530_na/11530_na.html)

#### External DAT Autoloader

20/40-GB DAT 8 Cassette Autoloader External (Opal)

166505-001

NOTE: Please see the 20/40-GB DAT DDS-4 8 Cassette Autoloader QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10518\\_na/10518\\_na.HTML](http://www5.compaq.com/products/quickspecs/10518_na/10518_na.HTML)

#### AIT Autoloader

HP StorageWorks AIT 35 GB Autoloader, Rackmount (Carbon)

280349-001

NOTE: Please see the AIT 35-GB Autoloader QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11404\\_na/11404\\_na.HTML](http://www5.compaq.com/products/quickspecs/11404_na/11404_na.HTML)

#### HP StorageWorks 1/8 Autoloader

HP StorageWorks 1/8 Autoloader, Tabletop, Ultrium 230

C9572CB

HP StorageWorks 1/8 Autoloader, Tabletop, DLT VS80

C9264CB

HP StorageWorks 1/8 Autoloader, Rackmount kit

C9266R

NOTE: Please see the HP StorageWorks 1/8 Autoloader QuickSpecs for additional accessories and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18000.www1.hp.com/products/quickspecs/North\\_America/10809.html](http://h18000.www1.hp.com/products/quickspecs/North_America/10809.html)

#### SSL1016 Tape Autoloader

SSL1016 DLT1 tape autoloader (includes two 8-cartridge magazines and a barcode reader)

330815-B21

NOTE: Please see the SSL1016 DLT1 tape autoloader Quick Specs for additional information:

[http://h18000.www1.hp.com/products/quickspecs/11626\\_na/11626\\_na.HTML](http://h18000.www1.hp.com/products/quickspecs/11626_na/11626_na.HTML)

SSL1016 SDLT160/320 tape autoloader (includes 2 8-cartridge magazines and a barcode reader)

330816-B21

NOTE: Please see the SSL1016 SDLT160/320 tape autoloader Quick Specs for additional information:

[http://h18000.www1.hp.com/products/quickspecs/11609\\_na/11609\\_na.HTML](http://h18000.www1.hp.com/products/quickspecs/11609_na/11609_na.HTML)

#### Rackmount Tape Drive Kits

3U Rackmount Kit

274338-B21

NOTE: The 3U Rackmount Kit (PN 274338-B21) can support up to (2) full-height or (4) half-height tape drives and compatible with multiple internal Single-Ended and LVD SCSI Tape Drives including the 12/24-GB DAT, 20/40-GB DAT, 20/40-GB DAT DDS-4 8 Cassette Autoloader, AIT 35-GB LVD, AIT 50 GB, AIT 100 GB, 20/40-GB DLT, 40/80-GB DLT, SDLT 110/220-GB, SDLT 160/320-GB, Ultrium 230, and Ultrium 460 Tape Drives.

5U Rackmount Kit

274339-B21

NOTE: The 5U Rackmount Kit (PN 274339-B21) can support up to (4) full-height tape drives and is compatible with all HP internal DLT/SDLT/Ultrium tape drives including the 20/40-GB DLT, 35/70-GB DLT, 40/80-GB DLT, SDLT 110/220-GB, SDLT 160/320, Ultrium 230, and Ultrium 460 tape drives.

NOTE: Please see the Rackmount Tape Drive Kits QuickSpecs for additional information regarding these kits, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/10854\\_na/10854\\_na.html](http://h18006.www1.hp.com/products/quickspecs/10854_na/10854_na.html)

## Options

### Rackmount Tape Drive Cable Kits

LVD Cable Kit, VHDCI/HD68

168048-B21

NOTE: For use with the 3U RM Storage Enclosure and DLT Tape Array III only.

LVD Cable Kit, HD68/HD68

242381-B21

NOTE: For use with the 3U RM Storage Enclosure and DLT Tape Array III only.

## Tape Automation

### Entry Level Tape Libraries

#### SSL2020 Automated AIT Library

SSL2020 AIT Mini-Library 1 drive, 20 slot Rackmount

175196-B21

SSL2020 AIT Mini-Library 2 drive, 20 slot Rackmount

175196-B22

SSL2020 AIT Library Pass Thru with Transport

175312-B21

SSL2020 AIT Library Pass Thru Extender

175312-B22

AIT 50-GB Drive Add-On LVD Drive for SSL2020 AIT Library

175197-B21

#### Required Adapters/Controllers for SSL2020 AIT Library

64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter

129803-B21

SAN Access Module for Smart Array 5302 Controller

216687-B21

SAN Access Module for Smart Array 5302 Controller (Japan)

216687-291

NOTE: Please see the SSL2020 Automated AIT Tape Library Solution QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/10580\\_na/10580\\_na.HTML](http://www5.compaq.com/products/quickspecs/10580_na/10580_na.HTML)

### MSL5000 Libraries

#### Mainstream Tape Library

#### MSL5026DLX DLT Library

MSL5026DLX, 1 40/80-GB DLT, LVD Rackmount

231891-B21

MSL5026DLX, 2 40/80-GB DLT, LVD Rackmount

231891-B22

#### MSL5026SL SDLT Library

NOTE: Please see the StorageWorks MSL5026DLX or MSL5026SL Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/10860\\_na/10860\\_na.HTML](http://www5.compaq.com/products/quickspecs/10860_na/10860_na.HTML)

MSL5026SL, Rackmount, 1 SDLT Drive (Graphite)

302512-B21

MSL5026SL, Rackmount, 2 SDLT Drive (Graphite)

302512-B22

NOTE: Please see the StorageWorks MSL5026SL Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11440\\_na/11440\\_na.HTML](http://www5.compaq.com/products/quickspecs/11440_na/11440_na.HTML)

### MSL5026S2 SDLT Library

MSL5026S2, Rackmount, 0 Drive Library

293472-B21

MSL5026S2, Rackmount, 1 Drive, SDLT2 Library

293472-B22

MSL5026S2, Rackmount, 2 Drives, SDLT2 Library

293472-B23

MSL5026S2FC, Rackmount, 1 Drive, SDLT2 Library

293472-B24

MSL5026S2FC, Rackmount, 2 Drives, SDLT2 Library

293472-B25

NOTE: Please see the StorageWorks MSL5026S2 Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11453\\_na/11453\\_na.HTML](http://www5.compaq.com/products/quickspecs/11453_na/11453_na.HTML)



# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

### *Departmental Tape Library*

#### *MSL5052SL SDLT Library*

MSL5052, Rackmount, 0 Drive, SDLT ALL

255102-B21

MSL50502SL, SDLT, 110/220, 2 Drives, LVD, Rackmount

249491-B21

NOTE: Please see the StorageWorks MSL5052SL Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11061\\_na/11061\\_na.HTML](http://www5.compaq.com/products/quickspecs/11061_na/11061_na.HTML)

#### *MSL5052S2 SDLT Library*

MSL5052S2, Tabletop, 2 Drives, SDLT2 Library

293476-B21

MSL5052S2, Rackmount, 2 Drives, SDLT2 Library

293474-B21

MSL5052S2FC, Rackmount, 2 Drives, SDLT2 Library

293474-B24

NOTE: Please see the StorageWorks MSL5052S2 Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11442\\_na/11442\\_na.HTML](http://www5.compaq.com/products/quickspecs/11442_na/11442_na.HTML)

#### *MSL5030 LTO Library*

MSL5030L1, Rackmount, 0 Drive Library

301897-B21

MSL5030L1, Rackmount, 1 Drive, LTO1 Library

301897-B22

MSL5030L1, Rackmount, 2 Drives, LTO1 Library

301897-B23

MSL5030L1FC, Rackmount, 1 Drive, LTO1 Library

301897-B24

MSL5030L1FC, Rackmount, 2 Drives, LTO1 Library

301897-B25

MSL5030L1, Tabletop, 1 Drive, LTO1 Library

301898-B21

MSL5030L1, Tabletop, 2 Drives, LTO1 Library

301898-B22

NOTE: Please see the StorageWorks MSL5030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11439\\_na/11439\\_na.HTML](http://www5.compaq.com/products/quickspecs/11439_na/11439_na.HTML)

#### *MSL5060 LTO Library*

MSL5060L1, Rackmount, 0 Drive Library

301899-B21

MSL5060L1, Rackmount, 2 Drives, LTO1 Library

301899-B22

MSL5060L1FC, Rackmount, 2 Drives, LTO1 Library

301899-B23

MSL5060L1, Tabletop, 2 Drives, LTO1 Library

301900-B21

NOTE: Please see the StorageWorks MSL5060 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11438\\_na/11438\\_na.HTML](http://www5.compaq.com/products/quickspecs/11438_na/11438_na.HTML)

#### *MSL5000 series Libraries Options*

MSL5K Field Upgrade SDLT 110/220 Drive, LVD

231823-B22

MSL5000 SDLT2 Upgrade Drive

293475-B21

MSL5000 LTO1 Upgrade Drive

301901-B21

MSL5000 Dual Magazine LTO

301902-B21

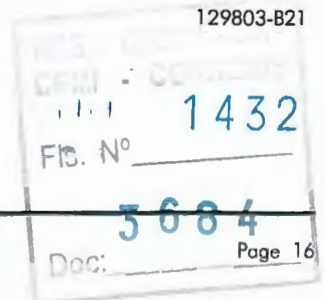
MSL5000 Dual Magazine DLT

232136-B21

#### *Required Adapters for MSL5000 series Libraries*

64-Bit/66MHz Dual Channel Wide Ultra3 SCSI Adapter

129803-B21



# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

### MSL6000 Libraries

#### MSL6030 LTO Library

|                                                           |            |
|-----------------------------------------------------------|------------|
| MSL6030, Rackmount, 0 Drive Library                       | 330731-B21 |
| MSL6030, Rackmount, 1 Drive, LTO2 Library                 | 330731-B22 |
| MSL6030, Rackmount, 2 Drive, LTO2 Library                 | 330731-B23 |
| MSL6030, Rackmount, embedded Fibre, 1 Drive, LTO2 Library | 330731-B24 |
| MSL6030, Rackmount, embedded Fibre, 2 Drive, LTO2 Library | 330731-B25 |
| MSL6030, Tabletop, 1 Drive, LTO2 Library                  | 330788-B21 |
| MSL6030, Tabletop, 2 Drive, LTO2 Library                  | 330788-B22 |

NOTE: Please see the StorageWorks MSL6030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://h18000.www1.hp.com/products/quickspecs/11625\\_na/11625\\_na.HTML](http://h18000.www1.hp.com/products/quickspecs/11625_na/11625_na.HTML)

#### MSL6060 LTO Library

|                                                           |            |
|-----------------------------------------------------------|------------|
| MSL6060, Rackmount, 0 Drive Library                       | 331196-B23 |
| MSL6060, Rackmount, 2 Drive, LTO2 Library                 | 331196-B21 |
| MSL6060, Rackmount, embedded Fibre, 2 Drive, LTO2 Library | 331196-B22 |
| MSL6060, Tabletop, 2 Drive, LTO2 Library                  | 331195-B21 |

NOTE: Please see the StorageWorks MSL6030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://h18000.www1.hp.com/products/quickspecs/11608\\_na/11608\\_na.HTML](http://h18000.www1.hp.com/products/quickspecs/11608_na/11608_na.HTML)

### MSL6000 series Libraries Options

|                                                    |            |
|----------------------------------------------------|------------|
| MSL Ultrium 460 upgrade drive in hot plug canister | 330729-B21 |
| MSL Universal passthrough mechanism                | 304825-B21 |
| MSL 10U passthrough extender                       | 231824-B23 |

### Enterprise 9000 System Library

#### ESL9322 Library

|                                    |            |
|------------------------------------|------------|
| ESL9322, 222 slot, 0 Drives, LTO2  | 330832-B21 |
| ESL9322, 222 slot, 2 Drives, SDLT2 | 293409-B22 |
| ESL9322, 222 slot, 8 Drives, SDLT2 | 293409-B28 |
| ESL9322, 322 slot, 2 Drives, SDLT2 | 293410-B22 |
| ESL9322, 322 slot, 8 Drives, SDLT2 | 293410-B28 |

NOTE: Please see the StorageWorks ESL9322 Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

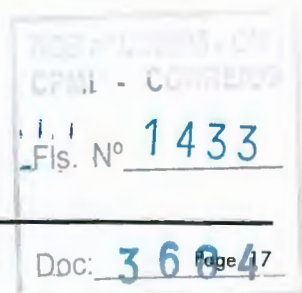
[http://www5.compaq.com/products/quickspecs/11628\\_na/11628\\_na.HTML](http://www5.compaq.com/products/quickspecs/11628_na/11628_na.HTML)

#### ESL9322L1 LTO Library

|                                     |            |
|-------------------------------------|------------|
| ESL9322L1, 222 slot, 2 Drives, LTO1 | 301927-B22 |
| ESL9322L1, 222 slot, 8 Drives, LTO1 | 301927-B28 |
| ESL9322L1, 322 slot, 2 Drives, LTO1 | 301928-B22 |
| ESL9322L1, 322 slot, 8 Drives, LTO1 | 301928-B28 |

NOTE: Please see the StorageWorks ESL9322L1 Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11445\\_na/11445\\_na.HTML](http://www5.compaq.com/products/quickspecs/11445_na/11445_na.HTML)





# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

### ESL9595SL SDLT Library

ESL9595SL Enterprise Library, 400 slot, 16 Drive

274672-B22

ESL9595SL Enterprise Library, 500 slot, 2 Drive

281627-B22

NOTE: Please see the StorageWorks ESL9595SL Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11332\\_na/11332\\_na.HTML](http://www5.compaq.com/products/quickspecs/11332_na/11332_na.HTML)

### ESL9595 Library

ESL9595, 400 slot, 0 Drive, LTO2

330833-B21

ESL9595, 400 slot, 2 Drives, SDLT2

293411-B22

ESL9595, 400 slot, 16 Drives, SDLT2

293411-B28

ESL9595, 500 slot, 2 Drives, SDLT2

293412-B22

ESL9595, 500 slot, 16 Drives, SDLT2

293412-B28

ESL9595, 595 slot, 2 Drives, SDLT2

293413-B22

ESL9595, 595 slot, 16 Drives, SDLT2

293413-B28

NOTE: Please see the StorageWorks ESL9595SL Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11629\\_na/11629\\_na.HTML](http://www5.compaq.com/products/quickspecs/11629_na/11629_na.HTML)

### ESL9595L1 LTO Library

ESL9595L1, 400 slot, 2 Drives, LTO1

301929-B22

ESL9595L1, 400 slot, 16 Drives, LTO1

301929-B28

ESL9595L1, 500 slot, 2 Drives, LTO1

301931-B22

ESL9595L1, 500 slot, 16 Drives, LTO1

301931-B28

ESL9595L1, 595 slot, 2 Drives, LTO1

301932-B22

ESL9595L1, 595 slot, 16 Drives, LTO1

301932-B28

NOTE: Please see the StorageWorks ESL9595L1 Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11435\\_na/11435\\_na.HTML](http://www5.compaq.com/products/quickspecs/11435_na/11435_na.HTML)

### ESL9000 series Libraries Options

ESL9000 Field Upgrade SDLT 110/220, LVD Drive (ESL9198SL, ESL9326SL, ESL9595SL)

234617-B21

ESL9595 500 Slot Upgrade

274674-B21

ESL9595 595 Slot Upgrade

274674-B22

ESL9000 LTO1 Upgrade Drive

301930-B21

ESL9000 LVD SDLT-160 Drive Upgrade

293414-B21

ESL9000 HVD SDLT-160 Drive Upgrade

293415-B21

ESL9000 Universal Load Port

302254-B21

ESL9322 222 Slot to ESL9322 322 Slot Upgrade

293588-B21

ESL9000 6 Slot DLT Magazine

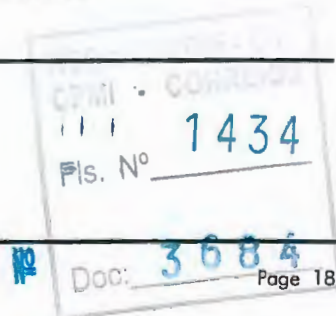
229909-B21

### Required Adapters for ESL9000 Libraries

64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter

129803-B21

NOTE: 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter is required to support the LVD based libraries (ESL9595SL).



# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                                                                                                                                                                                                                                                                                                                                            |                                                                                                  |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------|
| Smart Array Cluster Storage                                                                                                                                                                                                                                                                                                                | Smart Array Cluster Storage                                                                      | 201724-B21 |
|                                                                                                                                                                                                                                                                                                                                            | Smart Array Cluster Storage Redundant Controller Option Kit                                      | 218252-B21 |
|                                                                                                                                                                                                                                                                                                                                            | 128-MB Cache Module for Smart Array 5302 Controller                                              | 153506-B21 |
|                                                                                                                                                                                                                                                                                                                                            | 256-MB Battery-Backed Cache Module                                                               | 254786-B21 |
|                                                                                                                                                                                                                                                                                                                                            | 4-Port Shared Storage Module with Smart Array Multipath Software for Smart Array Cluster Storage | 292944-B21 |
| NOTE: Please see the Compaq Smart Array Cluster Storage QuickSpecs for additional information including configuration steps and additional options needed for a complete solution at:<br><a href="http://www5.compaq.com/products/quickspecs/11050_na/11050_na.html">http://www5.compaq.com/products/quickspecs/11050_na/11050_na.html</a> |                                                                                                  |            |

|                 |                                                                                                                                                                                                                                                                                                          |            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Cluster Options | Compaq ProLiant Cluster HA/F100 for MSA1000                                                                                                                                                                                                                                                              | 252408-B22 |
|                 | Compaq ProLiant Cluster HA/F200 for MSA1000                                                                                                                                                                                                                                                              | 252409-B22 |
|                 | NOTE: For additional information regarding the Compaq ProLiant Cluster for HA/F100, HA/F200 for MSA1000 please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11035_na/11035_na.html">http://www5.compaq.com/products/quickspecs/11035_na/11035_na.html</a>     |            |
|                 | ProLiant Cluster HA/F500 Basic Kit for MA8000/EMA 16000                                                                                                                                                                                                                                                  | 103250-B25 |
|                 | ProLiant Cluster HA/F500 Enhanced Kit for MA8000/EMA 16000                                                                                                                                                                                                                                               | 379937-B25 |
|                 | ProLiant Cluster HA/F500 Enhanced DT Kit for MA8000/EMA 16000                                                                                                                                                                                                                                            | 164227-B23 |
|                 | NOTE: For additional information regarding the Compaq ProLiant Cluster for HA/F500 please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/10232_na/10232_na.html">http://www5.compaq.com/products/quickspecs/10232_na/10232_na.html</a>                          |            |
|                 | ProLiant Cluster HA/F500 Basic Kit for Enterprise Virtual Array (v.2)                                                                                                                                                                                                                                    | 313047-B21 |
|                 | ProLiant Cluster HA/F500 Basic Kit for Enterprise Virtual Array (v.2)                                                                                                                                                                                                                                    | 313047-B22 |
|                 | NOTE: For additional information regarding the Compaq ProLiant Cluster HA/F500 for Enterprise Virtual Array please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11055_na/11055_na.html">http://www5.compaq.com/products/quickspecs/11055_na/11055_na.html</a> |            |

|         |                                                                                                                                                                                                                                                                                             |            |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| MSA1000 | MSA1000                                                                                                                                                                                                                                                                                     | 201723-B22 |
|         | MSA1000 Controller                                                                                                                                                                                                                                                                          | 218231-B22 |
|         | MSA Fibre Channel I/O Module                                                                                                                                                                                                                                                                | 218960-B21 |
|         | MSA1000 Fabric Switch                                                                                                                                                                                                                                                                       | 218232-B21 |
|         | MSA1000 Fibre Channel Adapter (FCA) 2101                                                                                                                                                                                                                                                    | 245299-B21 |
|         | HP StorageWorks msa hub 2/3                                                                                                                                                                                                                                                                 | 286763-B21 |
|         | NOTE: Please see the StorageWorks by Compaq Modular SAN Array 1000 QuickSpecs for additional options and configuration information at:<br><a href="http://www5.compaq.com/products/quickspecs/11033_na/11033_na.HTML">http://www5.compaq.com/products/quickspecs/11033_na/11033_na.HTML</a> |            |

|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| StorageWorks Modular Array 8000/Enterprise Modular Array 12000 | EMA12000 D14 60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 175990-B21 |
|                                                                | EMA12000 S14 60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 175991-B21 |
|                                                                | MA8000 60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 175992-B21 |
|                                                                | EMA12000 Blue 60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 175993-B21 |
|                                                                | NOTE: Options include controller, solution kits, ACS. MA8000/EMA12000 includes controller shelf, drive shelves and cabinet. Packaging upgrade to RA8000/ESA12000.<br>NOTE: Please see the StorageWorks MA8000/EMA12000 QuickSpecs for FC Hubs, FC switches, platform software, host adapters, disks and options for complete solutions at:<br><a href="http://www5.compaq.com/products/quickspecs/10545_na/10545_na.HTML">http://www5.compaq.com/products/quickspecs/10545_na/10545_na.HTML</a> |            |





# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                    |                          |            |
|--------------------|--------------------------|------------|
| StorageWorks       | EMA16000 D14 60Hz (opal) | 238792-B21 |
| Enterprise Modular | EMA16000 S14 60Hz (opal) | 238791-B21 |
| Array 16000 FC     |                          |            |

NOTE: Models include: Dual HSG80 controllers in each Model 2200 enclosure (2 pairs per single bus configuration, 4 pairs per dual bus configuration) with 1GB cache per controller pair, and 12 14-bay drive enclosures with redundant power supplies. Configure-to-Order (CTO) builds are available. Options include ACS, platform kits and software by HP.

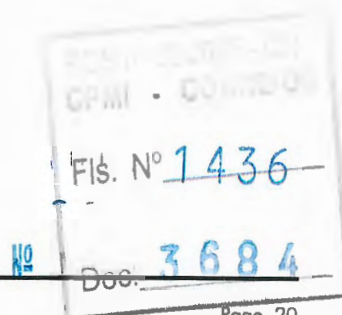
NOTE: Please see the StorageWorks EMA16000 QuickSpecs for FC switches, platform software, host adapters, disks and options for complete solutions at:

[http://www5.compaq.com/products/quickspecs/10812\\_na/10812\\_na.HTML](http://www5.compaq.com/products/quickspecs/10812_na/10812_na.HTML)

|                      |                                         |            |
|----------------------|-----------------------------------------|------------|
| StorageWorks Options | StorageWorks SAN Switch 2/8-EL          | 322120-B21 |
|                      | StorageWorks SAN Switch 2/8-EL Upgrade  | 325888-B21 |
|                      | StorageWorks SAN Switch 2/16            | 322118-B21 |
|                      | StorageWorks SAN Switch 2/16-EL Upgrade | 288250-B21 |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| UPS and PDU Power<br>Cord Matrix | <i>Please see the UPS and PDU cable matrix that lists cable descriptions, requirements, and specifications for UPS and PDU units.that lists cable descriptions, requirements, and specifications for UPS units.</i><br><a href="ftp://ftp.compaq.com/pub/products/servers/ProLiantstorage/power-protection/powercordmatrix.pdf">ftp://ftp.compaq.com/pub/products/servers/ProLiantstorage/power-protection/powercordmatrix.pdf</a> |  |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|                                                   |                                                                                    |            |
|---------------------------------------------------|------------------------------------------------------------------------------------|------------|
| Uninterruptible Power<br>Systems – Rack Mountable | Compaq UPS R1500 XR (1440VA, 1340 Watt), Low Voltage                               | 204404-001 |
|                                                   | Compaq UPS R3000 XR (2880VA, 2700 Watt), Low Voltage                               | 192186-001 |
|                                                   | Compaq UPS R3000 XR (3000VA, 2700 Watt), High Voltage                              | 192186-002 |
|                                                   | Rack-Mountable UPS R6000 (6000VA, 6000 Watt) High Voltage                          | 347207-001 |
|                                                   | NOTE: The UPS R6000 has a hardwired input.                                         |            |
|                                                   | UPS R12000 XR N+x (200-240V) (hardwired)                                           | 207552-B22 |
|                                                   | NOTE: The UPS R12000 XR has a hardwired input and output; requires a 100A circuit. |            |



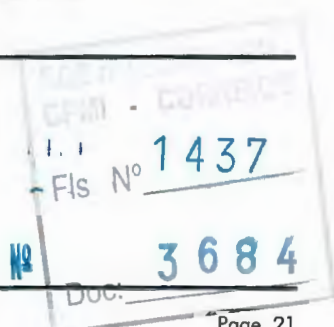
# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|             |                                                                                             |            |
|-------------|---------------------------------------------------------------------------------------------|------------|
| UPS Options | SNMP Serial Port Card                                                                       | 192189-B21 |
|             | NOTE: Supports tower and rack UPS XR models ranging from 1000 – 3000VA.                     |            |
|             | Six Port Card                                                                               | 192185-B21 |
|             | NOTE: Supports tower and rack UPS XR models ranging from 1000 – 3000VA.                     |            |
|             | High to Low Voltage Transformer (250VA)                                                     | 388643-B21 |
|             | NOTE: Supports R6000 UPS series only. 2.5 amps @ 125 Volts max output across two NEMA 5-15. |            |
|             | Extended Runtime Module, T1000 XR                                                           | 218967-B21 |
|             | NOTE: 2U each, two ERM maximum.                                                             |            |
|             | Extended Runtime Module, T1500 XR/T2200 XR                                                  | 218969-B21 |
|             | NOTE: 3U each, one ERM maximum.                                                             |            |
|             | Extended Runtime Module, R1500 XR                                                           | 218971-B21 |
|             | NOTE: 2U each, two ERM maximum.                                                             |            |
|             | Extended Runtime Module, R3000 XR                                                           | 192188-B21 |
|             | NOTE: 3U each, one ERM maximum.                                                             |            |
|             | Extended Runtime Module, R6000                                                              | 347224-B21 |
|             | NOTE: 3U each, two ERM maximum.                                                             |            |
|             | Extended Runtime Module, R12000 XR, 4U                                                      | 217800-B21 |
|             | R1200 XR Backplate Receptacle Kit, (2) L6-30R                                               | 325361-001 |
|             | NOTE: The R12000 XR Backplate Kit has a hardwired input.                                    |            |
|             | R1200 XR Backplate Receptacle Kit, (2) IEC-309R                                             | 325361-B21 |
|             | NOTE: The R12000 XR Backplate Kit has a hardwired input.                                    |            |
|             | SNMP-EN Adapter                                                                             | 347225-B21 |
|             | NOTE: 4U each, two ERM maximum.                                                             |            |
|             | SNMP-EN Adapter                                                                             | 347225-B21 |
|             | NOTE: Supports R6000 UPS series only.                                                       |            |
|             | Multi-Server UPS Card                                                                       | 123508-B21 |
|             | NOTE: Supports R6000 UPS series only.                                                       |            |
|             | Scalable UPS Card                                                                           | 123509-B21 |
|             | NOTE: Supports R6000 UPS series only.                                                       |            |

|                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                  |            |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Modular PDUs 1U/0U<br>(Up to 32 outlets)<br>NOTE: 1U/0U mounting brackets shipped with the unit (optimized for 10000 and 9000 series racks). | HP Modular Power Distribution Units (mPDU), Low Volt Model, 24A (100-127 VAC)                                                                                                                                                                                                                                                                    | 252663-D71 |
|                                                                                                                                              | NOTE: This mPDU (252663-D71) may also be used to connect the low volt model of the UPS R3000 XR.                                                                                                                                                                                                                                                 |            |
|                                                                                                                                              | HP Modular Power Distribution Units (mPDU), High Volt Model, 24A (200-240 VAC)                                                                                                                                                                                                                                                                   | 252663-D72 |
|                                                                                                                                              | HP Modular Power Distribution Units (mPDU), High Volt Model, 40A (200-240 VAC)                                                                                                                                                                                                                                                                   | 252663-B21 |
|                                                                                                                                              | NOTE: This mPDU (252663-B21), 40A model has a hardwired input.                                                                                                                                                                                                                                                                                   |            |
|                                                                                                                                              | HP Modular Power Distribution Units (mPDU), High Volt Model, 16A (200-240 VAC)                                                                                                                                                                                                                                                                   | 252663-B24 |
|                                                                                                                                              | NOTE: This PDU has a detachable input power cord and allows for adaptability to country specific power requirements. This model may also be used with the high volt UPSs R3000 XR and R6000 For North America, need to order cable PN 340653-001.                                                                                                |            |
|                                                                                                                                              | NOTE: Please see the following Modular Power Distribution Unit (Zero-U/1U Modular PDUs) QuickSpecs for additional options including shorter jumper cables and country specific power cords:<br><a href="http://www5.compaq.com/products/quickspecs/11041_na/11041_na.HTML">http://www5.compaq.com/products/quickspecs/11041_na/11041_na.HTML</a> |            |





# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|             |                                                                                                                                                                                                        |            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| PDU Options | 1U PDU Mounting Brackets Kit                                                                                                                                                                           | 217202-B21 |
|             | NOTE: The 1U PDU Mounting Brackets are required when mounting PDU's PN 207590-xxx series in 1U configurations.                                                                                         |            |
|             | Third Party Modular PDU Mounting Kit                                                                                                                                                                   | 310777-B21 |
|             | NOTE: This kit allows you to mount the Modular PDUs in racks other than the 9000/10000 Series racks (any racks using the standard 19" rail). For more details please refer the Modular PDU QuickSpecs. |            |

|              |                                                                                                                                                 |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Rack Builder | Please see the Rack Builder for configuration assistance at <a href="http://www.compaq.com/rackbuilder/">http://www.compaq.com/rackbuilder/</a> |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                                                                                                                                                                                                             |            |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Third Party Rack Kit | Third Party Rack Kit                                                                                                                                                                                                                                                                                        | 274739-B21 |
|                      | NOTE: The Third party rack kit supports the ML530 G2, ML570 G2, DL740, and DL760 G2. Provides support for any rack, square hole or round hole (including HP Rack System /E and HP Systems) with an adjustment range from 23 1/2" – 34" deep.                                                                |            |
|                      | NOTE: The Third Party Rack Kit is required for round hole racks or for square hole racks that do not conform to the adjustment range of the standard rail that ships with the server.                                                                                                                       |            |
|                      | Telco Rack Support NOTE: Support for all 2-post Telco racks requires the Third Party Rack Kit (PN 274739-B21) kit plus an additional option kit from Rack Solutions. The Rack Solutions brackets can be purchased at: <a href="http://www.racksolutions.com/compaq">http://www.racksolutions.com/compaq</a> |            |

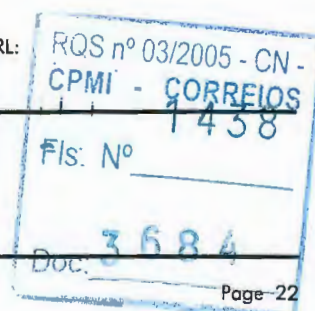
|                                             |                                                                                                        |            |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------|------------|
| HP Rack 10000 Series<br>(Graphite Metallic) | HP Rack S10614 (14U) Rack Cabinet - Shock Pallet                                                       | 292302-B22 |
|                                             | HP Rack 10842 (42U, 800mm wide) – Pallet                                                               | 257415-B21 |
|                                             | HP Rack 10842 (42U, 800mm wide) – Shock Pallet                                                         | 257415-B22 |
|                                             | HP Rack 10647 (47U) – Pallet                                                                           | 245160-B21 |
|                                             | HP Rack 10647 (47U) – Crated                                                                           | 245160-B23 |
|                                             | HP Rack 10642 (42U) – Pallet                                                                           | 245161-B21 |
|                                             | HP Rack 10642 (42U) – Shock Pallet                                                                     | 245161-B22 |
|                                             | HP Rack 10642 (42U) – Crated                                                                           | 245161-B23 |
|                                             | HP Rack 10636 (36U) – Pallet                                                                           | 245162-B21 |
|                                             | HP Rack 10636 (36U) – Shock Pallet                                                                     | 245162-B22 |
|                                             | HP Rack 10636 (36U) – Crated                                                                           | 245162-B23 |
|                                             | HP Rack 10622 (22U) – Pallet                                                                           | 245163-B21 |
|                                             | HP Rack 10622 (22U) – Shock Pallet                                                                     | 245163-B22 |
|                                             | HP Rack 10622 (22U) – Crated                                                                           | 245163-B23 |
|                                             | HP Rack 10614 (14U) – Shock Pallet                                                                     | 292303-B22 |
|                                             | NOTE: -B21 (pallet) used to ship empty racks shipped on a truck                                        |            |
|                                             | -B22 (shock pallet) used to ship racks with equipment installed (by custom systems, VARs and Channels) |            |
|                                             | -B23 (crated) used for air shipments of empty racks                                                    |            |

NOTE: It is mandatory to use a shock pallet in order to ship racks with equipment installed. Not all Compaq equipment is qualified to be shipped in the Rack 10000 series

NOTE: Please see the Rack 10000 QuickSpecs for Technical Specifications such as height, width, depth, weight, and color:

[http://www5.compaq.com/products/quickspecs/10995\\_na/10995\\_na.HTML](http://www5.compaq.com/products/quickspecs/10995_na/10995_na.HTML)

NOTE: For additional information regarding Rack Cabinets, please see the following URL:  
<http://www.compaq.com/racks>





# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                                |                                       |            |
|--------------------------------|---------------------------------------|------------|
| Compaq Rack 9000 Series (opal) | Compaq Rack 9142 (42U) – Pallet       | 120663-B21 |
|                                | Compaq Rack 9142 (42U) – Shock Pallet | 120663-B22 |
|                                | Compaq Rack 9142 (42U) – Crated       | 120663-B23 |
|                                | Compaq Rack 9122 (22U) – Pallet       | 120665-B21 |
|                                | Compaq Rack 9122 (22U) – Shock Pallet | 120665-B22 |
|                                | Compaq Rack 9122 (22U) – Crated       | 120665-B23 |

NOTE: –B21 (pallet) used to ship empty racks shipped on a truck

–B22 (shock pallet) used to ship racks with equipment installed (by custom systems, VARs and Channels)

–B23 (crated) used for air shipments of empty racks

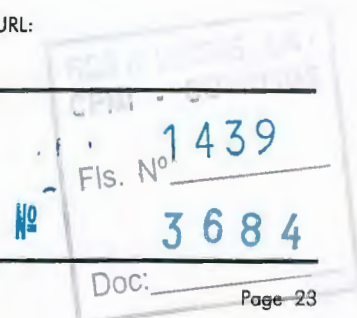
NOTE: Please see the Rack 9000 QuickSpecs for Technical Specifications such as height, width, depth, weight, and color:

[http://www5.compaq.com/products/quickspecs/10366\\_na/10366\\_na.HTML](http://www5.compaq.com/products/quickspecs/10366_na/10366_na.HTML)

NOTE: For additional information regarding Rack Cabinets, please see the following URL:

<http://www.compaq.com/racks>

|                                       |                                                                                                                                                                                                                      |            |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Options for HP Rack 10000 Series | Rack Blanking Panels – Graphite (Multi)                                                                                                                                                                              | 253214-B26 |
|                                       | NOTE: Contains one each of 1U, 2U, 4U and 8U.                                                                                                                                                                        |            |
|                                       | Rack Blanking Panels – Graphite (1U)                                                                                                                                                                                 | 253214-B21 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B21) contains 10 each of (1U).                                                                                                                                             |            |
|                                       | Rack Blanking Panels – Graphite (2U)                                                                                                                                                                                 | 253214-B22 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B22) contains 10 each of (2U).                                                                                                                                             |            |
|                                       | Rack Blanking Panels – Graphite (3U)                                                                                                                                                                                 | 253214-B23 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B23) contains 10 each of (3U).                                                                                                                                             |            |
|                                       | Rack Blanking Panels – Graphite (4U)                                                                                                                                                                                 | 253214-B24 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B24) contains 10 each of (4U).                                                                                                                                             |            |
|                                       | Rack Blanking Panels – Graphite (5U)                                                                                                                                                                                 | 253214-B25 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B25) contains 10 each of (5U).                                                                                                                                             |            |
|                                       | 800mm Wide Stabilizer Kit (Graphite)                                                                                                                                                                                 | 255488-B21 |
|                                       | NOTE: Supported by the Rack 10842 cabinet only.                                                                                                                                                                      |            |
|                                       | 600mm Stabilizer Kit – Graphite                                                                                                                                                                                      | 246107-B21 |
|                                       | Baying Kit for Rack 10000 series (Carbon)                                                                                                                                                                            | 248929-B21 |
|                                       | 42U Side Panel – Graphite Metallic                                                                                                                                                                                   | 246099-B21 |
|                                       | 110V Fan Kit (Graphite)                                                                                                                                                                                              | 257413-B21 |
|                                       | NOTE: Roof Mount Includes power cord with IEC320-C13 to Nemo 5-15P.                                                                                                                                                  |            |
|                                       | 220V Fan Kit (Graphite)                                                                                                                                                                                              | 257414-B21 |
|                                       | NOTE: Roof Mount Includes power cord with IEC320-C13 to Nema 6-15P.                                                                                                                                                  |            |
|                                       | 36U Side Panel – Graphite Metallic                                                                                                                                                                                   | 246102-B21 |
|                                       | 47U Side Panel – Graphite Metallic                                                                                                                                                                                   | 255486-B21 |
|                                       | 9000/10000 Series Offset Baying Kit (42U)                                                                                                                                                                            | 248931-B21 |
|                                       | NOTE: This kit can be used to connect 9000 and 10000 series racks of the same U height together. Kit contents include hardware for connecting racks and a panel to cover the 100mm gap at the rear of the two racks. |            |
|                                       | NOTE: For additional information regarding Rack Options, please see the following URL:                                                                                                                               |            |
|                                       | <a href="http://www.compaq.com/rackoptions">http://www.compaq.com/rackoptions</a>                                                                                                                                    |            |





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Rack

# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                         |                                                                                                                                                                                                                      |            |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Options for        | Baying/Coupling Kit                                                                                                                                                                                                  | 120669-B21 |
| Compaq Rack 9000 Series | 42U Side Panel                                                                                                                                                                                                       | 120670-B21 |
|                         | NOTE: The 42U Side Panel (PN 120670-B21) supports the Compaq Rack 9142 and Compaq Rack 9842.                                                                                                                         |            |
|                         | 36U Side Panel                                                                                                                                                                                                       | 120671-B21 |
|                         | NOTE: The 36U Side Panel (PN 120671-B21) supports the Compaq Rack 9136.                                                                                                                                              |            |
|                         | 110V Fan Kit (Graphite)                                                                                                                                                                                              | 257413-B21 |
|                         | NOTE: Roof Mount Includes power cord with IEC320-C13 to Nema 5-15P.                                                                                                                                                  |            |
|                         | 220V Fan Kit (Graphite)                                                                                                                                                                                              | 257414-B21 |
|                         | NOTE: Roof Mount Includes power cord with IEC320-C13 to Nema 6-15P.                                                                                                                                                  |            |
|                         | 600mm Stabilizer Option Kit                                                                                                                                                                                          | 120673-B21 |
|                         | 800mm Stabilizer Option Kit (Opal)                                                                                                                                                                                   | 234493-B21 |
|                         | NOTE: The 800mm Stabilizer Kit (PN 234493-B21) supports the Rack 9842 only.                                                                                                                                          |            |
|                         | 9142 Extension Kit                                                                                                                                                                                                   | 120679-B21 |
|                         | NOTE: The 9142 Extension Kit (PN 120679-B21) supports the Compaq Rack 9142 only.                                                                                                                                     |            |
|                         | 9142Split Rear Door (Opal)                                                                                                                                                                                           | 254045-B21 |
|                         | NOTE: The 9142 Split Rear Door (PN 254045-B21) supports the 600 mm wide, 42U 9000 series rack.                                                                                                                       |            |
|                         | 9136 Extension Kit                                                                                                                                                                                                   | 218216-B21 |
|                         | 9142 Short Rear Door                                                                                                                                                                                                 | 218217-B21 |
|                         | NOTE: The 9142 Short Rear Door (PN 218217-B21) supports the Compaq Rack 9142 only.                                                                                                                                   |            |
|                         | 9136 Short Rear Door                                                                                                                                                                                                 | 218218-B21 |
|                         | Rack Blanking Panel (Multi)                                                                                                                                                                                          | 169940-B21 |
|                         | NOTE: Kit includes four panels in 1U, 2U, 4U, and 8U.                                                                                                                                                                |            |
|                         | Rack Blanking Panels (1U)                                                                                                                                                                                            | 189453-B21 |
|                         | NOTE: The Rack Blanking Panels (PN 189453-B21) contains 10 each of (1U).                                                                                                                                             |            |
|                         | Rack Blanking Panels (2U)                                                                                                                                                                                            | 189453-B22 |
|                         | NOTE: The Rack Blanking Panels (PN 189453-B21) contains 10 each of (2U).                                                                                                                                             |            |
|                         | Rack Blanking Panels (3U)                                                                                                                                                                                            | 189453-B23 |
|                         | NOTE: The Rack Blanking Panels (PN 189453-B21) contains 10 each of (3U).                                                                                                                                             |            |
|                         | Rack Blanking Panels (4U)                                                                                                                                                                                            | 189453-B24 |
|                         | NOTE: The Rack Blanking Panels (PN 189453-B21) contains 10 each of (4U).                                                                                                                                             |            |
|                         | Rack Blanking Panels (5U)                                                                                                                                                                                            | 189453-B25 |
|                         | NOTE: The Rack Blanking Panels (PN 189453-B21) contains 10 each of (5U).                                                                                                                                             |            |
|                         | 9000/10000 Series Offset Baying Kit (42U)                                                                                                                                                                            | 248931-B21 |
|                         | NOTE: This kit can be used to connect 9000 and 10000 series racks of the same U height together. Kit contents include hardware for connecting racks and a panel to cover the 100mm gap at the rear of the two racks. |            |

NOTE: For additional information regarding Rack Options, please see the following URL:  
<http://www.compaq.com/rackoptions>



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# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                         |                                                           |            |
|-------------------------|-----------------------------------------------------------|------------|
| Rack Options for        | High Air Flow Rack Door Insert for the 7122 Rack          | 157847-B21 |
| Compaq Rack 7000 Series | High Air Flow Rack Door Insert for the 7142 Rack (single) | 327281-B21 |
|                         | High Air Flow Rack Door Insert for the 7142 Rack (6-pack) | 327281-B22 |
|                         | Compaq Networking Cable Management Kit                    | 292407-B21 |
|                         | Compaq Rack Extension Kit for 7142                        | 154392-B21 |

NOTE: For additional information regarding Rack Options, please see the following URL:  
<http://www.compaq.com/rackoptions>

|                                                   |                                                              |            |
|---------------------------------------------------|--------------------------------------------------------------|------------|
| Rack Options for Rack 7000, 9000 and 10000 Series | Monitor Utility Shelf- opal                                  | 303606-B21 |
|                                                   | Ballast Option Kit                                           | 120672-B21 |
|                                                   | Rack Rail Adapter Kit (25" depth)                            | 120675-B21 |
|                                                   | 100 kg Sliding Shelf                                         | 234672-B21 |
|                                                   | Monitor/Utility Shelf - Graphite                             | 253449-B21 |
|                                                   | Depth Adjustable Fixed Rail                                  | 332558-B21 |
|                                                   | Cable Management D-Rings Kit                                 | 168233-B21 |
|                                                   | Console Management Controller (CMC) Option Kit               | 203039-B21 |
|                                                   | Console Management Controller (CMC) Sensors Option Kit       | 203039-B22 |
|                                                   | Console Management Controller (CMC) Locking Option Kit       | 203039-B23 |
|                                                   | Console Management Controller (CMC) Smoke Sensors Option Kit | 203039-B24 |
|                                                   | Server Console Switch 1 x 2 port (100-230 VAC)               | 120206-001 |
|                                                   | Server Console Switch 1 x 4 port (100-230 VAC)               | 400336-001 |
|                                                   | Server Console Switch 1 x 8 port (100-230 VAC)               | 400337-001 |
|                                                   | Server Console Switch 2 x 8 port (100-230 VAC)               | 400338-001 |
|                                                   | Server Console Switch 2 x 8 port (48VDC)                     | 400542-B21 |
|                                                   | IP Console Switch Box, 1x1x16                                | 262585-B21 |
|                                                   | IP Console Switch Box, 3x1x16                                | 262586-B21 |
|                                                   | IP Console Interface Adapter, 8 pack                         | 262587-B21 |
|                                                   | IP Console Interface Adapter, 1 pack                         | 262588-B21 |
|                                                   | IP Console Expansion Module                                  | 262589-B21 |
|                                                   | KVM 9 PIN Adapter (4 Pack)                                   | 149361-B21 |
|                                                   | CPU to Server Console Cable, 12'                             | 110936-B21 |
|                                                   | CPU to Server Console Cable, 20'                             | 110936-B22 |
|                                                   | CPU to Server Console Cable, 40'                             | 110936-B23 |
|                                                   | CPU to Server Console Cable, 3'                              | 110936-B24 |
|                                                   | CPU to Server Console Cable, 7'                              | 110936-B25 |
|                                                   | CPU to Server Console Cable (Plenum Rated) 20'               | 149363-B21 |
|                                                   | CPU to Server Console Cable (Plenum Rated) 40'               | 149364-B21 |
|                                                   | IP CAT5 Cable 3', 4 pack                                     | 263474-B21 |
|                                                   | IP CAT5 Cable 6', 8 pack                                     | 263474-B22 |
|                                                   | IP CAT5 Cable 12', 8 pack                                    | 263474-B23 |
|                                                   | IP CAT5 Cable 20', 4 pack                                    | 263474-B24 |
|                                                   | IP CAT5 Cable 40', 1 pack                                    | 263474-B25 |
|                                                   | Switch Box Connector Kit (115V)                              | 144007-001 |
|                                                   | Switch Box Connector Kit (230V)                              | 144007-002 |
|                                                   | Switch Box Connector Kit (high voltage)                      | 144007-B33 |
|                                                   | 1U Rack Keyboard & Drawer (Carbon)                           | 257054-001 |
|                                                   | NOTE: The 1U Rack Keyboard & Drawer (PN 257054-001).         |            |



No

144007-002  
 144007-B33  
 257054-001  
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# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

|                                                                                                                                                                                  |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| TFT5600 Rack Keyboard Monitor                                                                                                                                                    | 221546-001 |
| Input Device Adjustable Rails                                                                                                                                                    | 287139-B21 |
| NOTE: Input Device Adjustable Rails (287139-B21) are for use with the TFT5110R, TFT5600RKM and integrated keyboard/drawer which is used in mounting into third party racks.      |            |
| Input Device Telca Rail                                                                                                                                                          | 287138-B21 |
| NOTE: Input Device Adjustable Rails (287138-B21) are for use ONLY with the TFT5110R, TFT5600RKM and integrated keyboard/drawer which is used in mounting into third party racks. |            |
| Keyboard/Monitor/Mouse extension cables                                                                                                                                          | 169989-001 |
| NOTE: For additional information regarding Rack Options, please see the following URL:<br><a href="http://www.compaq.com/rackoptions">http://www.compaq.com/rackoptions</a>      |            |

## Service and Support Offerings (Care Packs)

NOTE: These Service and Support Offerings are for Windows NT, Windows 2000 Server/Advanced Server or Novell NetWare Operating System.

### Hardware Services 4-Hour On-site Service

4-Hour On-site Service, 9-Hour x 5-Day Coverage, 3 Years (6-3 Part Number for U.S.) 401785-002

4-Hour On-site Service, 9-Hour x 5-Day Coverage, 3 Years (2-5-2 Part Number for Canada) FP-HE4EC-36

4-Hour On-site Service, 24-Hour x 7-Day Coverage, 3 Years (6-3 Part Number for U.S.) 401784-002

4-Hour On-site Service, 24-Hour x 7-Day Coverage, 3 Years (2-5-5 Part Number for Canada) FP-HE7EC-36

### Installation & Start-up Services

Hardware Installation (6-3 Part Number for U.S.) 401794-002

Hardware Installation (6-3 Part Number for Canada) FP-HEINS-EC

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Win NT Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (6-3 Part Number for U.S.) 240016-002

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Novell NetWare Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (6-3 Part Number for U.S.) 240011-002

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Win NT Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (2-5-2 Part Number for Canada) FM-MSTEC-04

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Novell NetWare Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (2-5-2 Part Number for Canada) FM-NSTEC-04

### Business Solutions Priority Service Plan - Priority Level

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Next Available Specialist (6-3 Part Number for U.S.) 239937-002

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Novell NetWare Operating System, Next Available Specialist (6-3 Part Number for U.S.) 239977-002

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Next Available Specialist (2-5-2 Part Number for Canada) FM-M01E4-36

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Novell NetWare Operating System, Next Available Specialist (2-5-2 Part Number for Canada) FM-N01E4-36



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# QuickSpecs

HP ProLiant DL760 Generation 2

## Options

### *Business Solutions Priority Service Plan – Priority 24 Level*

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Bronze Software Support, 2-hr response for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Next Available Specialist (6-3 Part Number for U.S.) 239939-002

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Bronze Software Support, 2-hr response for Novell NetWare Operating System, Next Available Specialist (6-3 Part Number for U.S.) 239979-002

### *Business Solutions Priority Service Plan – Priority Silver*

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive patch notification, 1 System Healthcheck per year (6-3 Part Number for U.S.) 239941-002

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive patch notification, 1 System Healthcheck per year (2-5-2 Part Number for Canada) FM-M04E4-36

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (6-3 Part Number for U.S.) 239943-002

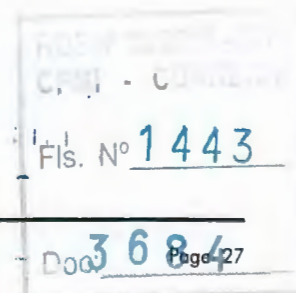
24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (2-5-2 Part Number for Canada) FM-M24E4-36

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review (6-3 Part Number for U.S.) 239981-002

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review (2-5-2 Part Number for Canada) FM-N04E4-36

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Novell NetWare Operating System (6-3 Part Number for U.S.) 239983-002

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Novell NetWare Operating System (2-5-2 Part Number for Canada) FM-N24E4-36

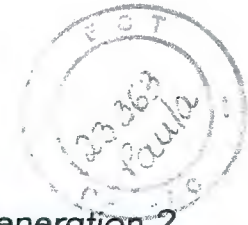




### Options

#### Business Solutions Priority Service Plan – Priority Gold

|                                                                                                                                                                                                                                                                                                                                                                                                                           |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (6-3 Part Number for U.S.)     | 239945-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (2-5-2 Part Number for Canada) | FM-M08E4-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                      | 239947-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                  | FM-M28E4-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (6-3 Part Number for U.S.)                                                                                                                      | 239985-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (2-5-2 Part Number for Canada)                                                                                                                  | FM-N08E4-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                                                                         | 239987-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                                                                     | FM-N28E4-36 |



### Options

#### Business Solutions Priority Service Plan – Priority Gold Executive

|                                                                                                                                                                                                                                                                                                                                                                                                                           |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (6-3 Part Number for U.S.)     | 239949-002  |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (2-5-2 Part Number for Canada) | FM-M09E4-36 |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                      | 239951-002  |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                  | FM-M29E4-36 |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (6-3 Part Number for U.S.)                                                                                                                      | 239989-002  |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (2-5-2 Part Number for Canada)                                                                                                                  | FM-N09E4-36 |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                                                                         | 239991-002  |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                                                                     | FM-N29E4-36 |

#### Data Center Services and Support Offerings (Care Pack Services)

NOTE: These Data Center Services and Support Offerings are for the Enterprise Support Plan. Installation and Startup and Update Subscription are highly recommended for the Data Center Solutions Program.

#### Data Center

|                                                                                                                                        |            |
|----------------------------------------------------------------------------------------------------------------------------------------|------------|
| Data Center Enterprise Support Plan for Single Server<br>7 x 24 2-hour H/W, 7 x 24 1-hour O/S (NT) One Year (6-3 Part Number for U.S.) | 224371-002 |
| Data Center Enterprise Support Plan for 2 Node Cluster 7 x 24 2-hour H/W, 7 x 24 1-hour O/S (NT) One Year (6-3 Part Number for U.S.)   | 224372-002 |
| Data Center Enterprise Support Plan for 4 Node Cluster 7 x 24 2-hour H/W, 7 x 24 1-hour O/S (NT) One Year (6-3 Part Number for U.S.)   | 224373-002 |
| Data Center Enterprise Support Plan for Single Server<br>7 x 24 4-hour H/W, 7 x 24 1-hour O/S (NT) One Year (6-3 Part Number for U.S.) | 224376-002 |
| Data Center Enterprise Support Plan for 2 Node Cluster 7 x 24 4-hour H/W, 7 x 24 1-hour O/S (NT) One Year (6-3 Part Number for U.S.)   | 224377-002 |
| Data Center Enterprise Support Plan for 4 Node Cluster 7 x 24 4-hour H/W, 7 x 24 1-hour O/S (NT) One Year (6-3 Part Number for U.S.)   | 224378-002 |

NOTE: For more information, customer/resellers can contact <http://www.compaq.com/services>.



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# QuickSpecs

HP ProLiant DL760 Generation 2

## Memory

HP ProLiant DL760 G2 1.5 GHz/1MB, 2048MB (4P)

### Standard Memory

2048-MB addressable buffered ECC SDRAM DIMM memory (2 x 256-MB DIMMs x 5 Hot-Plug RAID Memory Cartridges. The 5<sup>th</sup> cartridge is populated for redundancy.)

### Standard Memory Plus Optional Memory

Up to 51,200-MB of addressable ECC SDRAM DIMM memory is available with the installation of optional ECC SDRAM DIMM memory expansion kits.

### Standard Memory Replaced with Optional Memory

Up to 65,536-MB of addressable ECC SDRAM DIMM memory is available with the removal of standard memory and the installation of optional ECC SDRAM DIMM memory expansion kits.

NOTE: 8 slots per Hot-Plug RAID Memory Cartridge. Up to 64-GB addressable memory total. Memory must be added in banks of two DIMMs per cartridge across all five (four if running in a non-redundant mode) Hot-Plug RAID Memory Cartridges. Charts do not represent all possible configurations.

| Memory              |          | Slot    |         |         |         |         |         |         |         |
|---------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|
|                     |          | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
| Cartridge 1<br>(C1) | Standard | 256 MB  | 256 MB  | empty   | empty   | empty   | empty   | empty   | empty   |
|                     | Optional | 256 MB  | 256 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 2<br>(C2) | Standard | 256 MB  | 256 MB  | empty   | empty   | empty   | empty   | empty   | empty   |
|                     | Optional | 256 MB  | 256 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 3<br>(C3) | Standard | 256 MB  | 256 MB  | empty   | empty   | empty   | empty   | empty   | empty   |
|                     | Optional | 256 MB  | 256 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 4<br>(C4) | Standard | 256 MB  | 256 MB  | empty   | empty   | empty   | empty   | empty   | empty   |
|                     | Optional | 256 MB  | 256 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 5<br>(C5) | Standard | 256 MB  | 256 MB  | empty   | empty   | empty   | empty   | empty   | empty   |
|                     | Optional | 256 MB  | 256 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |

Following are memory options available from HP:

- 2048MB 133MHz ECC SDRAM Memory Option Kit (1x2048MB)  
NOTE: A ROM dated later than 2/14/2003 is needed to use 2 GB DIMMs.
- 1024MB 133MHz ECC SDRAM Memory Option Kit (1x1024MB)
- 512MB 133MHz ECC SDRAM Memory Option Kit (1x512MB)
- 256MB 133MHz ECC SDRAM Memory Option Kit (1x256MB)

317093-B21

236854-B21

236853-B21

236852-B21



File No 1446

3684

# QuickSpecs

HP ProLiant DL760 Generation 2

## Memory

HP ProLiant DL760 G2 2.0 GHz/2MB, 4096MB (4P)

### Standard Memory

4096-MB buffered ECC SDRAM DIMM memory (2 x 512-MB DIMMs x 5 Hot-Plug Memory Cartridges. The 5<sup>th</sup> cartridge is populated for redundancy.)

### Standard Memory Plus Optional Memory

Up to 53,248-MB of SDRAM DIMM memory is available with the installation of optional SDRAM DIMM memory expansion kits.

### Standard Memory Replaced with Optional Memory

Up to 65,536-MB of SDRAM DIMM memory is available with the removal of standard memory and the installation of optional SDRAM DIMM memory expansion kits.

NOTE: 8 slots per Hot-Plug RAID Memory Cartridge. Up to 64-GB addressable memory total. Memory must be added in banks of two DIMMs per cartridge across all five (four if running in a non-redundant mode) Hot-Plug RAID Memory Cartridges. Charts do not represent all possible configurations.

| Memory              |          | Slot    |         |         |         |         |         |         |         |
|---------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|
|                     |          | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
| Cartridge 1<br>(C1) | Standard | 512 MB  | 512 MB  |         |         |         |         |         |         |
|                     | Optional | 512 MB  | 512 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 2<br>(C2) | Standard | 512 MB  | 512 MB  |         |         |         |         |         |         |
|                     | Optional | 512 MB  | 512 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 3<br>(C3) | Standard | 512 MB  | 512 MB  |         |         |         |         |         |         |
|                     | Optional | 512 MB  | 512 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 4<br>(C4) | Standard | 512 MB  | 512 MB  |         |         |         |         |         |         |
|                     | Optional | 512 MB  | 512 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
| Cartridge 5<br>(C5) | Standard | 512 MB  | 512 MB  |         |         |         |         |         |         |
|                     | Optional | 512 MB  | 512 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                     | Maximum  | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |

Following are memory options available from HP:

- 2048MB 133MHz ECC SDRAM Memory Option Kit (1x2048MB)

317093-B21

NOTE: A ROM dated later than 2/14/2003 is needed to use 2 GB DIM

- 1024MB 133MHz ECC SDRAM Memory Option Kit (1x1024MB)

236854-B21

- 512MB 133MHz ECC SDRAM Memory Option Kit (1x512MB)

236853-B21

- 256MB 133MHz ECC SDRAM Memory Option Kit (1x256MB)

236852-B21

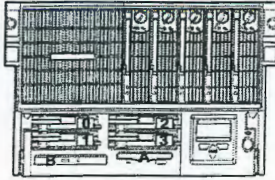




# QuickSpecs

HP ProLiant DL760 Generation 2

## Storage



|       |                                         |
|-------|-----------------------------------------|
| 0 - 3 | 1" Ultra320 SCSI Hot Plug drive bays    |
| A     | Integrated 1.44MB Floppy drive          |
| B     | Integrated 24x IDE CD-ROM (Low-Profile) |

## Drive Support

|                                               | Quantity Supported | Position Supported | Controller     |
|-----------------------------------------------|--------------------|--------------------|----------------|
| <b>Integrated Media</b>                       |                    |                    |                |
| Integrated 1.44-MB Diskette Drive             | Up to 1            | A                  | Integrated     |
| Integrated 24x IDE CD-ROM Drive (Low-profile) | Up to 1            | B                  | Integrated IDE |

## Hard Drives

### Ultra320 Hot Pluggable Drives

|                     | Quantity Supported | Position Supported | Controller                                            |
|---------------------|--------------------|--------------------|-------------------------------------------------------|
| 1-inch              | Up to 4            | 0-3                |                                                       |
| 146.8-GB 10,000 rpm |                    |                    | Integrated 5i Smart Array Controller                  |
| 72.8-GB 10,000 rpm  |                    |                    | Smart Array 532 Controller                            |
| 36.4-GB 10,000 rpm  |                    |                    | Smart Array 5302/128 Controller                       |
| 72.8-GB 15,000 rpm  |                    |                    | Smart Array 5304/256 Controller                       |
| 36.4-GB 15,000 rpm  |                    |                    | Smart Array 5312 Controller                           |
| 18.2-GB 15,000 rpm  |                    |                    | Smart Array 641 Controller                            |
|                     |                    |                    | Smart Array 642 Controller                            |
|                     |                    |                    | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter   |
|                     |                    |                    | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter |
|                     |                    |                    | 64-bit/133-MHz Dual Channel Ultra320 SCSI Adapter     |

NOTE: All U320 Universal Hard Drives are backward compatible to U2 or U3 speeds.

# QuickSpecs

HP ProLiant DL760 Generation 2

## Storage

### External Storage

|                                                                      | Quantity Supported                                                               | Position Supported | Controller                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| StorageWorks Enclosure 4300 Family (supports Ultra3/Ultra320 drives) | Up to 44                                                                         | External           | Smart Array 532 Controller<br>Smart Array 5302/128 Controller<br>Smart Array 5304/256 Controller<br>Smart Array 5312 Controller<br>Smart Array 642 Controller<br>64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter |
| MSA 1000                                                             | Please see the MSA 1000 QuickSpecs below to determine configuration requirements | External           | Please see the MSA 1000 QuickSpecs (URL below) for the latest list of supported HBA's                                                                                                                                                                                                                                             |

MSA 1000: [http://www5.compaq.com/products/quickspecs/11033\\_na/11033\\_na.HTML](http://www5.compaq.com/products/quickspecs/11033_na/11033_na.HTML)

### Maximum Storage Capacity – (StorageWorks Enclosure SCSI Attached)

|          |                                                                           |
|----------|---------------------------------------------------------------------------|
| Internal | 587.2 GB (4 x 146.8-GB Ultra320 1" Drives)                                |
| External | 90.428 TB hot plug SCSI storage (44 x (14 x 146.8-GB Ultra320 1" Drives)) |
| Total    | 91.016 TB                                                                 |

### Tape Drives

NOTE: For an up-to-date listing of the latest O/S Support details for each of the Tape Drives listed below, please see the following:  
[http://www5.compaq.com/products/quickspecs/North\\_America/10233.html](http://www5.compaq.com/products/quickspecs/North_America/10233.html)

NOTE: For an up-to-date listing of the latest O/S Support details for each of the Tape Storage Systems listed below, please see the following:  
[http://www5.compaq.com/products/quickspecs/North\\_America/10809.html](http://www5.compaq.com/products/quickspecs/North_America/10809.html)

|                                      | Quantity Supported                                     | Position Supported | Controller                                                                                 |
|--------------------------------------|--------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------|
| Internal AIT 100-GB, Hot Plug        | Up to 1                                                | 0+1 or 2+3         | Integrated 5i Smart Array Controller                                                       |
| Internal AIT 50-GB, Hot Plug         |                                                        |                    | Smart Array 532 Controller                                                                 |
| Internal AIT 35-GB, LVD, Hot Plug    |                                                        |                    | Smart Array 5302/128 Controller                                                            |
| Internal 20/40-GB DAT, Hot Plug      |                                                        |                    | Smart Array 5304/256 Controller                                                            |
| Internal DAT 72 tape drive           |                                                        |                    | Smart Array 5312 Controller                                                                |
|                                      |                                                        |                    | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                        |
|                                      |                                                        |                    | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter                                      |
|                                      |                                                        |                    | 64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter                                           |
|                                      |                                                        |                    | *NOTE: The Smart Array 532 Controller does not support the AIT 100-GB Hot Plug Tape Drive. |
| External AIT 100-GB                  | Up to 2 per controller                                 | External           | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                        |
| External AIT 50-GB                   |                                                        |                    | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter                                      |
| External AIT 35-GB LVD               | Up to 3 per controller                                 |                    | 64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter                                           |
| External DAT 12/24                   |                                                        |                    |                                                                                            |
| External DAT 20/40                   |                                                        |                    |                                                                                            |
| External DAT 72                      |                                                        |                    |                                                                                            |
| External DLT VS 40/80                | Up to 3 per controller                                 | External           | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                        |
| External DLT 40/80                   |                                                        |                    | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter                                      |
|                                      |                                                        |                    | 64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter                                           |
| HP StorageWorks AIT 35 GB Autoloader | Up to 1 (for a single HBA)<br>Up to 2 (for a dual HBA) | External           | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                        |
|                                      |                                                        |                    | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter                                      |
|                                      |                                                        |                    | 64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter                                           |
| External SDLT 110/220                | Up to 2 drives per                                     | External           | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                        |





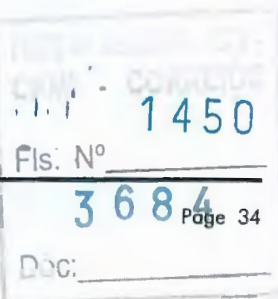
# QuickSpecs

HP ProLiant DL760 Generation 2

## Storage

|                                                                                                                                                                                                                                                                                                                             |                                                                                                 |          |                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| External SDLT 160/320<br>HP StorageWorks Ultrium 230<br>Tape Drive<br>HP StorageWorks Ultrium 460<br>Tape Drive                                                                                                                                                                                                             | controller                                                                                      |          | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter                                                         |
| SSL2020 AIT Library                                                                                                                                                                                                                                                                                                         | 2 drives per SCSI<br>channel                                                                    | External | 64-Bit Dual Channel Wide Ultra2 SCSI Adapter<br>64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>SAN Access Module for Smart Array 5302 Controller          |
| 20/40-GB DAT 8 Cassette<br>Autoloader External                                                                                                                                                                                                                                                                              | Up to 1                                                                                         | External | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter  |
| DLT1 1280 SuperLoader                                                                                                                                                                                                                                                                                                       | Up to 2                                                                                         | External | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter                                                      |
| MSL5026DLX (40/80GB DLT-<br>ased)<br>MSL5026SL (SDLT-based)<br>Library<br>MSL5052SL (SDLT-based)<br>Library<br>MSL5026S2 (SDLT-based)<br>Library<br>MSL5052S2 (SDLT-based)<br>Library<br>MSL5030L1 (LTO-based)<br>Library<br>MSL5060L1 (LTO-based)<br>Library<br>MSL6030 (LTO-based) Library<br>MSL6060 (LTO-based) Library | 2 drives per SCSI<br>channel                                                                    | External | 64-Bit Dual Channel Wide Ultra2 SCSI Adapter<br>64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133MHz Dual Channel Ultra320 SCSI Adapter           |
| SSL1016 tape autoloader                                                                                                                                                                                                                                                                                                     | Up to 2                                                                                         | External | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter |
| ESL9322<br>ESL9322L1<br>ESL9595SL<br>ESL9595<br>ESL9595L1                                                                                                                                                                                                                                                                   | Please see the ESL<br>Library QuickSpecs<br>below to determine<br>configuration<br>requirements | External | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                                                                                               |

595SL: [http://www5.compaq.com/products/quickspecs/11332\\_na/11332\\_na.HTML](http://www5.compaq.com/products/quickspecs/11332_na/11332_na.HTML)  
 ESL9322: [http://www5.compaq.com/products/quickspecs/11628\\_na/11628\\_na.HTML](http://www5.compaq.com/products/quickspecs/11628_na/11628_na.HTML)  
 ESL9322L1: [http://www5.compaq.com/products/quickspecs/11445\\_na/11445\\_na.HTML](http://www5.compaq.com/products/quickspecs/11445_na/11445_na.HTML)  
 ESL9595: [http://www5.compaq.com/products/quickspecs/11629\\_na/11629\\_na.HTML](http://www5.compaq.com/products/quickspecs/11629_na/11629_na.HTML)  
 ESL9595L1: [http://www5.compaq.com/products/quickspecs/11435\\_na/11435\\_na.HTML](http://www5.compaq.com/products/quickspecs/11435_na/11435_na.HTML)





# QuickSpecs

HP ProLiant DL760 Generation 2

## TechSpecs

|                                                                                                                             |                                                                                                                             |                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System Unit                                                                                                                 | Dimensions (HxWxD)                                                                                                          | 12.14 x 17.5 x 27 in/30.83 x 44.45 x 68.58 cm                                                                                                                |
|                                                                                                                             | Weight                                                                                                                      | 165 lb/75 kg                                                                                                                                                 |
| Input Requirements (per power supply)                                                                                       | No hard drives installed, two power supplies                                                                                |                                                                                                                                                              |
|                                                                                                                             |                                                                                                                             |                                                                                                                                                              |
| BTU Rating<br>(Maximum output)<br>(NOTE that the maximum heat output by the server is equal to the electrical power input.) | Rated Input Voltage                                                                                                         | 100 to 120 VAC/200 to 240 VAC (lowline/highline)                                                                                                             |
|                                                                                                                             | Rated Input Frequency                                                                                                       | 47 to 63 Hz (lowline/highline)                                                                                                                               |
|                                                                                                                             | Input Power                                                                                                                 | 740W/1700W (lowlinehighline)                                                                                                                                 |
|                                                                                                                             | Rated Input Current                                                                                                         | 8A at 100 VAC/10A at 200 VAC (lowlinehighline)                                                                                                               |
| Power Supply Output Power (per power supply)                                                                                | BTU Rating<br>(Maximum output)<br>(NOTE that the maximum heat output by the server is equal to the electrical power input.) | 1555 Watts (5309 BTU/hr)<br>(System is configured to draw maximum power)                                                                                     |
|                                                                                                                             |                                                                                                                             |                                                                                                                                                              |
| Temperature Range                                                                                                           | Rated Steady-State Power                                                                                                    | 500W/1150W (lowlinehighline)                                                                                                                                 |
|                                                                                                                             | Maximum Peak Power                                                                                                          | 540W/1150W (lowlinehighline)                                                                                                                                 |
| Relative Humidity<br>(non-condensing)                                                                                       | Operating                                                                                                                   | 50° to 95° F at sea level, altitude de-rating of 1.8° F per 1,000 ft to 10,000 ft (10° to 35°C at sea level, altitude de-rating of 1°C per 300 m to 3,000 m) |
|                                                                                                                             | Non-operating                                                                                                               | -20 to 140° F/-29° to 60° C                                                                                                                                  |
| Maximum Wet Bulb Temperature                                                                                                | Shipping                                                                                                                    | -22° to 122° F/-30° to 50° C                                                                                                                                 |
|                                                                                                                             | Operating                                                                                                                   | 20% to 80%                                                                                                                                                   |
| Acoustic Noise                                                                                                              | Non-operating                                                                                                               | 5% to 90%                                                                                                                                                    |
|                                                                                                                             | Idle<br>(Fixed Disk Drives Spinning)                                                                                        |                                                                                                                                                              |
|                                                                                                                             | L <sub>WAd</sub> (BELS)                                                                                                     | 7.0                                                                                                                                                          |
|                                                                                                                             | L <sub>pAm</sub> (dBA)                                                                                                      | 54                                                                                                                                                           |
|                                                                                                                             | Operating<br>(Random Seeks to Fixed Disks)                                                                                  |                                                                                                                                                              |
|                                                                                                                             | L <sub>WAd</sub> (BELS)                                                                                                     | 7.0                                                                                                                                                          |
|                                                                                                                             | L <sub>pAm</sub> (dBA)                                                                                                      | 54                                                                                                                                                           |





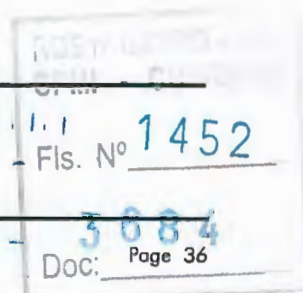
# QuickSpecs

HP ProLiant DL760 Generation 2

## TechSpecs

|                                |                                            |                                                                                                            |
|--------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Power Supply                   | 1150/500W, Hot Plug Redundant (2 standard) | One Redundant Power Supply (optimized to provide full redundancy at 220 volts)                             |
|                                | Input Specifications                       | Normal Line Voltage 100 to 120 VAC/<br>200 to 240 VAC                                                      |
|                                |                                            | Range Input Line 90 to 132 VAC/<br>180 to 265 VAC                                                          |
|                                |                                            | Frequency Range 47 to 63 Hz                                                                                |
|                                |                                            | Power Factor 0.95                                                                                          |
|                                |                                            | Input Current 8 A at 100 VAC/<br>10 A at 200 VAC                                                           |
|                                |                                            | Inrush Current < 70 A at 132 VAC<br>(cold start)                                                           |
|                                |                                            | Holdup Time 20 ms from zero crossing at 120 VAC                                                            |
| General Specifications         |                                            | Full Output Rating To 104° F/40° C and<br>5,000 ft/1524 m                                                  |
|                                |                                            | To 89.6° F/32° C and 10,000 ft/3,048 m<br>(derate linearly)                                                |
|                                |                                            | Minimum Load 1 A on 5 V output; 1 A on 12 V output;<br>0.5 A on 3.3 V output                               |
| Ambient Temperature Range      |                                            | Operating 50° to 104° F/10° to 40° C                                                                       |
|                                |                                            | Storage -40° to 149° F/-40° to 65° C                                                                       |
| Dielectric Voltage Withstand   |                                            | Input to Output 3,000 VAC/min                                                                              |
|                                |                                            | Input to Ground 1,500 VAC/min                                                                              |
| Input Transient Susceptibility |                                            | Common and Differential Mode 2,500 V, 1μs, damped sinusoid 600 V, 10 μs pulse<br>(superimposed on AC line) |
|                                |                                            | Differential Mode 20% step change in AC input voltage                                                      |

|                        |                                                     |                    |
|------------------------|-----------------------------------------------------|--------------------|
| 1.44-MB Diskette Drive | Size                                                | 3.5 in             |
|                        | LED Indicators (front panel)                        | Green              |
|                        | Read/Write Capacity per Diskette (high/low density) | 1.44 MB/720 KB     |
|                        | Drive Supported                                     | One                |
|                        | Drive Height                                        | 11 mm              |
|                        | Drive Rotation                                      | 300 rpm            |
|                        | Transfer Rate Synchronous (Maximum) (high/low)      | 500 K/250 K bits/s |
|                        | Bytes/Sector                                        | 512                |
|                        | Sectors/Track (high/low)                            | 18/9               |
|                        | Tracks/Side (high/low)                              | 80/80              |
| Access Times           | Track-to-Track (high/low)                           | 3/6 ms             |
|                        | Average (high/low)                                  | 174/94 ms          |
|                        | Settling Time                                       | 15 ms              |
|                        | Latency Average                                     | 83/100 ms          |
|                        | Cylinders (high/low)                                | 80/80              |
|                        | Read/Write Heads                                    | Two                |

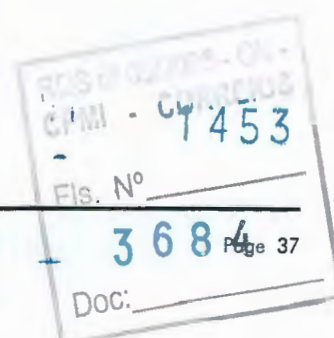


# QuickSpecs

HP ProLiant DL760 Generation 2

## TechSpecs

|                                         |                         |                  |                                                                                                                                                                    |
|-----------------------------------------|-------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Low-Profile 24X Max<br>IDE CD-ROM Drive | Disk                    | Applicable Disk  | CD-DA, CD-ROM (Mode 1 and 2)<br>CD-XA, CD-I (Mode 2, Form 1<br>and 2)<br>CD-I Ready, CD Extra, Video CD, CD-Bridge<br>Photo CD (Single and Multi-session)<br>CD-WO |
|                                         |                         | Capacity         | 550 MB (Mode 1, 12 cm)<br>640 MB (Mode 2, 12 cm)                                                                                                                   |
|                                         |                         | Diameter         | 4.7 x 3.15 in/12 x 8 cm                                                                                                                                            |
|                                         |                         | Rotational Speed | 4200 rpm maximum                                                                                                                                                   |
|                                         |                         | Center Hole      | 0.6 in/15 mm diameter                                                                                                                                              |
|                                         |                         | Thickness        | 1.2 mm                                                                                                                                                             |
|                                         |                         | Track Pitch      | 1.6 $\mu$ m                                                                                                                                                        |
|                                         | Block Size              | Mode 0           | 2,368, 2,352 bytes                                                                                                                                                 |
|                                         |                         | Mode 1           | 2,352, 2,340, 2,336, 2,048 bytes                                                                                                                                   |
|                                         |                         | Mode 2           | 2,352, 2,340, 2,336, 2,048 bytes                                                                                                                                   |
|                                         | Interface               | IDE (ATAPI)      |                                                                                                                                                                    |
|                                         | Access Times (typical)  | Random           | < 140 ms                                                                                                                                                           |
|                                         |                         | Full-Stroke      | < 300 ms                                                                                                                                                           |
|                                         | Data Transfer Rate      | Sustained        | 150 KB/s (sustained 1X)                                                                                                                                            |
|                                         |                         | Burst            | 2100 to 4800 KB/s                                                                                                                                                  |
|                                         | Cache Buffer            | 128 KB           |                                                                                                                                                                    |
|                                         | Start-up Time (typical) | < 10 seconds     |                                                                                                                                                                    |
|                                         | Stop Time               | < 5 seconds      |                                                                                                                                                                    |
|                                         | Operating Conditions    | Temperature      | 41° to 120°F/5° to 55°C                                                                                                                                            |
|                                         |                         | Humidity         | 10% to 80%                                                                                                                                                         |
|                                         | Dimensions              | (HxWxD, maximum) | 0.5 x 5.16 x 5.12 in/<br>1.27 x 13.1 x 13 cm                                                                                                                       |
|                                         |                         | Weight           | < 0.75 lb/< 340 g                                                                                                                                                  |





# QuickSpecs

HP ProLiant DL760 Generation 2

## TechSpecs

|                                                           |                                           |                                                                                  |
|-----------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------------------|
| Smart Array 5i Controller<br>(integrated on system board) | Protocol                                  | Wide Ultra3 SCSI                                                                 |
|                                                           | Processor                                 | 32-bit RISC                                                                      |
|                                                           | XOR engine                                | Hardware RAID                                                                    |
|                                                           | Electrical interface                      | Low Voltage Differential (LVD)                                                   |
|                                                           | Simultaneous Drive Transfer Channels      | 2                                                                                |
|                                                           | Channel Transfer Rate                     | 320 MB/s total; 160 MB/s per channel                                             |
|                                                           | SCSI Port Connectors                      | One external and one internal SCSI port                                          |
|                                                           | Memory                                    | 32 MB of DRAM used for code, transfer buffers, and non-battery-backed read cache |
|                                                           | Peak transfer rate                        | 160 MB/s                                                                         |
|                                                           | Logical Drives Supported                  | 32                                                                               |
|                                                           | Software Upgradeable Firmware             | Yes                                                                              |
|                                                           | RAID Support                              | RAID 5 (Distributed Data Guarding)                                               |
|                                                           |                                           | RAID 1+0 (Striping and Mirroring)                                                |
|                                                           |                                           | RAID 1 (Mirroring)                                                               |
|                                                           |                                           | RAID 0 (Striping)                                                                |
|                                                           | Disk Drive and Enclosure Protocol Support | Ultra2 and Ultra3                                                                |

|                                               |                       |                             |                                                |
|-----------------------------------------------|-----------------------|-----------------------------|------------------------------------------------|
| Compaq NC7770 PCI-X<br>Gigabit Server Adapter | Network Interface     | 10/100/1000-T               |                                                |
|                                               | Compatibility         | IEEE 802.3 10Base-T         |                                                |
|                                               |                       | IEEE 802.3ab 1000Base-T     |                                                |
|                                               |                       | IEEE 802.3u 100Base-TX      |                                                |
|                                               | Data Transfer Method  | 64-bit/133MHz PCI-X         |                                                |
|                                               | Network Transfer Rate | 10Base-T<br>(Half-Duplex)   | 10 Mb/s                                        |
|                                               |                       | 10Base-T<br>(Full-Duplex)   | 20 Mb/s                                        |
|                                               |                       | 100Base-TX<br>(Half-Duplex) | 100 Mb/s                                       |
|                                               |                       | 100Base-TX<br>(Full-Duplex) | 200 Mb/s                                       |
|                                               |                       | 1000Base-T<br>(Half-Duplex) | 1000 Mb/s                                      |
|                                               |                       | 1000Base-T<br>(Full-Duplex) | 2000 Mb/s                                      |
|                                               | Connector             | RJ-45                       |                                                |
|                                               | Cable Support         | 10Base-T                    | Category 3,4 or 5 UTP;<br>up to 328 ft/100 m   |
|                                               |                       | 10/100/1000Base-T           | Category 5 UTP (2 pair);<br>up to 328 ft/100 m |

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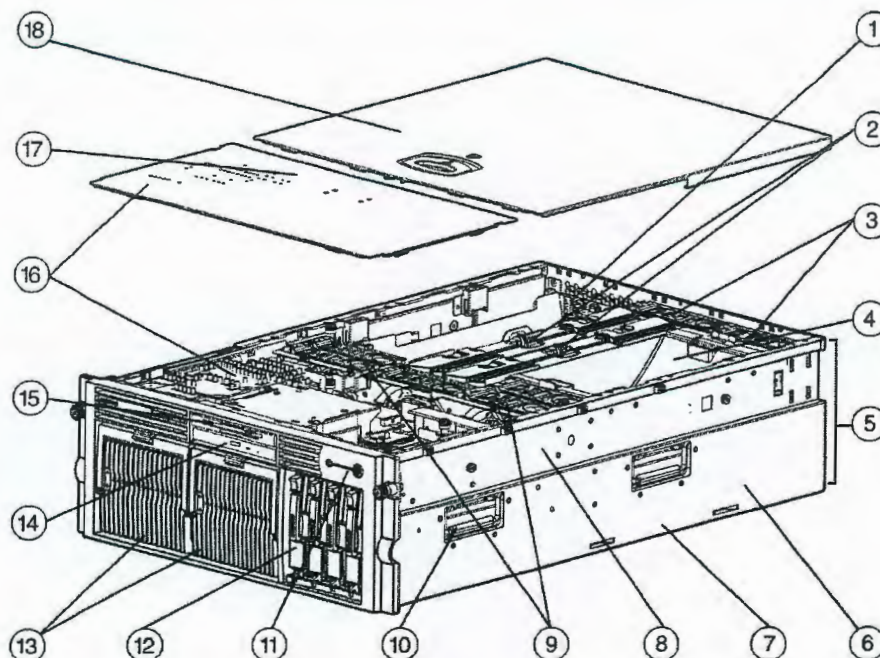
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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Overview



1. Six 64-bit/100-MHz PCI-X I/O Slots (Four Hot Plug, two Non-Hot Plug)
2. Dual Memory Expansion Boards (8 DIMM slots each - one board standard on all DL580 G2 models, 2nd board is optional)
3. Hot Plug Redundant Fans
4. Processor Air Baffle
5. 4U (7" Height) Rack Form Factor
6. Up to 4 Intel Processors MP
7. Intergrated Smart Array 5i Plus Controller (Battery Backed Write Cache standard on all 2P DL580 G2 models, optional on 1P model)
8. Tool-less "Snap In" rail solution
9. Additional Hot Plug Redundant Fans
10. Server Lifting Handle
11. Front Panel LED Display (internal and external health, Unit ID light) and Power Button
12. Wide Ultra3 Duplex Drive Cage (can be Simplex configured)
13. Dual 800-Watt Hot Plug Redundant Power Supplies (low line or high line), standard on all 2P DL580 G2 models (one ships standard on 1P model, requires optional RPS for redundancy)
14. Ejectable Slim Line Drives: Ejectable 24X (slim line) CD-ROM IDE Drive
15. Ejectable Slim Line Drives: Ejectable 1.44 MB (slim line) Diskette Drive
16. QuickFind Diagnostic Display (viewable through Front Access Panel)
17. Removable Front Access Panel
18. Removable Rear Access Panel

## What's New

- Intel® Xeon Processors MP at 2.0 GHz/2MB or 1.5 GHz/1M





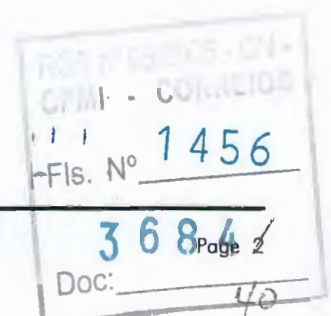
# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Overview

## What's New

- Next generation DL580 G2 delivers maximum performance and unprecedented availability in a flexible, rack optimized form factor
- Intel Xeon Processors MP at 2.0 GHz/2M, 1.9GHz/1M, 1.5GHz/1M, 1.60 GHz/1MB or 1.40 GHz/512KB
- ServerWorks Grand Champion-HE chipset
- 4x1 interleaved memory, 200MHz DDR SDRAM Memory (PC1600 Registered SDRAM with Advanced ECC functionality)
- 2048 MB (2P Models) or 1024 MB (1P Model) standard memory, expandable to 32 GB
- HP Advanced Memory Protection (Online Spare, Single Board Mirrored Memory, Hot Plug Mirrored Memory)
- Six, full length 64-bit/100 MHz PCI-X slots, 4 Hot Pluggable
- Integrated Lights-Out Standard Management (iLO) on system board
- Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot
- Integrated Smart Array 5i Plus Controller (Dual Channel, Ultra3) with 64-MB total memory on 5i Plus Memory Module
- Battery-Backed Write Cache Enabler module on all 2P models (optional on 1P model)
- Internal Hot Plug Drive Storage of up to 587.2 GB (4 x 146.8-GB 1" Wide Ultra3 SCSI hard drives)
- Redundant Cooling Zones for major subsystems (Memory, I/O, CPUs) assure 7x24 cooling
- Toolless and virtually cable-less internal design
- Innovative diagnostic lighting (QuickFind Diagnostic Display) for rapid response to service events
- Rapid Deployment racking solution (rack rails and cable management)
- Protected by HP Services, including a three-year, Next Business Day on-site, limited, Global warranty and extended Pre-Failure Warranty that covers processors, memory and disk drives — Certain restrictions and exclusions apply. Consult the HP Customer Support Center at 1-800-345-1518 for details.



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Standard Features

|                                                 |                                           |
|-------------------------------------------------|-------------------------------------------|
| Processor                                       | Intel Xeon Processor MP at 2.00 GHz\2MB   |
| One or more of the following depending on Model | Intel Xeon Processor MP 1.90 GHz\1MB      |
|                                                 | Intel Xeon Processor MP at 1.50 GHz\1MB   |
|                                                 | Intel Xeon Processor MP at 1.60 GHz\1MB   |
|                                                 | Intel Xeon Processor MP at 1.40 GHz\512KB |

|                                         |                                              |
|-----------------------------------------|----------------------------------------------|
| Cache Memory                            | 2-MB Integrated Level 3 Cache                |
| One of the following depending on Model | NOTE: 2.0 GHz Models only.                   |
|                                         | 1-MB Integrated Level 3 Cache                |
|                                         | NOTE: 1.9GHz, 1.6GHz and 1.5GHz Models only. |
|                                         | 512-KB Integrated Level 3 Cache              |
|                                         | NOTE: 1.40 GHz Models only.                  |

|               |                               |
|---------------|-------------------------------|
| Upgradability | Upgradable to quad processing |
|---------------|-------------------------------|

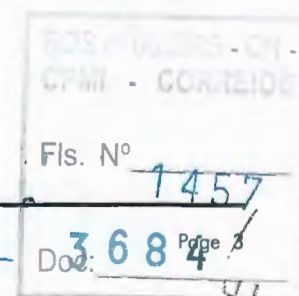
|         |                                                                                                                                                                                                        |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chipset | ServerWorks Grand Champion-HE chipset                                                                                                                                                                  |
|         | NOTE: For more information regarding ServerWorks, please see the following URL:<br><a href="http://www.serverworks.com/products/overview.html">http://www.serverworks.com/products/overview.html</a> . |

|                                         |                                                                                                                                                                                                                   |                                                                                                                              |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Memory                                  | Standard                                                                                                                                                                                                          | 2048 MB 200-MHz Double Data Rate (DDR) SDRAM (PC1600 Registered SDRAM Memory with Advanced ECC functionality) (2P Models)    |
| One of the following depending on Model | Maximum                                                                                                                                                                                                           | 32 GB                                                                                                                        |
|                                         | Standard                                                                                                                                                                                                          | 1024 MB 200-MHz Double Data Rate (DDR) SDRAM (PC1600-MHz Registered SDRAM Memory with Advanced ECC functionality) (1P Model) |
|                                         | Maximum                                                                                                                                                                                                           | 32 GB                                                                                                                        |
|                                         | NOTE: Advanced ECC Memory Technology protects the data even in the event of an entire SDRAM component failure. Embedded in the chipset design, this feature allows the use of Industry-Standard Registered DIMMs. |                                                                                                                              |
|                                         | NOTE: 32 GB achieved with use of 2nd, optional memory board and 2GB Registered DIMM sticks.                                                                                                                       |                                                                                                                              |

|                 |                                                                 |
|-----------------|-----------------------------------------------------------------|
| Work Controller | Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot |
|-----------------|-----------------------------------------------------------------|

|                 |                                   |                                             |
|-----------------|-----------------------------------|---------------------------------------------|
| Expansion Slots | I/O (6 Total, 5 Available)        | PCI Voltage:                                |
|                 | 64-bit/100-MHz PCI-X Hot Plug     | 3, 4, 5 and 6 available                     |
|                 | 64-bit/100-MHz PCI-X Non-Hot Plug | 1, 2 (NIC in slot 2)                        |
|                 |                                   | 3.3 Volt or Universal cards (3.3/5.0V) only |
|                 |                                   | 3.3 Volt or Universal (3.3/5.0V) cards only |

|               |                                                                            |
|---------------|----------------------------------------------------------------------------|
| Manageability | Integrated Lights-Out (iLO) Standard Management (ASIC on the System Board) |
|---------------|----------------------------------------------------------------------------|





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Standard Features

- Storage Controllers** Smart Array 5i Plus Controller (integrated on system board), Dual Channel, Ultra3 (supports RAID 0, 1, 1+0, and 5 across internal hard disk drives) with 64 MB of memory.
- 64-MB total memory for code, transfer buffers, and read/write cache on the 5i Plus Memory Module
  - Connector for Battery Backed Write Cache (BBWC) Enabler

NOTE: The Smart Array 5i Plus Controller is integrated on the system board and is designed to support the duplex/simplex drive cage. An external SCSI port is not available on the DL580 G2. External SCSI solutions require the addition of a PCI or PCI-X option card.

NOTE: For complete list of devices supported the Smart Array 5i Controller see the following:

[http://www5.hp.com/products/quickspecs/10890\\_na/10890\\_na.HTML](http://www5.hp.com/products/quickspecs/10890_na/10890_na.HTML)

- Storage Data Protection** The Battery-Backed Write Cache (BBWC) Enabler protects up to 64-MB write cache memory from hard boot, power, controller, or system board failures.

- Standard on DL580 G2 2P Models, optional on DL580 G2 1P Models
- Battery charge/life: Up to 72 hours/3 years
- Transportable data protection
- Increases overall controller performance

NOTE: Safely transport your write cache data to another DL580 G2 in the data center by removing the BBWC Enabler and 5i Plus Memory Module simultaneously (connected by short cable).

- Storage**
- |                           |                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diskette Drives           | 1.44 MB (slim line) – ejectable for security and serviceability                                                                                                                                                                                                                                                                                                                                     |
| CD-ROM                    | 24x IDE CD-ROM Drive (slim line) – ejectable for security and serviceability                                                                                                                                                                                                                                                                                                                        |
| Hard Drives               | None                                                                                                                                                                                                                                                                                                                                                                                                |
| Maximum Internal Storage  | 587.2 GB (4 x 146.8 GB Wide Ultra 320 1 <sup>2</sup> drives) (internal hot plug Ultra3 drive cage)                                                                                                                                                                                                                                                                                                  |
| Hard Disk Drive Backplane | Internal Wide Ultra3 backplane supports up to four 1" hard disk drives and is easily configurable to support simplex (4x1) or duplex mode (2x2) Standard shipping configuration is the duplex mode.<br>NOTE: Optional SCSI cable assembly 288874-B21 is required for connecting Smart Array Controller in a PCI slot to internal hard drive backplane. Duplex configuration requires two such kits. |

- Interfaces**
- |                         |   |
|-------------------------|---|
| Serial                  | 1 |
| Pointing Device (Mouse) | 1 |
| Graphics                | 1 |
| Keyboard                | 1 |
| Rear USB Ports          | 2 |
| iLO Remote Management   | 1 |
| Network RJ-45           | 1 |

- Graphics** Integrated 1280 x 1024, 16M color on PCI local bus, 8-MB of SDRAM video memory

- Form Factor** Rack (4U = 7 inches), ships with sliding rails and cable management system  
Space saving form factor (4U) provides space efficiencies while providing maximum deployment flexibility



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Standard Features

### ProLiant Essentials Foundation Pack Software

#### Insight Manager 7

Insight Manager 7 helps maximize system uptime and performance and reduces the cost of maintaining the IT infrastructure by providing proactive notification of problems before those problems result in costly downtime and reduced productivity. Insight Manager 7 is easy to set up and provides rapid access to detailed fault and performance information gathered by the Management Agents. One-click access to the Integrated Lights-Out or Remote Insight Lights Out Edition board allows systems administrators to take full graphical control of ProLiant servers in remote locations or lights-out data centers. Finally, Insight Manager 7 in concert with the Version Control Agents and Version Control Repository Manager enables systems administrators to version manage and update system software across groups of ProLiant servers.

#### SmartStart

SmartStart is a tool that simplifies server setup, providing a rapid way to deploy reliable and consistent server configurations. For more information, please visit the SmartStart Web site at <http://www.hp.com/servers/smartstart>.

SmartStart version supported (minimum): SmartStart 5.40.

#### Management Agents

The Management Agents form the foundation for HP's Intelligent Manageability strategy. They provide direct, browser-based access to in-depth instrumentation built into HP servers, workstations, desktops, and portables, and send alerts to Insight Manager 7 and other enterprise management applications in case of subsystem or environmental failures. For additional information about the Management Agents and other management products from HP, please visit the management Web site at <http://www.hp.com/servers/manage>.

#### ActiveUpdate

Active Update is a web-based application that keeps IT managers directly connected to HP for proactive notification and delivery of the latest software updates.

#### ROMPaq, support software, and configuration utilities

The latest software, drivers, and firmware fully optimized and tested for your ProLiant server and options.

#### Survey Utility and diagnostics utilities

The most advanced configuration analysis, reporting and troubleshooting utilities used by HP and at your fingertips.

#### Optional ProLiant Essentials Value Packs

Optional software offerings that selectively extend the functionality of an Adaptive Infrastructure to address specific business problems and needs:

- Rapid Deployment Pack - an automated solution for multi-server deployment and provisioning, enabling companies to quickly and easily adapt to changing business demands.
- Workload Management Pack - provides easier management of complex environments, improving overall server utilization and enabling Windows® 2000 customers for the first time to confidently deploy multiple applications on a single multiprocessor ProLiant Server.
- Integrated Lights-Out Advanced Pack - upgrades the Integrated Lights-Out processor to full virtual presence and control with graphical console and virtual media.
- Integrated Lights-Out Advanced Pack - upgrades the Integrated Lights-Out processor to full virtual presence and control with graphical console and virtual media.
- Recovery Server Option Pack - entry-level high availability software that will provide reliable protection and increased uptime against server hardware and operating system failures.
- Performance Management Pack - a performance management solution that identifies and explains hardware performance bottlenecks on ProLiant servers and attached options enabling users to better utilize their valuable resources.

NOTE: Flexible and volume quantity license kits are available for ProLiant Essentials Value Packs. Refer to <http://www.hp.com/servers/proliantessentials> or the various ProLiant Essentials Value Pack product QuickSpecs for more information.

NOTE: For more information regarding ProLiant Essentials Software, please see the following URL: <http://www.hp.com/servers/proliantessentials>

NOTE: These Web sites are available in English only.



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Standard Features

|                              |                                                                                                                                                     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Industry Standard Compliance | ACPI 2.0 Compliant<br>PCI 2.2 Compliant<br>PXE Support<br>WOL Support<br>Physical Address Extension (PAE) Support<br>Microsoft® Logo certifications |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|

## Intelligent Manageability Integrated Lights-Out (iLO) Standard Management

- Virtual Text Remote Console
- Virtual Power Button Control
- Dedicated LAN Connectivity
- Automatic IP Configuration via DHCP/DNS/WINS
- Industry Standard 128-bit Secure Sockets Layer (SSL) Security
- IML and iLO Event Logging
- Support for 12 user accounts with customizable access privileges

Integrated Lights-Out (iLO) Advanced Pack (supports Advanced features such as Graphical Remote Console and Virtual Floppy - available as a separate option)

Automatic Server Recovery-2 (ASR-2)

Insight Manager 7

Redundant ROM

Remote Flash ROM

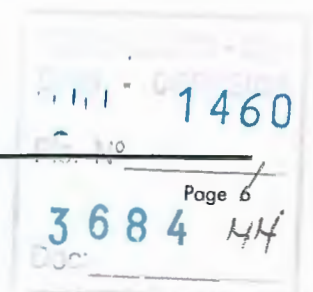
ROM-Based Setup Utility (RBSU)

Integrated Management Log (IML)

Hot Spare Boot (NOTE: Upon the event of a failed processor or VRM in a multi-processing environment, the system will automatically reboot and use the remaining good processor(s).)

Dynamic sector repairing and drive parameter tracking (with Smart Array controllers)

Redundant/adaptive load balancing NIC Support



### Standard Features

#### Availability

- Standard Advanced ECC functionality detects and corrects single bit and specific multi-bit memory errors (4bit and 8bit) while using industry standard registered DIMMS. Functionality is embedded in the chipset design.
- HP Advanced Memory Protection Technology – delivers unsurpassed memory protection and server availability:
  - Online Spare Memory  
Offers a higher level of memory protection than Advanced ECC alone. If the number of single-bit correctable errors on a bank exceeds the pre-defined error threshold, that bank will fail over to the online spare bank without intervention or server interruption. The failed memory can then be replaced at the user's convenience during a scheduled maintenance window.
  - Single-Board Mirrored Memory  
Single-board mirrored memory provides a higher level of availability than Advanced ECC and Online Spare Memory because it protects against multi-bit errors. Single-board Mirrored Memory uses mirrored banks on a single memory board that is configured with one redundant bank of memory. The system writes to both banks, but reads from one. If a DIMM(s) has a multi-bit error, the system simply reads from the mirrored bank instead. This process occurs without intervention or server interruption, and the failed DIMM can be replaced during a regularly scheduled shutdown.
  - Hot Plug Mirrored Memory  
Hot Plug Mirrored Memory is a fault-tolerant memory feature that provides a higher level of availability than Advanced ECC, Online Spare Memory, or Single-Board Mirrored Memory because it protects against multi-bit errors and does not require any server downtime to replace failed DIMMs. Hot Plug Mirrored Memory requires that two memory boards be installed, one an exact mirror of the other, which run in parallel and provide protection against multi-bit memory errors. When configured for Hot Plug Mirrored Memory, the system writes to both memory boards, but reads from one. If a read error occurs, the system fails over to the redundant memory board. At that point the memory board containing the failed DIMMs can be hot replaced. Once the failed DIMMs are replaced and the memory board re-installed into the server, the system goes back to full mirrored status. All this occurs without bringing the server down.  
  
NOTE: Hot Plug Mirrored Memory and Dual-Board Online Spare Memory require the use of two memory cards. All DL580 G2 servers ship standard with a single memory board. The second memory board is optional (P/N 203320-B21).  
  
NOTE: All HP Advanced Memory Protection modes are user configurable through the ROM-Based Setup Utility (RBSU) and viewable through Insight Manager 7 and the Integrated Management Log (IML.).
- PCI-X Hot Plug Technology (Four 64bit/100-MHz PCI-X hot plug slots available)
- Smart Array 5i Plus Controller with standard Battery Backed Write Cache (BBWC) Enabler provides transportable data protection and increases overall controller performance. Up to 64MB Battery Backed Write Cache protection available on 2P DL580 G2 models (BBWC Enabler is optional on 1P model.)
- Redundant Cooling Zones across major server subsystems (Memory, I/O, CPU) provide 7x24 cooling. Each zone is independent of each other and is able to support n+ 1 redundancy, as indicated below:
  - PCI-X expansion zone is 1+ 1 redundant (fans 1 and 2)
  - Memory zone is 1+ 1 redundant (fans 3 and 4)
  - CPU zone is 2+ 1 redundant (fans 5, 6, and 7)

This zone configuration enables the server to withstand up to three fan failures, provided that they are not within the same zone. Each fan is hot plug redundant and individually removable.

- Up to four Hot Plug Ultra3 Drive Bays
- Duplex or Simplex SCSI Backplane (Duplex configuration is standard)
- Dual Hot Plug Redundant Power Supplies (standard on 2P Models, one ships standard on 1P Models.)



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Standard Features

### Serviceability

- Innovative Diagnostic Lighting
- QuickFind Diagnostic Display – precisely depicts all major subsystems of the server (PCI-X I/O, Memory, CPU, Redundant Cooling, Interlock, Thermtrip) and gives instant visual indication of fault status. Located on top front of server.
- LED display on front panel indicates power, internal health, external health, Unit ID light.
- LED display on Memory board indicates Memory status, health, and protection mode.
- Tool-less, virtually cable-less interior design
  - Tool-less access to interior of server
  - Two ejectable, slim line media drives (diskette and CD-ROM standard with support for optional DVD-ROM drives) are removable without the use of tools
  - Front access power supplies
  - Spring-loaded memory board release latches prevent unseating incidents
  - PCI Card Guides locks full length PCI cards in place during transit
  - SCSI Duplex/Simplex Drive Cage connects directly to system board – no cables.  
NOTE: Configure your SCSI Duplex/Simplex Drive Cage by means of simple switch (duplex to simplex) located on the cage itself. System ships standard in Duplex mode.
  - Seven individually removable fans connect without cables to the system board
  - Processor/VRM Retention Cage securely locks both processor and VRM into their respective sockets
  - Tool-less removal of system board
- Quick Deploy Rails
  - Tool-less design "snap in" rail

### Security

Power-on password  
Keyboard password  
Diskette drive control  
Diskette boot control  
Network Server Mode  
Security Provision  
Serial interface control  
Administrator's password  
Disk configuration lock  
Hot plug access security  
Removable Diskette drive  
Removable CD-ROM drive

### Power Supply

800-Watt (low line or high line) Hot Plug Power Supply

NOTE: One 800-Watt Hot Plug Power Supply ships standard with 1P Models (optional Redundant Hot Plug Power Supply Option Kit).

NOTE: Two 800-Watt Hot Plug Power Supplies ship standard with 2P Models.

### System Fans

Standard

7 Hot plug, redundant fans (individually removable)

Maximum

7 Hot plug, redundant fans (individually removable)

- Redundant Cooling Zones across major server subsystems (Memory, I/O, CPU) provide 7x24 cooling. Each zone is independent of each other and is able to support n+ 1 redundancy, as indicated below:
  - PCI-X expansion zone is 1+ 1 redundant (fans 1 and 2)
  - Memory zone is 1+ 1 redundant (fans 3 and 4)
  - CPU zone is 2+ 1 redundant (fans 5, 6, and 7)
- This zone configuration enables the server to withstand up to three fan failures, provided that they are not within the same zone. Each fan is hot plug redundant and individually removable.

### Required Cabling

For required cabling information, refer to the HP Web site at  
<http://www.compaq.com/products/servers/proliantDL580/>.



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Standard Features

### OS Support

Microsoft Windows NT® Server  
Microsoft Windows 2000  
Novell NetWare  
LINUX (Red Hat, SuSE)  
Sun Solaris 8 Intel Platform Edition

NOTE: For a more complete and up-to-date listing of supported OSs and versions, please visit our OS Support Matrix at: <ftp://ftp.HP.com/pub/products/servers/os-support-matrix-310.pdf>.

NOTE: For an up-to-date listing of the latest drivers available for the HP ProLiant DL580 G2, please see: <http://www.HP.com/support/files/server/us/index.html>.

### Rack Airflow Requirements

#### ● Rack 9000 and 10000 series Cabinets

The increasing power of new high-performance processor technology requires increased cooling efficiency for rack-mounted servers. The Compaq 9000 Series Rack and the 10000 Series Racks provides enhanced airflow for maximum cooling, allowing these racks to be fully loaded with servers using the latest processors.

#### ● Rack 7000 series Cabinets

When installing a server with processors running at speeds of 550 MHz or greater in Compaq Rack 7000 series racks with glass doors (165753-001 (42U), and 163747-001 (22U)), the new processor technology requires the installation of Compaq's High Airflow Rack Door Inserts (327281-B21 (42U), 327281-B22 (42U 6 pack), or 157847-B21 (22U)) to promote enhanced airflow for maximum cooling.

CAUTION: If a third-party rack is used, observe the following additional requirements to ensure adequate airflow and to prevent damage to the equipment:

- Front and rear doors: If your 42U server rack includes closing front and rear doors, you must allow 5,350 sq cm (830 square inches) of hole evenly distributed from top to bottom to permit adequate airflow (equivalent to the required 64 percent open area for ventilation).
- Side: The clearance between the installed rack component and the side panels of the rack must be a minimum of 7 cm (2.75 inches).

CAUTION: Always use blanking panels to fill all remaining empty front panel U-spaces in the rack. This arrangement ensures proper airflow. Using a rack without blanking panels results in improper cooling that can lead to thermal damage.

NOTE: For additional information, refer to the Setup and Installation Guide or the Documentation CD provided with the server, or to the server documentation located in the Support section at the following URL: <http://www5.HP.com/products/servers/proliantdl580/index.html>.

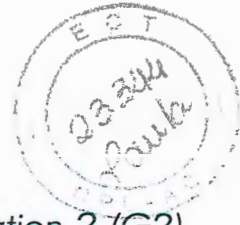
### Rack Airflow Requirements

DL580 G2 rack models provide tool-free support for square hole racks (including Compaq/HP 7000, 9000, 10000 and H9 series) with an adjustment range from 28" – 29" in depth



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| CPMI - CORRELOS |      |
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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Standard Features

### Service and Support

HP Services provides a three-year, limited warranty, including Pre-Failure Warranty (coverage of hard drives, memory and processors) fully supported by a worldwide network of resellers and service providers. HP technical assistance is available 7x24, toll free in the United States and Canada. Telephone support services may be covered under warranty or available for an additional fee.

NOTE: Limited Warranty includes 3 year Parts, 3 year Labor, 3-year on-site support.

A full range of Care Pack packaged hardware and software services:

- Installation and start up
- Extended coverage hours and enhanced response times
- System management and performance services
- Availability and recovery services

NOTE: For more information, customer/resellers can contact <http://www.compaq.com/services>.

Please see the following URL regarding Warranty Information For Your HP Products:

[http://www.compaq.com/support/warranty\\_upgrades/web\\_statements/176738.html](http://www.compaq.com/support/warranty_upgrades/web_statements/176738.html).

For additional information regarding Worldwide Limited Warranty and Technical Support, please see the following URL:

<ftp://ftp.compaq.com/pub/supportinformation/ejourney/176738.pdf>.

NOTE: Certain restrictions and exclusions may apply. Consult the Customer Support Center for details.



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Models

|                                                      |                    |                                                                                                                                            |
|------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| DL580R02 X2.0 GHz<br>-2MB, 2048MB (2P)<br>202176-001 | Processor(s)       | (2) Intel Xeon Processors MP at 2.0 GHz standard (up to 4 supported)                                                                       |
|                                                      | Cache Memory       | 2-MB Integrated Level 3 Cache                                                                                                              |
|                                                      | Memory             | 2048 MB PC1600 registered ECC SDRAM (Standard) to 32 GB (Maximum)<br>(4x1 interleaved memory and HP Advanced Memory Protection Technology) |
|                                                      | Network Controller | Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot                                                                            |
|                                                      | Storage Controller | Smart Array 5i Plus Controller (Dual Channel, Ultra3) with Battery-Backed Write Cache Enabler (integrated on system board)                 |
|                                                      | Manageability      | Integrated Lights-Out (iLO) Standard management (integrated on system board)                                                               |
|                                                      | Hard Drives        | None ship standard                                                                                                                         |
|                                                      | Internal Storage   | 587.2 GB maximum (with optional hard drives)                                                                                               |
|                                                      | Power Supply       | Two 800W Hot Plug Redundant Power Supplies (low line or high line)                                                                         |
|                                                      | Optical Drive      | 24x IDE slim-line CD-ROM Drive                                                                                                             |
|                                                      | Form Factor        | Rack 4U                                                                                                                                    |

|                                                  |                    |                                                                                                                                            |
|--------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| DL580R02 X1900-1MB,<br>2048MB (2P)<br>202175-001 | Processor(s)       | (2) Intel Xeon Processors MP at 1.90 GHz standard (up to 4 supported)                                                                      |
|                                                  | Cache Memory       | 1-MB Integrated Level 3 Cache                                                                                                              |
|                                                  | Memory             | 2048 MB PC1600 registered ECC SDRAM (Standard) to 32 GB (Maximum)<br>(4x1 interleaved memory and HP Advanced Memory Protection Technology) |
|                                                  | Network Controller | Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot                                                                            |
|                                                  | Storage Controller | Smart Array 5i Plus Controller (Dual Channel, Ultra3) with Battery-Backed Write Cache Enabler (integrated on system board)                 |
|                                                  | Manageability      | Integrated Lights-Out (iLO) Standard management (integrated on system board)                                                               |
|                                                  | Hard Drives        | None ship standard                                                                                                                         |
|                                                  | Internal Storage   | 587.2 GB maximum (with optional hard drives)                                                                                               |
|                                                  | Power Supply       | Two 800W Hot Plug Redundant Power Supplies (low line or high line)                                                                         |
|                                                  | Optical Drive      | 24x IDE slim-line CD-ROM Drive                                                                                                             |
|                                                  | Form Factor        | Rack 4U                                                                                                                                    |

|                                                  |                    |                                                                                                                                            |
|--------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| DL580R02 X1600-1MB,<br>2048MB (2P)<br>202103-001 | Processor(s)       | (2) Intel Xeon Processors MP at 1.60 GHz standard (up to 4 supported)                                                                      |
|                                                  | Cache Memory       | 1-MB Integrated Level 3 Cache                                                                                                              |
|                                                  | Memory             | 2048 MB PC1600 registered ECC SDRAM (Standard) to 32 GB (Maximum)<br>(4x1 interleaved memory and HP Advanced Memory Protection Technology) |
|                                                  | Network Controller | Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot                                                                            |
|                                                  | Storage Controller | Smart Array 5i Plus Controller (Dual Channel, Ultra3) with Battery-Backed Write Cache Enabler (integrated on system board)                 |
|                                                  | Manageability      | Integrated Lights-Out (iLO) Standard management (integrated on system board)                                                               |
|                                                  | Hard Drives        | None ship standard                                                                                                                         |
|                                                  | Internal Storage   | 587.2 GB maximum (with optional hard drives)                                                                                               |
|                                                  | Power Supply       | Two 800W Hot Plug Redundant Power Supplies (low line or high line)                                                                         |
|                                                  | Optical Drive      | 24x IDE slim-line CD-ROM Drive                                                                                                             |
|                                                  | Form Factor        | Rack 4U                                                                                                                                    |





# QuickSpecs

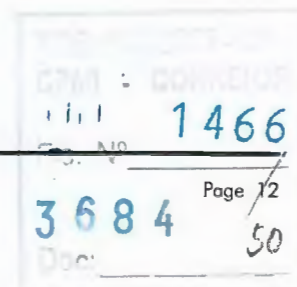
## HP ProLiant DL580 Generation 2 (G2)

### Models

|                                                    |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DL580R02 X1400-512KB,<br>2048MB (2P)<br>201202-001 | Processor(s)<br>Cache Memory<br>Memory<br>Network Controller<br>Storage Controller<br>Manageability<br>Hard Drives<br>Internal Storage<br>Power Supply<br>Optical Drive<br>Form Factor | (2) Intel Xeon Processors MP at 1.40 GHz standard (up to 4 supported)<br>512-KB Integrated Level 3 Cache<br>2048 MB PC1600 registered ECC SDRAM (Standard) to 32 GB (Maximum)<br>(4x1 interleaved memory and HP Advanced Memory Protection Technology)<br>Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot<br>Smart Array 5i Plus Controller (Dual Channel, Ultra3) with Battery-Backed Write Cache Enabler (integrated on system board)<br>Integrated Lights-Out (iLO) Standard management (integrated on system board)<br>None ship standard<br>587.2 GB maximum (with optional hard drives)<br>Two 800W Hot Plug Redundant Power Supplies (low line or high line)<br>24x IDE slim-line CD-ROM Drive<br>Rack 4U |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                  |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DL580R02 X1500-1MB,<br>1024MB (1P)<br>202174-001 | Processor(s)<br>Cache Memory<br>Memory<br>Network Controller<br>Storage Controller<br>Manageability<br>Hard Drives<br>Internal Storage<br>Power Supply<br>Optical Drive<br>Form Factor | (1) Intel Xeon Processor MP at 1.50 GHz standard (up to 4 supported)<br>1MB Integrated Level 3 Cache<br>1024 MB PC1600 registered ECC SDRAM (Standard) to 32 GB (Maximum)<br>(4x1 interleaved memory and HP Advanced Memory Protection Technology)<br>Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot<br>Smart Array 5i Plus Controller (Dual Channel, Ultra3) with Battery-Backed Write Cache Enabler (integrated on system board)<br>Integrated Lights-Out (iLO) Standard management (integrated on system board)<br>None ship standard<br>587.2 GB maximum (with optional hard drives)<br>Two 800W Hot Plug Redundant Power Supplies (low line or high line)<br>24x IDE slim-line CD-ROM Drive<br>Rack 4U |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                    |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DL580R02 X1400-512KB,<br>1024MB (1P)<br>201201-001 | Processor(s)<br>Cache Memory<br>Memory<br>Network Controller<br>Storage Controller<br>Manageability<br>Hard Drives<br>Internal Storage<br>Power Supply<br>Optical Drive<br>Form Factor | (1) Intel Xeon Processor MP at 1.40 GHz standard (up to 4 supported)<br>512-KB Integrated Level 3 Cache<br>1024 MB PC1600 registered ECC SDRAM (Standard) to 32 GB (Maximum)<br>(4x1 interleaved memory and HP Advanced Memory Protection Technology)<br>Integrated Compaq NC7770 PCI-X Gigabit Server Adapter in a slot<br>Smart Array 5i Plus Controller (Dual Channel, Ultra3) with Battery-Backed Write Cache Enabler (integrated on system board)<br>Integrated Lights-Out (iLO) Standard management (integrated on system board)<br>None ship standard<br>587.2 GB maximum (with optional hard drives)<br>Two 800W Hot Plug Redundant Power Supplies (low line or high line)<br>24x IDE slim-line CD-ROM Drive<br>Rack 4U |
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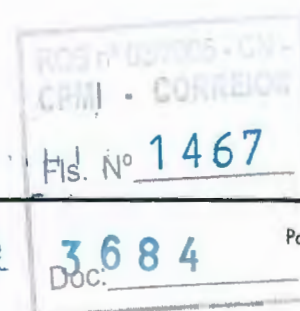


# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

|                               |                                                                                                                                                                                                                                                                                                |            |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| ProLiant DL580 Unique Options | 8192MB PC1600 Registered ECC SDRAM Memory Kit (4 x 2048 MB)                                                                                                                                                                                                                                    | 202173-B21 |
|                               | 4096MB PC1600 Registered ECC SDRAM Memory Kit (4 x 1024 MB)                                                                                                                                                                                                                                    | 202172-B21 |
|                               | 2048MB PC1600 Registered ECC SDRAM Memory Kit (4 x 512 MB)                                                                                                                                                                                                                                     | 202171-B21 |
|                               | 1024MB PC1600 Registered ECC SDRAM Memory Kit (4 x 256 MB)                                                                                                                                                                                                                                     | 202170-B21 |
|                               | Hot Plug Memory Expansion Board                                                                                                                                                                                                                                                                | 203320-B21 |
|                               | NOTE: The Hot Plug Memory Expansion Board provides 8 additional DIMM slots for powering memory-intensive applications.                                                                                                                                                                         |            |
|                               | 800W Hot Plug Redundant Power Supply                                                                                                                                                                                                                                                           | 278535-001 |
|                               | 800W Hot Plug Redundant Power Supply -inc IEC                                                                                                                                                                                                                                                  | 278535-B21 |
|                               | DL580 G2 Third Party Racking Kit                                                                                                                                                                                                                                                               | 287528-B21 |
|                               | DL580 G2 Folding Cable Management Arm                                                                                                                                                                                                                                                          | 289294-B21 |
|                               | DL580 G2 Cable Assembly, SCSI, Ultra3, LVDS                                                                                                                                                                                                                                                    | 288874-B21 |
|                               | NOTE: All DL580 G2 models ship standard with the integrated Smart Array 5i Plus Controller, which has been designed to deliver maximum performance and availability across the internal SCSI Duplex backplane.                                                                                 |            |
|                               | <ul style="list-style-type: none"> <li>The Ultra3 SCSI cable is required only if the customer chooses to bypass the Smart Array 5i Plus Controller and connect slot-based SCSI adapters or RAID controllers to the internal SCSI Duplex backplane.</li> </ul>                                  |            |
|                               | <ul style="list-style-type: none"> <li>Two cables are required to maintain the standard, duplexed configuration of the backplane.</li> </ul>                                                                                                                                                   |            |
|                               | <ul style="list-style-type: none"> <li>One cable is required if the simplex configuration is chosen</li> </ul>                                                                                                                                                                                 |            |
|                               | The backplane is easily configured to simplex mode by means of a simple switch (duplex to simplex) located on the top of the backplane itself.                                                                                                                                                 |            |
|                               | Cord, AC Line, 20A, 250V                                                                                                                                                                                                                                                                       | 235604-001 |
|                               | Cable, 16A, IEC320-C20 to IEC320-C19                                                                                                                                                                                                                                                           | 295633-B21 |
|                               | NOTE: Power cord (295633-B21) connects ProLiant servers to PDUs or UPSs with IEC320-C19 output connections.                                                                                                                                                                                    |            |
|                               | Cable, 10A, IEC320-C14 to IEC320-C19                                                                                                                                                                                                                                                           | 291034-B21 |
|                               | NOTE: Power cord (291034-B21) connects ProLiant DL580 G2 servers to PDUs or UPSs with IEC320-C13 output connections. This power cord has been specifically designed to work with the ProLiant DL580 G2 server. Please NOTE the following important precautions when deploying this power cord: |            |
|                               | <ul style="list-style-type: none"> <li>Use the cord only in conjunction with the ProLiant DL580 G2 server.</li> </ul>                                                                                                                                                                          |            |
|                               | <ul style="list-style-type: none"> <li>Use the cord to connect the ProLiant DL580 G2 server only to PDUs or UPSs with IEC320-C13 output connections.</li> </ul>                                                                                                                                |            |
|                               | <ul style="list-style-type: none"> <li>Do not use the cord with any other ProLiant or third party server.</li> </ul>                                                                                                                                                                           |            |
|                               | <ul style="list-style-type: none"> <li>Do not use the cord with any other office equipment or computers.</li> </ul>                                                                                                                                                                            |            |
|                               | <ul style="list-style-type: none"> <li>Do not use the cord as an extension cord.</li> </ul>                                                                                                                                                                                                    |            |
|                               | <ul style="list-style-type: none"> <li>Do not plug the cord into a wall outlet.</li> </ul>                                                                                                                                                                                                     |            |
|                               | Failure to adhere to these precautions may invalidate the server warranty.                                                                                                                                                                                                                     |            |
|                               |                                                                                                                                                                                                                                                                                                |            |
|                               |                                                                                                                                                                                                                                                                                                |            |





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

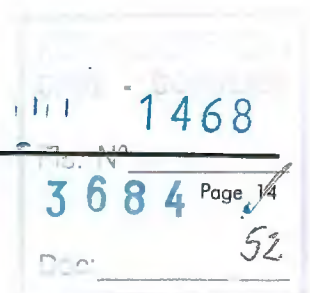
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|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| ProLiant Essentials<br>Value Pack Software | Rapid Deployment Pack, 1 User, V1.x                                                                                                                                                                                                                                                                        | 267196-B21 |
|                                            | NOTE: This license allows 1 server to be managed and deployed via the Deployment Server.                                                                                                                                                                                                                   |            |
|                                            | Rapid Deployment Pack, 10 Users, V1.x                                                                                                                                                                                                                                                                      | 269817-B21 |
|                                            | NOTE: This license allows 10 servers to be managed and deployed via the Deployment Server.                                                                                                                                                                                                                 |            |
|                                            | ProLiant Essentials Workload Management Pack (Featuring Compaq Resource Partitioning Manager version 2.0)                                                                                                                                                                                                  | 303284-B21 |
|                                            | ProLiant Essentials Recovery Server Option Pack                                                                                                                                                                                                                                                            | 280189-B21 |
|                                            | Integrated Lights-Out (iLO) Advanced Pack                                                                                                                                                                                                                                                                  | 263825-B21 |
|                                            | ProLiant Essentials Performance Management Pack v2.0, Single License                                                                                                                                                                                                                                       | 306696-B21 |
|                                            | NOTE: Flexible and volume quantity license kits are available for ProLiant Essentials Value Packs. Refer to <a href="http://www.hp.com/servers/proliantessentials">http://www.hp.com/servers/proliantessentials</a> or the various ProLiant Essentials Value Pack product QuickSpecs for more information. |            |
|                                            | NOTE: For more information regarding ProLiant Essentials Software, please see the following URL: <a href="http://www.hp.com/servers/proliantessentials">http://www.hp.com/servers/proliantessentials</a> .                                                                                                 |            |
|                                            | NOTE: These Web sites are available in English only.                                                                                                                                                                                                                                                       |            |

|          |                             |            |
|----------|-----------------------------|------------|
| Software | HP digital asset protection | 302316-001 |
|----------|-----------------------------|------------|

|           |                                                                                                           |            |
|-----------|-----------------------------------------------------------------------------------------------------------|------------|
| Processor | Intel Xeon MP X2.0 GHz-2MB Processor Option Kit                                                           | 307276-B21 |
|           | NOTE: This processor option kit (PN 307276-B21) supports the ProLiant ML570 G2 and the DL580 G2.          |            |
|           | Intel Xeon MP X1.9 GHz-1MB Processor Option Kit                                                           | 311228-B21 |
|           | NOTE: This processor option kit (PN 311228-B21) supports the ProLiant ML570 G2 and the ProLiant DL580 G2. |            |
|           | Intel Xeon MP X1.50 GHz-1MB Processor Option Kit                                                          | 191220-B21 |
|           | NOTE: This processor option kit (PN 191220-B21) supports the ProLiant ML570 G2 and the ProLiant DL580 G2. |            |
|           | Intel Xeon MP X1.60 GHz-1MB Processor Option Kit                                                          | 226776-B21 |
|           | NOTE: This processor option kit (PN 226776-B21) supports the ProLiant DL580 G2 only.                      |            |
|           | Intel Xeon MP X1.40 GHz-512KB Processor Option Kit                                                        | 226775-B21 |
|           | NOTE: This processor option kit (PN 226775-B21) supports the ProLiant ML570 G2 and the ProLiant DL580 G2. |            |

|                |                                                                                                                        |            |
|----------------|------------------------------------------------------------------------------------------------------------------------|------------|
| Memory (DIMMs) | 8192 MB PC1600 Registered ECC SDRAM Memory Kit (4 x 2048 MB)                                                           | 202173-B21 |
|                | 4096 MB PC1600 Registered ECC SDRAM Memory Kit (4 x 1024 MB)                                                           | 202172-B21 |
|                | 2048 MB PC1600 Registered ECC SDRAM Memory Kit (4 x 512 MB)                                                            | 202171-B21 |
|                | 1024 MB PC1600 Registered ECC SDRAM Memory Kit (4 x 256 MB)                                                            | 202170-B21 |
|                | Hot Plug Memory Expansion Board                                                                                        | 203320-B21 |
|                | NOTE: The Hot Plug Memory Expansion Board provides 8 additional DIMM slots for powering memory-intensive applications. |            |

|                |                                            |            |
|----------------|--------------------------------------------|------------|
| Optical Drives | Slimline DVD-ROM Drive (8X/24X) Option Kit | 264007-B21 |
|----------------|--------------------------------------------|------------|



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### Hard Drives

#### Ultra 320 SCSI – Universal Hot Plug

|                                                   |            |
|---------------------------------------------------|------------|
| 36.4GB 10,000 rpm, U320 Universal Hard Drive, 1"  | 286713-B22 |
| 72.8GB 10,000 rpm, U320 Universal Hard Drive, 1"  | 286714-B22 |
| 146.8GB 10,000 rpm, U320 Universal Hard Drive, 1" | 286716-B22 |
| 18.2GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286775-B22 |
| 36.4GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286776-B22 |
| 72.8GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286778-B22 |

NOTE: All U320 Universal Hard Drives are backward compatible to U2 or U3 speeds. U320 drives require an optional U320 Smart Array Controller or U320 SCSI HBA to support U320 transfer rates.

NOTE: Please see the Hard Drive QuickSpecs for Technical Specifications such as capacity, height, width, interface, transfer rate, seek time, physical configuration, and operating temperature:

U320 Hard Drive QS:

[http://www5.compaq.com/products/quickspecs/11531\\_na/11531\\_na.HTML](http://www5.compaq.com/products/quickspecs/11531_na/11531_na.HTML)



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### Storage Controllers

|                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Smart Array 532 Controller                                                                                                                                                                                                                                                                                                                                                                                                               | 225338-B21 |
| Smart Array 5302/128 Controller                                                                                                                                                                                                                                                                                                                                                                                                          | 283552-B21 |
| Smart Array 5304/256 Controller                                                                                                                                                                                                                                                                                                                                                                                                          | 283551-B21 |
| Smart Array 5312 Controller                                                                                                                                                                                                                                                                                                                                                                                                              | 238633-B21 |
| Smart Array 641 Controller                                                                                                                                                                                                                                                                                                                                                                                                               | 291966-B21 |
| Smart Array 642 Controller                                                                                                                                                                                                                                                                                                                                                                                                               | 291967-B21 |
| Ultra3 Channel Expansion Module for Smart Array 5300 Controller                                                                                                                                                                                                                                                                                                                                                                          | 153507-B21 |
| 128-MB Cache Module for Smart Array 5302 Controller                                                                                                                                                                                                                                                                                                                                                                                      | 153506-B21 |
| 256-MB Battery-Backed Cache Module                                                                                                                                                                                                                                                                                                                                                                                                       | 254786-B21 |
| NOTE: This 256-MB Battery-Backed Cache Module supports the Smart Array 5300 series controllers, MSA 1000 and the Smart Array Cluster Storage.                                                                                                                                                                                                                                                                                            |            |
| RAID ADG Upgrade for Smart Array 5302                                                                                                                                                                                                                                                                                                                                                                                                    | 288601-B21 |
| Battery-Backed Write Cache Enabler Option Kit                                                                                                                                                                                                                                                                                                                                                                                            | 255514-B21 |
| NOTE: This Battery-Backed Write Cache Enable Option Kit (PN 255514-xx1) is optional for the DL560 1P Model only.                                                                                                                                                                                                                                                                                                                         |            |
| 64 MB Battery Backed Write Cache Enabler                                                                                                                                                                                                                                                                                                                                                                                                 | 291969-B21 |
| NOTE: This 64 MB BBWC supports the Smart Array 641 Controller and Smart Array 642 Controller.                                                                                                                                                                                                                                                                                                                                            |            |
| DL580 G2 Cable Assembly, SCSI, Ultra3, LVDS                                                                                                                                                                                                                                                                                                                                                                                              | 288874-B21 |
| NOTE: All DL580 G2 models ship standard with the integrated Smart Array 5i Plus Controller, which has been designed to deliver maximum performance and availability across the internal SCSI Duplex backplane.                                                                                                                                                                                                                           |            |
| <ul style="list-style-type: none"> <li>The Ultra3 SCSI cable is required only if the customer chooses to bypass the Smart Array 5i Plus Controller and connect slot-based SCSI adapters or RAID controllers to the internal SCSI Duplex backplane.</li> <li>Two cables are required to maintain the standard, duplexed configuration of the backplane.</li> <li>One cable is required if the simplex configuration is chosen.</li> </ul> |            |
| The backplane is easily configured to simplex mode by means of a simple switch duplex to simplex located on the top of the backplane itself.                                                                                                                                                                                                                                                                                             |            |
| 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter                                                                                                                                                                                                                                                                                                                                                                                    | 154457-B21 |
| 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                                                                                                                                                                                                                                                                                                                                                                      | 129803-B21 |
| 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                                                                                                                                                                                                                                                                                                                                                        | 268351-B22 |
| 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter, Alternate OS                                                                                                                                                                                                                                                                                                                                                                        | 284688-B21 |
| NOTE: Please see the following Controller or SCSI Adapter QuickSpecs for Technical Specifications such as PCI Bus, PCI Peak Data Transfer Rate, SCSI Protocols supported, SCSI Peak Data Transfer Rate, Channels, SCSI Ports, Drives supported, Cache, RAID support, and additional information:                                                                                                                                         |            |
| <a href="http://www5.compaq.com/products/quickspecs/11063_na/11063_na.HTML">http://www5.compaq.com/products/quickspecs/11063_na/11063_na.HTML</a> (Smart Array 5i Plus)                                                                                                                                                                                                                                                                  |            |
| <a href="http://www5.compaq.com/products/quickspecs/10851_na/10851_na.HTML">http://www5.compaq.com/products/quickspecs/10851_na/10851_na.HTML</a> (Smart Array 532)                                                                                                                                                                                                                                                                      |            |
| <a href="http://www5.compaq.com/products/quickspecs/10640_na/10640_na.HTML">http://www5.compaq.com/products/quickspecs/10640_na/10640_na.HTML</a> (Smart Array 5300 Series)                                                                                                                                                                                                                                                              |            |
| <a href="http://www5.compaq.com/products/quickspecs/11328_na/11328_na.HTML">http://www5.compaq.com/products/quickspecs/11328_na/11328_na.HTML</a> (Smart Array 5312)                                                                                                                                                                                                                                                                     |            |
| <a href="http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML">http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML</a> (Smart Array 641)                                                                                                                                                                                                                                                                      |            |
| <a href="http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML">http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML</a> (Smart Array 642)                                                                                                                                                                                                                                                                      |            |
| <a href="http://www5.compaq.com/products/quickspecs/10429_na/10429_na.HTML">http://www5.compaq.com/products/quickspecs/10429_na/10429_na.HTML</a> (SCSI Adapter)                                                                                                                                                                                                                                                                         |            |
| <a href="http://www5.compaq.com/products/quickspecs/11555_na/11555_na.HTML">http://www5.compaq.com/products/quickspecs/11555_na/11555_na.HTML</a> (U320 Adapter)                                                                                                                                                                                                                                                                         |            |



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

|                    |                                                                                                      |            |
|--------------------|------------------------------------------------------------------------------------------------------|------------|
| Communications     | Compaq NC3134 Fast Ethernet NIC 64 PCI Dual Port 10/100                                              | 138603-B21 |
|                    | Compaq NC3135 Fast Ethernet Module Dual 10/100 Upgrade Module for NC3134                             | 138604-B21 |
|                    | Compaq NC6132 Gigabit Module 1000 SX Upgrade Module for NC3134                                       | 338456-B23 |
|                    | Compaq NC6136 Gigabit Server Adapter, 64-bit/66-MHz, PCI, 1000 SX                                    | 203539-B21 |
|                    | HP NC6770 PCI-X Gigabit Server Adapter, 1000-SX                                                      | 244949-B21 |
|                    | Compaq NC7131 Gigabit Server Adapter, 64-bit/66-MHz, PCI, 10/100/1000-T                              | 158575-B21 |
|                    | Compaq NC7132 10/100/1000-T Upgrade Module for NC3134 and NC3131                                     | 153543-B21 |
|                    | Compaq NC7770 PCI-X Gigabit Server Adapter                                                           | 244948-B21 |
| Redundant Options  | 800W Hot Plug Redundant Power Supply                                                                 | 278535-001 |
|                    | 800W Hot Plug Redundant Power Supply -inc IEC                                                        | 278535-B21 |
| Management Options | Remote Insight Lights-Out Edition II                                                                 | 227251-001 |
| Security           | HP/Atalla AXL600L SSL Accelerator Card for ProLiant Servers                                          | 524545-B21 |
|                    | Compaq AXL300 Accelerator PCI Card (HW SSL Encryption) for ProLiant Servers                          | 227933-B21 |
| Monitors           | <i>Essential Series</i>                                                                              |            |
|                    | Compaq S9500 CRT Monitor (19-inch, Carbon/Silver)                                                    | 261615-003 |
|                    | Compaq S7500 CRT Monitor (17-inch, Carbon/Silver)                                                    | 261606-001 |
|                    | Compaq S5500 CRT Monitor (15-inch Carbon/Silver)                                                     | 261602-001 |
|                    | Compaq TFT1501 Flat Panel Monitor (15-inch, Carbon/Silver)                                           | 301042-003 |
|                    | Compaq TFT1701 Flat Panel Monitor (17-inch, Carbon/Silver)                                           | 292847-003 |
|                    | <i>Advantage Series</i>                                                                              |            |
|                    | Compaq V7550 CRT Color Monitor (17-inch, Carbon/Silver)                                              | 261611-003 |
|                    | Compaq TFT1720 Flat Panel Monitor (17-inch, Carbon/Silver)                                           | 295926-003 |
|                    | Compaq FT1720M Flat Panel Monitor<br>(17-inch, Carbon/Silver, includes speaker, USB port, headphone) | 301958-003 |
|                    | Compaq TFT1520 Flat Panel Monitor (15-inch, Carbon/Silver)                                           | 295925-003 |
|                    | Compaq TFT1520M Flat Panel Monitor<br>(15-inch, Carbon/Silver includes speaker, USB port, headphone) | 301957-003 |
|                    | <i>Performance Series</i>                                                                            |            |
|                    | HP P930 CRT Monitor (19-inch, Flat-screen, Carbon/Silver)                                            | 302268-003 |
|                    | HP P1130 CRT Monitor (21-inch, Flat-screen, Carbon/Silver)                                           | 302270-003 |
|                    | HP L1825 Flat Panel Monitor (18-inch, Carbon/Silver)                                                 | 303486-003 |
|                    | HP L2025 Flat Panel Monitor (20-inch, Carbon/Silver)                                                 | 303102-003 |
|                    | Compaq TFT1825 Flat Panel Monitor (18-inch, Carbon/Silver)                                           | 296751-003 |
|                    | Compaq TFT2025 Flat Panel Monitor (20-inch, Carbon/Silver)                                           | 285550-003 |
|                    | <i>Rackmount Flat Panel Monitors</i>                                                                 |            |
|                    | TFT5110R Flat Panel Monitor (Carbon) (1U rack mountable)                                             | 281683-B21 |
|                    | TFT5010R Flat Panel Monitor (2U rack mountable)                                                      | 217248-001 |
|                    | NOTE: Monitors larger than 17" may be too heavy for use in rack systems.                             |            |





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### Tape Drives

#### Internal and External DAT Tape Drives

|                                                                  |            |
|------------------------------------------------------------------|------------|
| HP StorageWorks 20/40-GB DAT DDS-4 Tape Drive, External (Carbon) | 157770-002 |
| HP StorageWorks Internal 20/40-GB DAT, Hot Plug (Carbon)         | 215488-B21 |
| HP StorageWorks 3U Rackmount Tape Drive Kit                      | 274338-B21 |

NOTE: Please see the 20/40-GB DAT Tape Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10426\\_na/10426\\_na.HTML](http://www5.compaq.com/products/quickspecs/10426_na/10426_na.HTML)

#### Internal and External AIT Tape Drives

|                                                             |            |
|-------------------------------------------------------------|------------|
| HP StorageWorks External AIT 35-GB, LVD Tape Drive (Carbon) | 216885-001 |
| HP StorageWorks Internal AIT 35-GB, LVD, Hot Plug (Carbon)  | 216886-B21 |

NOTE: Please see the AIT 35 GB, LVD Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10712\\_na/10712\\_na.HTML](http://www5.compaq.com/products/quickspecs/10712_na/10712_na.HTML)

|                                                         |            |
|---------------------------------------------------------|------------|
| HP StorageWorks AIT 50-GB Tape Drive, External (Carbon) | 157767-002 |
| Internal AIT 50-GB, Hot Plug (Carbon)                   | 215487-B21 |
| HP StorageWorks Rackmount AIT 50-GB, 3U (Single Drive)  | 274333-B21 |
| HP StorageWorks 3U Rackmount Tape Drive Kit             | 274338-B21 |

NOTE: Please see the AIT 50-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10425\\_na/10425\\_na.HTML](http://www5.compaq.com/products/quickspecs/10425_na/10425_na.HTML)

|                                                         |            |
|---------------------------------------------------------|------------|
| HP StorageWorks External AIT 100-GB Tape Drive (Carbon) | 249160-001 |
| HP StorageWorks Internal AIT 100-GB, Hot-Plug (Carbon)  | 249161-B21 |

NOTE: Please see the AIT 100-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11062\\_na/11062\\_na.HTML](http://www5.compaq.com/products/quickspecs/11062_na/11062_na.HTML)

NOTE: Internal Hot Plug AIT drives can be supported by the integrated Smart Array Si Plus Controller.

#### External DLT Tape Drives

|                                                    |            |
|----------------------------------------------------|------------|
| HP StorageWorks External 20/40-GB DLT Drive (opal) | 340744-B22 |
|----------------------------------------------------|------------|

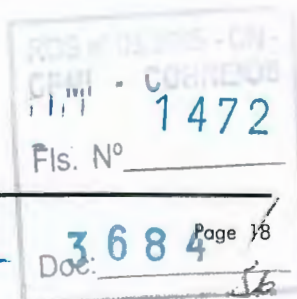
NOTE: Please see the 20/40-GB DLT Drive QuickSpecs for additional options such as data and cleaning cartridges, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10234\\_na/10234\\_na.HTML](http://www5.compaq.com/products/quickspecs/10234_na/10234_na.HTML)

|                                                                      |            |
|----------------------------------------------------------------------|------------|
| HP StorageWorks 40/80-GB DLT Tape Drive, External (Carbon)           | 146197-B22 |
| HP StorageWorks Rackmount DLT 40/80, 3U (Single Drive)               | 274332-B21 |
| HP StorageWorks Rackmount DLT 40/80, Dual-Drive, 3U (Two Drives)     | 274335-B21 |
| HP StorageWorks Rackmount DLT 40/80 Tape Array III, 5U (Four Drives) | 274337-B21 |

NOTE: Please see the 40/80-GB DLT Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10658\\_na/10658\\_na.HTML](http://www5.compaq.com/products/quickspecs/10658_na/10658_na.HTML)



### Options

#### External DLT VS Tape Drives

HP StorageWorks DLT VS 40/80 Tape Drive, External (Carbon)

280129-B22

NOTE: Please see the DLT VS 40/80 Tape Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11403\\_na/11403\\_na.HTML](http://www5.compaq.com/products/quickspecs/11403_na/11403_na.HTML)

#### External SDLT Tape Drives

HP StorageWorks SDLT 110/220, External (carbon)

192103-002

HP StorageWorks SDLT 110/220, External (carbon)

192103-B32

NOTE: Please see the SDLT 110/220-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and media, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10772\\_na/10772\\_na.HTML](http://www5.compaq.com/products/quickspecs/10772_na/10772_na.HTML)

HP StorageWorks SDLT 160/320, External (carbon)

257319-001

NOTE: Please see the SDLT 160/320-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and media, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11406\\_na/11406\\_na.HTML](http://www5.compaq.com/products/quickspecs/11406_na/11406_na.HTML)

HP StorageWorks Rackmount SDLT 110/220, 3U (Single Drive)

274331-B21

HP StorageWorks Rackmount SDLT 110/220, Dual-Drive, 3U (Two Drives)

274334-B21

HP StorageWorks Rackmount SDLT 110/220 Tape Array III, 5U (Four Drives)

274336-B21

NOTE: Please see the SDLT 110/220-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and media, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10772\\_na/10772\\_na.HTML](http://www5.compaq.com/products/quickspecs/10772_na/10772_na.HTML)

#### External SuperLoader

DLT1 1280 SuperLoader

268664-B21

NOTE: Please see the StorageWorks DLT1 1280 SuperLoader QuickSpecs for additional options and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11330\\_na/11330\\_na.HTML](http://www5.compaq.com/products/quickspecs/11330_na/11330_na.HTML)

#### External LTO Ultrium Tape Drives

HP StorageWorks LTO Ultrium 230 Tape Drive, External (Carbon)

Q1516A

NOTE: Please see the HP StorageWorks LTO Ultrium Tape Drive QuickSpecs for additional options such as controllers, and other related items, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11415\\_na/11415\\_na.HTML](http://www5.compaq.com/products/quickspecs/11415_na/11415_na.HTML)

#### External HP StorageWorks Ultrium 460 tape drive for ProLiant

HP StorageWorks Ultrium 460 tape drive for ProLiant, external (Carbon)

Q1519A

NOTE: Please see the HP StorageWorks Ultrium 460 Tape Drive QuickSpecs for additional options such as controllers, and other related items, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11530\\_na/11530\\_na.HTML](http://www5.compaq.com/products/quickspecs/11530_na/11530_na.HTML)

#### 1/8 Autoloader

HP Storage Works 1/8 Autoloader, DLT vs 80

C9264CB

HP Storage Works 1/8 Autoloader, Ultrium 230

C9572CB

Rackmount Kit for 1/8 Autoloader

C9268R

NOTE: Please see the 1/8 Autoloader QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11496\\_na/11496\\_na.HTML](http://www5.compaq.com/products/quickspecs/11496_na/11496_na.HTML)



### Options

#### SSL1016 tape autoloader

SSL1016 DLT1 tape autoloader (includes two 8-cartridge magazines and a barcode reader)

330815-B21

NOTE: Please see the SSL1016 DLT1 tape autoloader Quick Specs for additional information:

[http://h18000.www1.hp.com/products/quickspecs/11626\\_na/11626\\_na.HTML](http://h18000.www1.hp.com/products/quickspecs/11626_na/11626_na.HTML)

SSL1016 SDLT160/320 tape autoloader (includes 2 8-cartridge magazines and a barcode reader)

330816-B21

NOTE: Please see the SSL1016 SDLT160/320 tape autoloader Quick Specs for additional information:

[http://h18000.www1.hp.com/products/quickspecs/11609\\_na/11609\\_na.HTML](http://h18000.www1.hp.com/products/quickspecs/11609_na/11609_na.HTML)

#### Internal and External AIT Autoloader

HP StorageWorks AIT 35 GB Autoloader, Rackmount (Carbon)

280349-001

NOTE: Please see the AIT 35-GB Autoloader QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11404\\_na/11404\\_na.HTML](http://www5.compaq.com/products/quickspecs/11404_na/11404_na.HTML)

#### Rackmount Tape Drive Kits

3U Rackmount Kit

274338-B21

NOTE: The 3U Rackmount Kit (PN 274338-B21) can NOTE up to (2) full-height or (4) half-height tape drives and compatible with multiple Single-Ended and LVD SCSI Tape Drives including the 12/24-GB DAT, 20/40-GB DAT, 20/40-GB DAT DDS-4 8 Cassette Autoloader, AIT 35-GB LVD, AIT 50 GB, 20/40-GB DLT, 40/80-GB DLT, and the SDLT 110/220-GB Tape Drives.

5U Rackmount Kit

274339-B21

NOTE: The 5U Rackmount Kit (PN 274339-B21) can support up to (4) full-height tape drives and is compatible with all Compaq DLT/SDLT tape drives including the 20/40-GB DLT, 35/70-GB DLT, 40/80-GB DLT, and the SDLT 110/220-GB tape drives.

NOTE: Please see the Rackmount Tape Drive Kits QuickSpecs for additional information regarding these kits, please see the following:

[http://www5.compaq.com/products/quickspecs/10854\\_na/10854\\_na.HTML](http://www5.compaq.com/products/quickspecs/10854_na/10854_na.HTML)

#### Rackmount Tape Drive Cable Kits

LVD Cable Kit, VHDCI/HD68

168048-B21

NOTE: For use with the 3U RM Storage Enclosure and DLT Tape Array III only.

LVD Cable Kit, HD68/HD68

242381-B21

NOTE: For use with the 3U RM Storage Enclosure and DLT Tape Array III only.

### a Automation

#### StorageWorks ESL9000 Enterprise System Library

ESL9322L1 – LTO Ultrium based enterprise library with up to 8 drives and 222, 322 slots

ESL9322L1 222 slot 2 DRV LTO1

301927-B22

ESL9322L1 222 slot 8 DRV LTO1

301927-B28

ESL9322L1 322 slot 2 DRV LTO1

301928-B22

ESL9322L1 322 slot 8 DRV LTO1

301928-B28

ESL9322 enterprise library with up to 8 drives and 222, 322 slots

ESL9322 222 slot 0 DRV LTO2

330832-B21

ESL9322 222 slot 2 DRV SDLT2

293409-B22

ESL9322 222 slot 8 DRV SDLT2

293409-B28

ESL9322 322 slot 2 DRV SDLT2

293410-B22

ESL9322 322 slot 8 DRV SDLT2

293410-B28

NOTE: Please see the StorageWorks ESL9322 Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11628\\_na/11628\\_na.HTML](http://www5.compaq.com/products/quickspecs/11628_na/11628_na.HTML)

# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### ESL9322: Common Options

ESL9322, slot upgrade 222 to 322 slots

293588-B21

ESL9595L1 – LTO Ultrium based enterprise library with up to 16 drives and 400, 500, 595 slots

ESL9595L1 400 slot 2 DRV LTO1

301929-B22

ESL9595L1 400 slot 16 DRV LTO1

301929-B28

ESL9595L1 500 slot 2 DRV LTO1

301931-B22

ESL9595L1 500 slot 16 DRV LTO1

301931-B28

ESL9595L1 595 slot 2 DRV LTO1

301932-B22

ESL9595L1 595 slot 16 DRV LTO1

301932-B28

NOTE: Please see the StorageWorks ESL9595L1 Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11435\\_na/11435\\_na.HTML](http://www5.compaq.com/products/quickspecs/11435_na/11435_na.HTML)

### ESL9595 –enterprise library with up to 16 drives and 400, 500, 595 slots

ESL9595 400 slot 0 DRV LTO2

330833-B21

ESL9595 400 slot 2 DRV SDLT 160/320

293411-B22

ESL9595 400 slot 16 DRV SDLT 160/320

293411-B28

ESL9595 500 slot 2 DRV SDLT 160/320

293412-B22

ESL9595 500 slot 16 DRV SDLT 160/320

293412-B28

ESL9595 595 slot 2 DRV SDLT 160/320

293413-B22

ESL9595 595 slot 16 DRV SDLT 160/320

293413-B28

NOTE: Please see the StorageWorks ESL9595 Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11629\\_na/11629\\_na.HTML](http://www5.compaq.com/products/quickspecs/11629_na/11629_na.HTML)

### ESL9595SL – SDLT110 based enterprise library with up to 16 drives and 400, 500, 595 slots

ESL9595SL 400 slots, 2 DRV SDLT110/220

274672-B22

ESL9595SL 400 slots, 16 DRV SDLT110/220

274672-B28

ESL9595SL 500 slots, 2 DRV SDLT110/220

281627-B22

ESL9595SL 500 slots, 16 DRV SDLT110/220

281627-B28

ESL9595SL 595 slots, 2 DRV SDLT110/220

281628-B22

ESL9595SL 595 slots, 16 DRV SDLT110/220

281628-B28

NOTE: Please see the StorageWorks ESL9595SL Enterprise Library QuickSpecs for additional information including Tape Drives, Cartridges, Controllers, and SCSI Cables and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11332\\_na/11332\\_na.HTML](http://www5.compaq.com/products/quickspecs/11332_na/11332_na.HTML)

### ESL9595: Common Options

ESL9595SL 400 to 500 slot upgrade

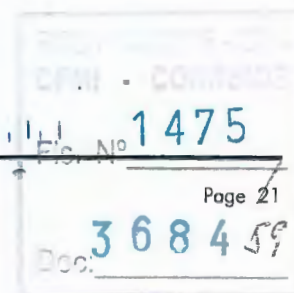
274674-B21

ESL9595SL 500 to 595 slot upgrade

274674-B22

ESL9595SL 400 to 595 slot upgrade

274674-B23





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### Add-on drives & Accessories

|                                                                                                          |            |
|----------------------------------------------------------------------------------------------------------|------------|
| ESL9000 LVD SDLT 160/320 Drive upgrade (ESL9595S2 and ESL9322S2 only)                                    | 293414-B21 |
| ESL9000 LTO1 drive upgrade (ESL9322L1 and ESL9595L1 only)                                                | 301930-B21 |
| ESL9000 Universal Load Port (support both LTO & SDLT cartridges) Not removable                           | 302254-B21 |
| ESL9000 Pass-thru kit (graphite)                                                                         | 161268-B23 |
| ESL9000 Field Upgrade SDLT 110/220, LVD Drive (ESL9198SL, ESL9326SL, ESL9595SL only)                     | 234617-B21 |
| ESL9000 Field Upgrade SDLT 110/220, HVD Drive (for existing ESL9326D/DX customers)                       | 234617-B22 |
| LVD Extender Kit for ESL9198DLX, ESL9198SL, ESL9326SL                                                    | 221249-B21 |
| ESL 9000 Pass Through Kit for Multi Unit Connectivity                                                    | 161268-B21 |
| 64-Bit/66Mhz Dual Channel Wide Ultra3 SCSI Adapter                                                       | 129803-B21 |
| NOTE: 64-Bit/66Mhz Dual Channel Wide Ultra3 SCSI Adapter is required to support the LVD based libraries. |            |

### StorageWorks MSL5000 departmental libraries

#### MSL5060L1 – LTO Ultrium 1 based departmental library up to 4 drives and 60 slots

|                                                      |            |
|------------------------------------------------------|------------|
| MSL5060L1, 0 DRV LTO1 RM Library                     | 301899-B21 |
| MSL5060L1, 2 DRV LTO1 RM Library                     | 301899-B22 |
| MSL5060L1, 2 DRV LTO1 TT Library                     | 301900-B21 |
| MSL5060L1FC, 2 DRV LTO1 RM-with integrated FC router | 301899-B23 |

NOTE: Please see the StorageWorks MSL5060 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11438\\_na/11438\\_na.HTML](http://www5.compaq.com/products/quickspecs/11438_na/11438_na.HTML)

#### MSL5052S2 – SDLT160 based departmental library up to 4 drives and 52 slots

|                                                       |            |
|-------------------------------------------------------|------------|
| MSL5052S2, RM 0 DRV SDLT ALL                          | 255102-B21 |
| MSL5052S2, 2 DRV SDLT2 TT LIB                         | 293476-B21 |
| MSL5052S2, 2 DRV SDLT2 RM LIB                         | 293474-B21 |
| MSL5052S2FC 2 DRV SDLT2 RM- with integrated FC router | 293474-B24 |

NOTE: Please see the StorageWorks MSL5052S2 Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11442\\_na/11442\\_na.HTML](http://www5.compaq.com/products/quickspecs/11442_na/11442_na.HTML)

#### MSL5030L1 – LTO Ultrium 1 mid-range library up to 2 drives and 30 slots

|                                                       |            |
|-------------------------------------------------------|------------|
| MSL5030L1, 0 DRV LTO1 RM Library                      | 301897-B21 |
| MSL5030L1, 1 DRV LTO1 RM Library                      | 301897-B22 |
| MSL5030L1, 2 DRV LTO1 RM Library                      | 301897-B23 |
| MSL5030L1, 1 DRV LTO1 TT Library                      | 301898-B21 |
| MSL5030L1, 2 DRV LTO1 TT Library                      | 301898-B22 |
| MSL5030L1FC, 1 DRV LTO1 RM- with integrated FC router | 301897-B24 |
| MSL5030L1FC, 2 DRV LTO1 RM-with integrated FC router  | 301897-B25 |

NOTE: Please see the StorageWorks MSL5030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11439\\_na/11439\\_na.HTML](http://www5.compaq.com/products/quickspecs/11439_na/11439_na.HTML)



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### MSL5026S2 – SDLT160 based mid-range library up to 2 drives and 26 slots

|                                                        |            |
|--------------------------------------------------------|------------|
| MSL5026S2, 0 DRV SDLT2 RM Library                      | 293472-B21 |
| MSL5026S2, 1 DRV SDLT2 RM Library                      | 293472-B22 |
| MSL5026S2, 2 DRV SDLT2 RM Library                      | 293472-B23 |
| MSL5026S2, 1 DRV SDLT2 TT Library                      | 293473-B21 |
| MSL5026S2, 2 DRV SDLT2 TT Library                      | 293473-B22 |
| MSL5026S2FC, 1 DRV SDLT2 RM- with integrated FC router | 293472-B24 |
| MSL5026S2FC, 2 DRV SDLT2 RM- with integrated FC router | 293472-B25 |

NOTE: Please see the StorageWorks MSL5026SL Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11453\\_na/11453\\_na.HTML](http://www5.compaq.com/products/quickspecs/11453_na/11453_na.HTML)

### MSL5026SL Graphite – SDLT110 based mid-range library up to 2 drives and 26 slots

|                                    |            |
|------------------------------------|------------|
| MSL5026SL, 1 DRV SDLT TT, graphite | 302511-B21 |
| MSL5026SL, 2 DRV SDLT TT, graphite | 302511-B22 |
| MSL5026SL, 1 DRV SDLT RM, graphite | 302512-B21 |
| MSL5026SL, 2 DRV SDLT RM, graphite | 302512-B22 |

NOTE: Please see the StorageWorks MSL5026SL Graphite Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11440\\_na/11440\\_na.HTML](http://www5.compaq.com/products/quickspecs/11440_na/11440_na.HTML)

### MSL5026SL Opal – SDLT110 based mid-range library up to 2 drives and 26 slots

|                        |            |
|------------------------|------------|
| MSL5026, 0 DR, LVD, RM | 231979-B21 |
|------------------------|------------|

### MSL5026DLX– 40/80GB DLT based mid-range library up to 2 drives and 26 slots

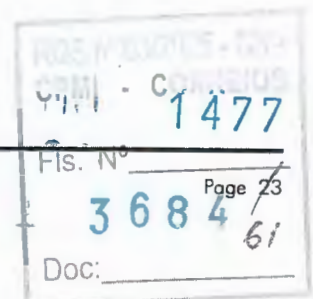
|                                    |            |
|------------------------------------|------------|
| MSL5026DLX, 1 40/80GB DLT, LVD, TT | 231821-B21 |
| MSL5026DLX, 2 40/80GB DLT, LVD, TT | 231821-B22 |
| MSL5026DLX, 1 40/80GB DLT, LVD, RM | 231891-B21 |
| MSL5026DLX, 2 40/80GB DLT, LVD, RM | 231891-B22 |

NOTE: Please see the StorageWorks MSL5026DLX Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/10860\\_na/10860\\_na.HTML](http://www5.compaq.com/products/quickspecs/10860_na/10860_na.HTML)

### MSL5000 Add-on drives & accessories

|                                                                                                                                                |            |
|------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| MSL5000 SDLT 160/320 Upgrade DRV (MSL5052S2 & MSL5026S2 only)                                                                                  | 293475-B21 |
| MSL5000 LTO Ultrium 1 Upgrade DRV (MSL5060L1 & MSL5030L1 only)                                                                                 | 301901-B21 |
| MSL5000 SDLT 110/220 Upgrade DRV                                                                                                               | 231823-B22 |
| MSL5000 40/80GB DLT Upgrade DRV                                                                                                                | 231823-B21 |
| MSL5000 Dual Magazine LTO (2 X 15 slot magazines)                                                                                              | 301902-B21 |
| MSL5000 Dual Magazine DLT (2 X 13 slot magazines)                                                                                              | 232136-B21 |
| MSL5000 pass through mechanism 10 U (required for multi-unit scalability)                                                                      | 231824-B21 |
| MSL5000, Pass through mechanism 10U (includes elevator mechanism and router, required to connect first two units in a stack)                   | 231824-B21 |
| MSL5026, 5U Pass through extender (required one for each unit connected to the stack, for third and additional units) – for MSL5026 & MSL5030  | 231824-B22 |
| MSL5052, 10U Pass-Through Extender (required one for each unit connected to the stack, for third and additional units) – for MSL5052 & MSL5060 | 231824-B23 |





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### MSL6000 Libraries

#### MSL6030 LTO Library

|                                                           |            |
|-----------------------------------------------------------|------------|
| MSL6030, Rackmount, 0 Drive Library                       | 330731-B21 |
| MSL6030, Rackmount, 1 Drive, LTO2 Library                 | 330731-B22 |
| MSL6030, Rackmount, 2 Drive, LTO2 Library                 | 330731-B23 |
| MSL6030, Rackmount, embedded Fibre, 1 Drive, LTO2 Library | 330731-B24 |
| MSL6030, Rackmount, embedded Fibre, 2 Drive, LTO2 Library | 330731-B25 |
| MSL6030, Tabletop, 1 Drive, LTO2 Library                  | 330788-B21 |
| MSL6030, Tabletop, 2 Drive, LTO2 Library                  | 330788-B22 |

NOTE: Please see the StorageWorks MSL6030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11625\\_na/11625\\_na.HTML](http://www5.compaq.com/products/quickspecs/11625_na/11625_na.HTML)

#### MSL6060 LTO Library

|                                                           |            |
|-----------------------------------------------------------|------------|
| MSL6060, Rackmount, 0 Drive Library                       | 331196-B23 |
| MSL6060, Rackmount, 2 Drive, LTO2 Library                 | 331196-B21 |
| MSL6060, Rackmount, embedded Fibre, 2 Drive, LTO2 Library | 331196-B22 |
| MSL6060, Tabletop, 2 Drive, LTO2 Library                  | 331195-B21 |

NOTE: Please see the StorageWorks MSL6030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11608\\_na/11608\\_na.HTML](http://www5.compaq.com/products/quickspecs/11608_na/11608_na.HTML)

### MSL6000 series Libraries Options

|                                                    |            |
|----------------------------------------------------|------------|
| MSL Ultrium 460 upgrade drive in hot plug canister | 330729-B21 |
| MSL Universal passthrough mechanism                | 304825-B21 |
| MSL 10U passthrough extender                       | 231824-B23 |

#### StorageWorks SSL2000 small system library

##### SSL2020 – AIT50 based library with up to 2 drives and 20 slots

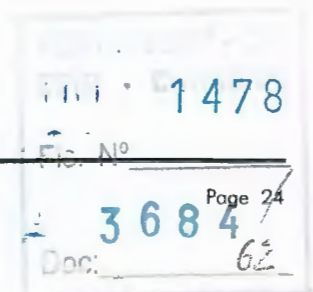
|                                                     |            |
|-----------------------------------------------------|------------|
| SSL2020 AIT Mini-Library 1 drive, 20 slot Table Top | 175195-B21 |
| SSL2020 AIT Mini-Library 2 drive, 20 slot Table Top | 175195-B22 |
| SSL2020 AIT Mini-Library 1 drive, 20 slot Rackmount | 175196-B21 |
| SSL2020 AIT Mini-Library 2 drive, 20 slot Rackmount | 175196-B22 |
| SSL2020 AIT Library Pass Thru with Transport        | 175312-B21 |

#### Add-on drives and accessories

|                                                         |            |
|---------------------------------------------------------|------------|
| SSL2020 AIT Library Pass Thru Extender                  | 175312-B22 |
| AIT 50GB Drive Add-On LVD Drive for SSL2020 AIT Library | 175197-B21 |
| 19 Slot Magazine for SSL2020 AIT Library                | 175198-B21 |
| AIT 50-GB Data Cassette (5 pack)                        | 152841-001 |
| AIT Cleaning Cassette                                   | 402374-B21 |

NOTE: Please see the SSL2020 Automated AIT Tape Library Solution QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/10580\\_na/10580\\_na.HTML](http://www5.compaq.com/products/quickspecs/10580_na/10580_na.HTML)

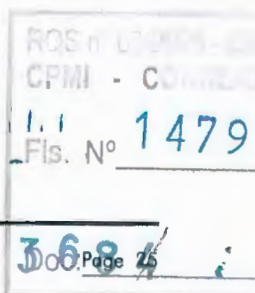


# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

|                         |                                                                                                                                                                                                                                                                                                                           |            |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Cluster Options         | ProLiant Cluster HA/F100 for MSA1000 v2                                                                                                                                                                                                                                                                                   | 252408-B22 |
|                         | ProLiant Cluster HA/F200 for MSA1000 v2                                                                                                                                                                                                                                                                                   | 252409-B22 |
|                         | NOTE: For additional information regarding the ProLiant Cluster for HA/F100, HA/F200 for MSA1000 please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11035_na/11035_na.html">http://www5.compaq.com/products/quickspecs/11035_na/11035_na.html</a>                             |            |
|                         | ProLiant Cluster HA/F100 for Windows NT and 2000 Advanced Server                                                                                                                                                                                                                                                          | 309816-B21 |
|                         | ProLiant Cluster HA/F200 Upgrade Kit (NT 4.0EE to W2K AS)                                                                                                                                                                                                                                                                 | 176848-B22 |
|                         | ProLiant Cluster HA/F200 for Windows NT and 2000 Advanced Server                                                                                                                                                                                                                                                          | 380357-B23 |
|                         | NOTE: For additional information regarding the ProLiant Cluster for HA/F100, HA/F200 for Windows NT and 2000 Advanced Server please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/10777_na/10777_na.html">http://www5.compaq.com/products/quickspecs/10777_na/10777_na.html</a> |            |
|                         | ProLiant Cluster HA/F500 Basic Kit                                                                                                                                                                                                                                                                                        | 103250-B24 |
|                         | ProLiant Cluster HA/F500 Enhanced Kit                                                                                                                                                                                                                                                                                     | 379937-B24 |
|                         | ProLiant Cluster HA/F500 Enhanced DT Kit                                                                                                                                                                                                                                                                                  | 164227-B22 |
|                         | NOTE: For additional information regarding the ProLiant Cluster for HA/F500 please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/10232_na/10232_na.html">http://www5.compaq.com/products/quickspecs/10232_na/10232_na.html</a>                                                  |            |
|                         | ProLiant Cluster HA/F500 for Enterprise Virtual Array                                                                                                                                                                                                                                                                     | 254623-B22 |
|                         | NOTE: For additional information regarding the ProLiant Cluster HA/F500 for Enterprise Virtual Array please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11055_na/11055_na.html">http://www5.compaq.com/products/quickspecs/11055_na/11055_na.html</a>                         |            |
|                         | ProLiant Cluster HA/L100 LifeKeeper for Linux                                                                                                                                                                                                                                                                             | 303523-B22 |
|                         | NOTE: For additional information regarding the ProLiant Cluster HA/L100 LifeKeeper for Linux, please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11533_na/11533_na.html">http://www5.compaq.com/products/quickspecs/11533_na/11533_na.html</a>                                |            |
|                         | HP Serviceguard for Linux ProLiant Cluster                                                                                                                                                                                                                                                                                | 305199-B21 |
|                         | NOTE: Kit includes 2 licenses, documentation and an Ethernet crossover cable.                                                                                                                                                                                                                                             |            |
|                         | HP Serviceguard for Linux License                                                                                                                                                                                                                                                                                         | 307554-B21 |
|                         | NOTE: Kit includes single license version and documentation.                                                                                                                                                                                                                                                              |            |
|                         | NOTE: For additional information regarding the HP Serviceguard for Linux License, please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11518_na/11518_na.html">http://www5.compaq.com/products/quickspecs/11518_na/11518_na.html</a>                                            |            |
| External Storage — Rack | StorageWorks Enclosure Model 4314R (rack-mountable)                                                                                                                                                                                                                                                                       | 190209-001 |
|                         | StorageWorks Enclosure Model 4354R (rack-mountable)                                                                                                                                                                                                                                                                       | 190211-001 |
|                         | NOTE: The StorageWorks Enclosure 4300 Family supports the Wide Ultra3, Ultra320 1" Hot Plug Hard Drives.                                                                                                                                                                                                                  |            |
|                         | StorageWorks Enclosure 4200 Redundant Power Supply Option                                                                                                                                                                                                                                                                 | 119826-B21 |
|                         | StorageWorks Enclosure 4200 Ultra3 Single Bus I/O Module Option                                                                                                                                                                                                                                                           | 190212-B21 |
|                         | StorageWorks Enclosure 4200 Ultra3 Dual Bus I/O Module Option                                                                                                                                                                                                                                                             | 190213-B21 |
|                         | StorageWorks Enclosure Tower to Rack Conversion Kit                                                                                                                                                                                                                                                                       | 150213-B21 |







# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

|         |                                          |            |
|---------|------------------------------------------|------------|
| MSA1000 | MSA1000                                  | 201723-B22 |
|         | MSA1000 Controller                       | 218231-B22 |
|         | MSA Fibre Channel I/O Module             | 218960-B21 |
|         | MSA1000 Fabric Switch                    | 218232-B21 |
|         | MSA1000 Fibre Channel Adapter (FCA) 2101 | 245299-B21 |
|         | HP StorageWorks msa hub 2/3              | 286763-B21 |

NOTE: Please see the StorageWorks by Compaq Modular SAN Array 1000 QuickSpecs for additional options and configuration information at:

[http://www5.compaq.com/products/quickspecs/11033\\_na/11033\\_na.HTML](http://www5.compaq.com/products/quickspecs/11033_na/11033_na.HTML)

|                                                                |                    |            |
|----------------------------------------------------------------|--------------------|------------|
| StorageWorks Modular Array 8000/Enterprise Modular Array 12000 | EMA12000 D14 60Hz  | 175990-B21 |
|                                                                | EMA12000 S14 60Hz  | 175991-B21 |
|                                                                | MA8000 60Hz        | 175992-B21 |
|                                                                | EMA12000 Blue 60Hz | 175993-B21 |

NOTE: Options include controller, solution kits, ACS. MA8000/EMA12000 includes controller shelf, drive shelves and cabinet. Packaging upgrade to RA8000/ESA12000.

NOTE: Please see the StorageWorks MA8000/EMA12000 QuickSpecs for FC Hubs, FC switches, platform software, host adapters, disks and options for complete solutions at:

[http://www5.compaq.com/products/quickspecs/10545\\_na/10545\\_na.HTML](http://www5.compaq.com/products/quickspecs/10545_na/10545_na.HTML)

|                                                |                          |            |
|------------------------------------------------|--------------------------|------------|
| StorageWorks Enterprise Modular Array 16000 FC | EMA16000 D14 60Hz (opal) | 238792-B21 |
|                                                | EMA16000 S14 60Hz (opal) | 238791-B21 |

NOTE: Models include: Dual HSG80 controllers in each Model 2200 enclosure (2 pairs per single bus configuration, 4 pairs per dual bus configuration) with 1GB cache per controller pair, and 12 14-bay drive enclosures with redundant power supplies. Configure-to-Order (CTO) builds are available. Options include ACS, platform kits and software by HP.

NOTE: Please see the StorageWorks EMA16000 QuickSpecs for FC switches, platform software, host adapters, disks and options for complete solutions at:

[http://www5.compaq.com/products/quickspecs/10812\\_na/10812\\_na.HTML](http://www5.compaq.com/products/quickspecs/10812_na/10812_na.HTML)

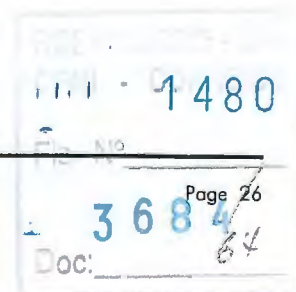
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|----------------------|---------------------------------------------|------------|
| StorageWorks Options | StorageWorks SAN Switch 2/8-EL              | 322120-B21 |
|                      | StorageWorks SAN Switch 2/16                | 322118-B21 |
|                      | StorageWorks SAN Switch 2/8-EL Upgrade Kit  | 325888-B21 |
|                      | StorageWorks SAN Switch 2/16-EL Upgrade Kit | 288250-B21 |
|                      | StorageWorks Director 2/64                  | 286809-B21 |

NOTE: Please see the StorageWorks Director 2/64 QuickSpecs for additional information:

[http://www5.compaq.com/products/quickspecs/11003\\_na/11003\\_na.HTML](http://www5.compaq.com/products/quickspecs/11003_na/11003_na.HTML)

|                               |                                                                                                                                                                                                              |  |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| UPS and PDU Power Cord Matrix | Please see the UPS and PDU cable matrix that lists cable descriptions, requirements, and specifications for UPS and PDU units.that lists cable descriptions, requirements, and specifications for UPS units. |  |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

<ftp://ftp.compaq.com/pub/products/servers/ProLiantstorage/power-protection/powercordmatrix.pdf>



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

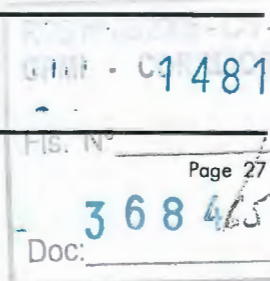
## Options

|                                                                                    |                                                           |            |
|------------------------------------------------------------------------------------|-----------------------------------------------------------|------------|
| Uninterruptible Power Systems — Rack                                               | Compaq UPS R1500 XR (1440VA, 1340 Watt), Low Voltage      | 204404-001 |
|                                                                                    | Compaq UPS R3000 XR (2880VA, 2700 Watt), Low Voltage      | 192186-001 |
|                                                                                    | Compaq UPS R3000 XR (3000VA, 2700 Watt), High Voltage     | 192186-002 |
|                                                                                    | Rack-Mountable UPS R6000 (6000VA, 6000 Watt) High Voltage | 347207-001 |
|                                                                                    | UPS R12000 XR N+x (200-240V) (hardwired)                  | 207552-B22 |
| NOTE: The UPS R12000 XR has a hardwired input and output; requires a 100A circuit. |                                                           |            |

|             |                                                                                                                                                                                                                                                                                                |            |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| UPS Options | SNMP Serial Port Card                                                                                                                                                                                                                                                                          | 192189-B21 |
|             | NOTE: Supports tower and rack UPS XR models ranging from 1000 – 3000VA.                                                                                                                                                                                                                        |            |
|             | Six Port Card                                                                                                                                                                                                                                                                                  | 192185-B21 |
|             | NOTE: Supports tower and rack UPS XR models ranging from 1000 – 3000VA.                                                                                                                                                                                                                        |            |
|             | High to Low Voltage Transformer (250VA)                                                                                                                                                                                                                                                        | 388643-B21 |
|             | NOTE: Supports R6000 UPS series only. 2.5 amps @ 125 Volts max output across two NEMA 5-15.                                                                                                                                                                                                    |            |
|             | Extended Runtime Module, R1500 XR                                                                                                                                                                                                                                                              | 218971-B21 |
|             | NOTE: 2U each, two ERM maximum.                                                                                                                                                                                                                                                                |            |
|             | Extended Runtime Module, R3000 XR                                                                                                                                                                                                                                                              | 192188-B21 |
|             | NOTE: 2U each, one ERM maximum.                                                                                                                                                                                                                                                                |            |
|             | Extended Runtime Module, R6000                                                                                                                                                                                                                                                                 | 347224-B21 |
|             | NOTE: 3U each, two ERM maximum.                                                                                                                                                                                                                                                                |            |
|             | Extended Runtime Module, R12000 XR, 4U                                                                                                                                                                                                                                                         | 217800-B21 |
|             | NOTE: 4U each, two ERM maximum.                                                                                                                                                                                                                                                                |            |
|             | R1200 XR Backplate Receptacle Kit, (2) L6-30R                                                                                                                                                                                                                                                  | 325361-001 |
|             | NOTE: The R12000 XR Backplate Kit has a hardwired input.                                                                                                                                                                                                                                       |            |
|             | R1200 XR Backplate Receptacle Kit, (2) IEC-309R                                                                                                                                                                                                                                                | 325361-B21 |
|             | NOTE: The R12000 XR Backplate Kit has a hardwired input.                                                                                                                                                                                                                                       |            |
|             | SNMP-EN Adapter                                                                                                                                                                                                                                                                                | 347225-B21 |
|             | NOTE: Supports R6000 UPS series only.                                                                                                                                                                                                                                                          |            |
|             | Multi-Server UPS Card                                                                                                                                                                                                                                                                          | 123508-B21 |
|             | NOTE: Supports R6000 UPS series only.                                                                                                                                                                                                                                                          |            |
|             | Scalable UPS Card                                                                                                                                                                                                                                                                              | 123509-B21 |
|             | NOTE: Supports R6000 UPS series only.                                                                                                                                                                                                                                                          |            |
|             | Cable, 16A, IEC320-C20 to IEC320-C19                                                                                                                                                                                                                                                           | 295633-B21 |
|             | NOTE: Power cord (295633-B21) connects ProLiant servers to PDUs or UPSs with IEC320-C19 output connections.                                                                                                                                                                                    |            |
|             | Cable, 10A, IEC320-C14 to IEC320-C19                                                                                                                                                                                                                                                           | 291034-B21 |
|             | NOTE: Power cord (291034-B21) connects ProLiant DL580 G2 servers to PDUs or UPSs with IEC320-C13 output connections. This power cord has been specifically designed to work with the ProLiant DL580 G2 server. Please NOTE the following important precautions when deploying this power cord: |            |

- Use the cord only in conjunction with the ProLiant DL580 G2 server.
- Use the cord to connect the ProLiant DL580 G2 server only to PDUs or UPSs with IEC320-C13 output connections.
- Do not use the cord with any other ProLiant or third party server.
- Do not use the cord with any other office equipment or computers.
- Do not use the cord as an extension cord.
- Do not plug the cord into a wall outlet.

Failure to adhere to these precautions may invalidate the server warranty.





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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

|                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Modular PDUs 1U/0U<br>(Up to 32 outlets)<br>NOTE: 1U/0U mounting brackets shipped with the unit (optimized for 10000 and 9000 series racks).                                                                                                                                                     | Modular Power Distribution Units (mPDU), High Volt Model, 16A (200-240 VAC)                                                                                                                                                                                                                                                                                                                                                     | 252663-B24 |
|                                                                                                                                                                                                                                                                                                  | NOTE: This model has a detachable input power cord and is adaptable to country specific requirements. The 16A PDU also connects to the high volt models of the UPS R3000 XR and R6000 models. Cable P/N 340653-001 required if connecting to UPS R3000 XR (192186-002 -High Volt model only).                                                                                                                                   |            |
|                                                                                                                                                                                                                                                                                                  | Modular Power Distribution Units (mPDU), Low Volt Model, 24A (100-127 VAC)                                                                                                                                                                                                                                                                                                                                                      | 252663-D71 |
|                                                                                                                                                                                                                                                                                                  | NOTE: This model has a detachable input power cord and is adaptable to country specific requirements. The 16A PDU also connects to the high volt models of the UPS R3000 XR and R6000 models. Cable P/N 340653-001 required if connecting to UPS R3000 XR (192186-002 -High Volt model only).                                                                                                                                   |            |
|                                                                                                                                                                                                                                                                                                  | Modular Power Distribution Units (mPDU), High Volt Model, 24A (200-240 VAC)                                                                                                                                                                                                                                                                                                                                                     | 252663-D72 |
|                                                                                                                                                                                                                                                                                                  | NOTE: L6-30 input.                                                                                                                                                                                                                                                                                                                                                                                                              |            |
|                                                                                                                                                                                                                                                                                                  | Modular Power Distribution Units (mPDU), High Volt Model, 40A (200-240 VAC)                                                                                                                                                                                                                                                                                                                                                     | 252663-B21 |
|                                                                                                                                                                                                                                                                                                  | NOTE: The 40A model has a hardwired input.                                                                                                                                                                                                                                                                                                                                                                                      |            |
| NOTE: Please see the following Modular Power Distribution Unit (Zero-U/1U Modular PDUs) QuickSpecs for additional options including cables:<br><a href="http://www5.compaq.com/products/quickspecs/11041_na/11041_na.HTML">http://www5.compaq.com/products/quickspecs/11041_na/11041_na.HTML</a> |                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
| Rack Builder                                                                                                                                                                                                                                                                                     | Please see the Rack Builder for configuration assistance at <a href="http://www.compaq.com/rackbuilder/">http://www.compaq.com/rackbuilder/</a>                                                                                                                                                                                                                                                                                 |            |
| Third Party Rack Kit                                                                                                                                                                                                                                                                             | DL580 G2 rack model support:<br>The DL580 G2 Third Party rack kit 287528-B21 provides support for any rack, square hole or round hole, (including HP Rack System /E and HP Systems), with an adjustment range from 23 1/2" - 34" deep.<br>NOTE: The Third party rack kit is required for round hole racks or for square hole racks that do not conform to the adjustment range of the standard rail that ships with the server. | 287528-B21 |
| Telco Rack Support                                                                                                                                                                                                                                                                               | DL580 G2 rack model support:<br>Support for all 2-post Telco racks requires the Third Party option kit 287528-B21, plus an additional option kit from Rack Solutions. The Rack Solutions brackets can be purchased at:<br><a href="http://www.racksolutions.com/hp">http://www.racksolutions.com/hp</a>                                                                                                                         | 287528-B21 |



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

|                                             |                                                  |            |
|---------------------------------------------|--------------------------------------------------|------------|
| HP Rack 10000 Series<br>(Graphite Metallic) | HP Rack S10614 (14U) Rack Cabinet – Shock Pallet | 292302-B22 |
|                                             | HP Rack 10842 (42U, 800mm wide) – Pallet         | 257415-B21 |
|                                             | HP Rack 10842 (42U, 800mm wide) – Shock Pallet   | 257415-B22 |
|                                             | HP Rack 10647 (47U) – Pallet                     | 245160-B21 |
|                                             | HP Rack 10647 (47U) – Crated                     | 245160-B23 |
|                                             | HP Rack 10642 (42U) – Pallet                     | 245161-B21 |
|                                             | HP Rack 10642 (42U) – Shock Pallet               | 245161-B22 |
|                                             | HP Rack 10642 (42U) – Crated                     | 245161-B23 |
|                                             | HP Rack 10636 (36U) – Pallet                     | 245162-B21 |
|                                             | HP Rack 10636 (36U) – Shock Pallet               | 245162-B22 |
|                                             | HP Rack 10636 (36U) – Crated                     | 245162-B23 |
|                                             | HP Rack 10622 (22U) – Pallet                     | 245163-B21 |
|                                             | HP Rack 10622 (22U) – Shock Pallet               | 245163-B22 |
|                                             | HP Rack 10622 (22U) – Crated                     | 245163-B23 |

NOTE: -B21 (pallet) used to ship empty racks shipped on a truck

-B22 (shock pallet) used to ship racks with equipment installed (by custom systems, VARs and Channels)

-B23 (crated) used for air shipments of empty racks

NOTE: Please see the Rack 10000 QuickSpecs for Technical Specifications such as height, width, depth, weight, and color:

[http://www5.compaq.com/products/quickspecs/10995\\_na/10995\\_na.HTML](http://www5.compaq.com/products/quickspecs/10995_na/10995_na.HTML)

NOTE: For additional information regarding Rack Cabinets, please see the following URL:

<http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html>

|                                   |                                       |            |
|-----------------------------------|---------------------------------------|------------|
| Compaq Rack 9000 Series<br>(opal) | Compaq Rack 9142 (42U) – Pallet       | 120663-B21 |
|                                   | Compaq Rack 9142 (42U) – Shock Pallet | 120663-B22 |
|                                   | Compaq Rack 9142 (42U) – Crated       | 120663-B23 |
|                                   | Compaq Rack 9122 (22U) – Pallet       | 120665-B21 |
|                                   | Compaq Rack 9122 (22U) – Shock Pallet | 120665-B22 |
|                                   | Compaq Rack 9122 (22U) – Crated       | 120665-B23 |

NOTE: -B21 (pallet) used to ship empty racks shipped on a truck

-B22 (shock pallet) used to ship racks with equipment installed (by custom systems, VARs and Channels)

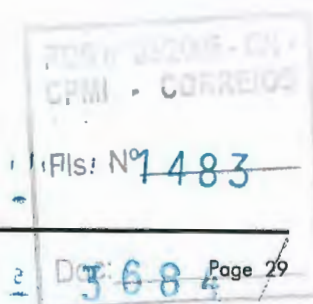
-B23 (crated) used for air shipments of empty racks

NOTE: Please see the Rack 9000 QuickSpecs for Technical Specifications such as height, width, depth, weight, and color:

[http://www5.compaq.com/products/quickspecs/10366\\_na/10366\\_na.HTML](http://www5.compaq.com/products/quickspecs/10366_na/10366_na.HTML)

NOTE: For additional information regarding Rack Cabinets, please see the following URL:

<http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html>



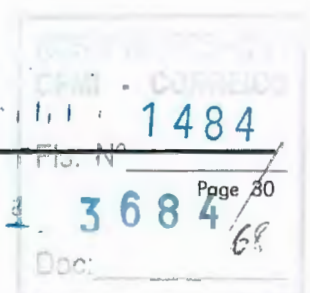


# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

|                                       |                                                                                                                                                                                                                                                                                |            |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Options for HP Rack 10000 Series | Rack Blanking Panels – Graphite (Multi)                                                                                                                                                                                                                                        | 253214-B26 |
|                                       | NOTE: Contains one each of 1U, 2U, 4U and 8U.                                                                                                                                                                                                                                  |            |
|                                       | Rack Blanking Panels – Graphite (1U)                                                                                                                                                                                                                                           | 253214-B21 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B21) contains 10 each of (1U).                                                                                                                                                                                                       |            |
|                                       | Rack Blanking Panels – Graphite (2U)                                                                                                                                                                                                                                           | 253214-B22 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B22) contains 10 each of (2U).                                                                                                                                                                                                       |            |
|                                       | Rack Blanking Panels – Graphite (3U)                                                                                                                                                                                                                                           | 253214-B23 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B23) contains 10 each of (3U).                                                                                                                                                                                                       |            |
|                                       | Rack Blanking Panels – Graphite (4U)                                                                                                                                                                                                                                           | 253214-B24 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B24) contains 10 each of (4U).                                                                                                                                                                                                       |            |
|                                       | Rack Blanking Panels – Graphite (5U)                                                                                                                                                                                                                                           | 253214-B25 |
|                                       | NOTE: The Rack Blanking Panels (PN 253214-B25) contains 10 each of (5U).                                                                                                                                                                                                       |            |
|                                       | 800mm Wide Stabilizer Kit (Graphite)                                                                                                                                                                                                                                           | 255488-B21 |
|                                       | NOTE: Supported by the Rack 10842 cabinet only.                                                                                                                                                                                                                                |            |
|                                       | 600mm Stabilizer Kit – Graphite                                                                                                                                                                                                                                                | 246107-B21 |
|                                       | Baying Kit for Rack 10000 series (Carbon)                                                                                                                                                                                                                                      | 248929-B21 |
|                                       | 42U Side Panel – Graphite Metallic                                                                                                                                                                                                                                             | 246099-B21 |
|                                       | 110V Fan Kit (Graphite)                                                                                                                                                                                                                                                        | 257413-B21 |
|                                       | NOTE: Roof Mount Includes power cord with IEC320-C13 to Nema 5-15P.                                                                                                                                                                                                            |            |
|                                       | 220V Fan Kit (Graphite)                                                                                                                                                                                                                                                        | 257414-B21 |
|                                       | NOTE: Roof Mount Includes power cord with IEC320-C13 to Nema 6-15P.                                                                                                                                                                                                            |            |
|                                       | 36U Side Panel – Graphite Metallic                                                                                                                                                                                                                                             | 246102-B21 |
|                                       | 47U Side Panel – Graphite Metallic                                                                                                                                                                                                                                             | 255486-B21 |
|                                       | 9000/10000 Series Offset Baying Kit (42U)                                                                                                                                                                                                                                      | 248931-B21 |
|                                       | NOTE: This kit can be used to connect 9000 and 10000 series racks of the same U height together. Kit contents include hardware for connecting racks and a panel to cover the 100mm gap at the rear of the two racks.                                                           |            |
|                                       | NOTE: For additional information regarding Rack Cabinets, please see the following URL:<br><a href="http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html">http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html</a> |            |



# QuickSpecs

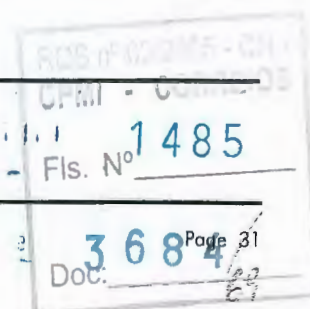
HP ProLiant DL580 Generation 2 (G2)



## Options

|                                             |                                                                                                                                                                                                                                                                                |            |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Options for<br>Compaq Rack 9000 Series | Baying/Coupling Kit                                                                                                                                                                                                                                                            | 120669-B21 |
|                                             | 42U Side Panel                                                                                                                                                                                                                                                                 | 120670-B21 |
|                                             | NOTE: The 42U Side Panel (PN 120670-B21) supports the Compaq Rack 9142 and Compaq Rack 9842.                                                                                                                                                                                   |            |
|                                             | 36U Side Panel                                                                                                                                                                                                                                                                 | 120671-B21 |
|                                             | NOTE: The 36U Side Panel (PN 120671-B21) supports the Compaq Rack 9136.                                                                                                                                                                                                        |            |
|                                             | 9142 Extension Kit                                                                                                                                                                                                                                                             | 120679-B21 |
|                                             | NOTE: The 9142 Extension Kit (PN 120679-B21) supports the Compaq Rack 9142 only.                                                                                                                                                                                               |            |
|                                             | 9142 Split Rear Door                                                                                                                                                                                                                                                           | 254045-B21 |
|                                             | NOTE: The 9142 Split Rear Door (PN 254045-B21) supports the 600 mm wide, 42U 9000 series rack.                                                                                                                                                                                 |            |
|                                             | 9136 Extension Kit                                                                                                                                                                                                                                                             | 218216-B21 |
|                                             | 9142 Short Rear Door                                                                                                                                                                                                                                                           | 218217-B21 |
|                                             | NOTE: The 9142 Short Rear Door (PN 218217-B21) supports the Compaq Rack 9142 only.                                                                                                                                                                                             |            |
|                                             | 9136 Short Rear Door                                                                                                                                                                                                                                                           | 218218-B21 |
|                                             | 9122 Short Rear Door (Opal)                                                                                                                                                                                                                                                    | 218219-B21 |
|                                             | 800mm Stabilizer Option Kit (Opal)                                                                                                                                                                                                                                             | 234493-B21 |
|                                             | NOTE: The 800mm Stabilizer Kit (PN 234493-B21) supports the Rack 9842 only.                                                                                                                                                                                                    |            |
|                                             | 600mm Stabilizer Option Kit                                                                                                                                                                                                                                                    | 120673-B21 |
|                                             | Rack Blanking Panel (Multi)                                                                                                                                                                                                                                                    | 169940-B21 |
|                                             | NOTE: Kit includes four panels in 1U, 2U, 4U, and 8U.                                                                                                                                                                                                                          |            |
|                                             | Rack Blanking Panels (1U)                                                                                                                                                                                                                                                      | 189453-B21 |
|                                             | NOTE: The Rack Blanking Panels (PN 189453-B21) contains 10 each of (1U).                                                                                                                                                                                                       |            |
|                                             | Rack Blanking Panels (2U)                                                                                                                                                                                                                                                      | 189453-B22 |
|                                             | NOTE: The Rack Blanking Panels (PN 189453-B22) contains 10 each of (2U).                                                                                                                                                                                                       |            |
|                                             | Rack Blanking Panels (3U)                                                                                                                                                                                                                                                      | 189453-B23 |
|                                             | NOTE: The Rack Blanking Panels (PN 189453-B23) contains 10 each of (3U).                                                                                                                                                                                                       |            |
|                                             | Rack Blanking Panels (4U)                                                                                                                                                                                                                                                      | 189453-B24 |
|                                             | NOTE: The Rack Blanking Panels (PN 189453-B24) contains 10 each of (4U).                                                                                                                                                                                                       |            |
|                                             | Rack Blanking Panels (5U)                                                                                                                                                                                                                                                      | 189453-B25 |
|                                             | NOTE: The Rack Blanking Panels (PN 189453-B25) contains 10 each of (5U).                                                                                                                                                                                                       |            |
|                                             | 9000/10000 Series 42U Offset Baying Kit                                                                                                                                                                                                                                        | 248931-B21 |
|                                             | NOTE: This kit can be used to connect 9000 and 10000 series racks of the same U height together. Kit contents include hardware for connecting racks and a panel to cover the 100mm gap at the rear of the two racks.                                                           |            |
|                                             | NOTE: For additional information regarding Rack Cabinets, please see the following URL:<br><a href="http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html">http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html</a> |            |

|                                             |                                                                                                                                                                                                                                                                                |            |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Options for<br>Compaq Rack 7000 Series | High Air Flow Rack Door Insert for the 7122 Rack                                                                                                                                                                                                                               | 157847-B21 |
|                                             | High Air Flow Rack Door Insert for the 7142 Rack (single)                                                                                                                                                                                                                      | 327281-B21 |
|                                             | High Air Flow Rack Door Insert for the 7142 Rack (6-pack)                                                                                                                                                                                                                      | 327281-B22 |
|                                             | Compaq Networking Cable Management Kit                                                                                                                                                                                                                                         | 292407-B21 |
|                                             | Compaq Rack Extension Kit for 7142                                                                                                                                                                                                                                             | 154392-B21 |
|                                             | NOTE: For additional information regarding Rack Cabinets, please see the following URL:<br><a href="http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html">http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html</a> |            |





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### Rack Options for Rack 7000, 9000 and 10000 Series

|                                                                                                                                                                                  |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Ballast Option Kit                                                                                                                                                               | 120672-B21 |
| Rack Rail Adapter Kit (25-inch depth)                                                                                                                                            | 120675-B21 |
| Cable Management D-Rings Kit                                                                                                                                                     | 168233-B21 |
| Monitor/Utility Shelf - Graphite                                                                                                                                                 | 253449-B21 |
| Depth Adjustable Fixed Rail                                                                                                                                                      | 332558-B21 |
| Input Device Adjustable Rails                                                                                                                                                    | 287139-B21 |
| NOTE: Input Device Adjustable Rails (287139-B21) are for use ONLY with the TFT5110R, TFT5600RKM and integrated keyboard/drawer which is used in mounting into third party racks. |            |
| Input Device Telco Rails                                                                                                                                                         | 287138-B21 |
| NOTE: Input Device Telco Rails (287138-B21) are for use ONLY with the TFT5110R, TFT5600RKM and integrated keyboard/drawer which is used in mounting into third party racks.      |            |
| Console Management Controller (CMC) Option Kit                                                                                                                                   | 203039-B21 |
| Console Management Controller (CMC) Sensors Option Kit                                                                                                                           | 203039-B22 |
| Console Management Controller (CMC) Locking Option Kit                                                                                                                           | 203039-B23 |
| Console Management Controller (CMC) Smoke Sensors Option Kit                                                                                                                     | 203039-B24 |
| Server Console Switch 1 x 2 port (100 to 230 VAC)                                                                                                                                | 120206-001 |
| Server Console Switch 1 x 4 port (100 to 230 VAC)                                                                                                                                | 400336-001 |
| Server Console Switch 1 x 8 port (100 to 230 VAC)                                                                                                                                | 400337-001 |
| Server Console Switch 1 x 2 port (100 to 230 VAC)                                                                                                                                | 400338-001 |
| Server Console Switch 2 x 8 port (48 VDC)                                                                                                                                        | 400542-B21 |
| KVM 9 PIN Adapter (4 Pack)                                                                                                                                                       | 149361-B21 |
| CPU to Server Console Cable, 12'                                                                                                                                                 | 110936-B21 |
| CPU to Server Console Cable, 20'                                                                                                                                                 | 110936-B22 |
| CPU to Server Console Cable, 40'                                                                                                                                                 | 110936-B23 |
| CPU to Server Console Cable, 3'                                                                                                                                                  | 110936-B24 |
| CPU to Server Console Cable, 7'                                                                                                                                                  | 110936-B25 |
| CPU to Server Console Cable (Plenum Rated) 20'                                                                                                                                   | 149363-B21 |
| CPU to Server Console Cable (Plenum Rated) 40'                                                                                                                                   | 149364-B21 |
| Switch Box Connector Kit (115 V)                                                                                                                                                 | 144007-001 |
| Switch Box Connector Kit (230 V)                                                                                                                                                 | 144007-002 |
| TFT5600 RKM (Rack-mount Keyboard Monitor)                                                                                                                                        | 221546-001 |
| 1U Rack Keyboard & Drawer                                                                                                                                                        | 257054-001 |

NOTE: For additional information regarding Rack Cabinets, please see the following URL:  
<http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html>

### Service and Support Offerings (Care Pack Services)

|                                                                                           |            |
|-------------------------------------------------------------------------------------------|------------|
| <b>Hardware Services 4-Hour On-site Service</b>                                           |            |
| 4-Hour On-site Service, 5-Day x 9-Hour Coverage,<br>3 Years (6-3 Part Number for U.S.)    | 401783-002 |
| 4-Hour On-site Service, 5-Day x 9-Hour Coverage,<br>3 Years (6-3 Part Number for Canada)  | 401783-122 |
| 4-Hour On-site Service, 7-Day x 24-Hour Coverage,<br>3 Years (6-3 Part Number for U.S.)   | 401782-002 |
| 4-Hour On-site Service, 7-Day x 24-Hour Coverage,<br>3 Years (6-3 Part Number for Canada) | 401782-122 |
| 4-Hour On-site Service, 5-Day x 9-Hour Coverage,<br>3 Years (6-3 Part Number for U.S.)    | 401783-002 |



### Options

#### Installation & Start-up Services

Hardware Installation (2-5-2 Part Number for Canada)

FP-MIINS-IN

Hardware Installation (6-3 Part Number for US)

401793-002

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Win NT Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (2-5-2 Part Number for Canada.)

FM-MSTEC-03

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Win NT Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (6-3 Part Number for U.S.)

240015-002

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Novell NetWare Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (2-5-2 Part Number for Canada)

FM-NSTEC-03

Pre-installation planning; unpack equipment, install most current Compaq HW options internal to server at same time of server installation; assemble & test; basic user information provided; Install & configure basic functionality of Novell NetWare Operating System plus up to 1 day start-up activity, configure print & network access services, and orientation (6-3 Part Number for U.S.)

240010-002

#### Care Pack Priority Services for ProLiant Servers – Priority Level

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Next Available Specialist (2-5-2 Part Number for Canada)

FM-M01E3-36

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Next Available Specialist (6-3 Part Number for U.S.)

239936-002

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Novell NetWare Operating System, Next Available Specialist (2-5-2 Part Number for Canada)

FM-N01E3-36

9 x 5 HW, 4-hr response, Next Available HW engineer; 9 x 5 Bronze Software Support 2-hr response for Novell NetWare Operating System, Next Available Specialist (6-3 Part Number for U.S.)

239976-002

#### Care Pack Priority Services for ProLiant Servers – Priority 24 Level

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Bronze Software Support, 2-hr response for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Next Available Specialist (6-3 Part Number for U.S.)

239938-002

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Bronze Software Support, 2-hr response for Novell NetWare Operating System, Next Available Specialist (6-3 Part Number for U.S.)

239978-002



### Options

#### Care Pack Priority Services for ProLiant Servers - Priority Silver

|                                                                                                                                                                                                                                                                                                                                                                      |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review (2-5-2 Part Number for Canada)              | FM-M04E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System Operating System, Technical Account Manager, Technical Newsletter, SW activity review (6-3 Part Number for U.S.) | 239940-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (6-3 Part Number for U.S.)                                                                                                                                                               | 239942-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (2-5-2 Part Number for Canada)                                                                                                                                                           | FM-M24E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review (2-5-2 Part Number for Canada)                                                                 | FM-N04E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday – Friday, 8AM – 5PM local time, 2-hr response after hours for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review (6-3 Part Number for U.S.)                                                                     | 239980-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Novell NetWare Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                              | FM-N24E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Novell NetWare Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                  | 239982-002  |

#### Care Pack Priority Services for ProLiant Servers - Priority Gold

|                                                                                                                                                                                                                                                                                                                                                                                                                           |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (2-5-2 Part Number for Canada) | FM-M08E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (6-3 Part Number for U.S.)     | 239944-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                  | FM-M28E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                      | 239946-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (2-5-2 Part Number for Canada)                                                                                                                  | FM-N08E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (6-3 Part Number for U.S.)                                                                                                                      | 239984-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                                                                     | FM-N28E3-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                                                                         | 239986-002  |

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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Options

### Care Pack Priority Services for ProLiant Servers – Priority Gold Executive

|                                                                                                                                                                                                                                                                                                                                                                                                                           |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (2-5-2 Part Number for Canada) | FM-M09E3-36 |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive revision management, Upgrade impact planning, 2 System Healthcheck per year (6-3 Part Number for U.S.)     | 239948-002  |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                  | FM-M29E3-36 |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                      | 239950-002  |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (2-5-2 Part Number for Canada.)                                                                                                                 | FM-N09E3-36 |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Software Support, 30 minute response (critical), 1-hr response (non-critical), for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review, Upgrade impact planning (6-3 Part Number for U.S.)                                                                                                                      | 239988-002  |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                                                                     | FM-N29E3-36 |
| 24 x 7 HW, 2-hr response, Named HW engineer; 24 x 7 Gold Subsequent System Support for Novell NetWare Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                                                                                         | 239990-002  |

NOTE: For more information, customer/resellers can contact <http://www.compaq.com/services>.



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Memory

HP ProLiant DL580 G2 1.60 GHz 2P Models and 1.40 GHz 2P Models

Standard Memory

2048 MB 200MHz Double Data Rate (DDR) SDRAM (PC1600 Registered SDRAM Memory with Advanced ECC functionality)

Standard Memory Plus Optional Memory and Optional Memory board

Up to 26,624-MB memory is available with the optional installation of PC1600 Registered ECC SDRAM Memory kits and a second, optional memory board.

Standard Memory Replaced with Optional Memory and Optional memory board

Up to 32,768-MB of memory is available with the removal of the standard 2048-MB of memory, the optional installation of PC1600 Registered ECC SDRAM Memory kits, and a second, optional memory board.

NOTE: Memory must be added in banks of four DIMMs. This chart does not represent all possible memory configurations.

| Standard Memory Summary |         | Standard Memory Board (Slots) |        |        |        |       |       |       |       |
|-------------------------|---------|-------------------------------|--------|--------|--------|-------|-------|-------|-------|
|                         |         | 1                             | 2      | 3      | 4      | 5     | 6     | 7     | 8     |
| Standard                | 2048 MB | 512 MB                        | 512 MB | 512 MB | 512 MB | Empty | Empty | Empty | Empty |

| Optional Memory Summary                                                   |           | Standard Memory Board (Slots)     |         |         |         |         |         |         |         |
|---------------------------------------------------------------------------|-----------|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Optional (Standard Memory Plus Optional Memory Board and Optional Memory) | 26,624 MB | 1                                 | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
|                                                                           |           | 512 MB                            | 512 MB  | 512 MB  | 512 MB  | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                                                                           |           | Optional 2nd Memory Board (Slots) |         |         |         |         |         |         |         |
|                                                                           |           | 1                                 | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
|                                                                           |           | 2048 MB                           | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |

| Maximum Memory Summary                                                             |           | Standard Memory Board (Slots)     |         |         |         |         |         |         |         |
|------------------------------------------------------------------------------------|-----------|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Maximum (Standard Memory Replaced with Optional Memory with Optional Memory board) | 32,768 MB | 1                                 | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
|                                                                                    |           | 2048 MB                           | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                                                                                    |           | Optional 2nd Memory Board (Slots) |         |         |         |         |         |         |         |
|                                                                                    |           | 1                                 | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
|                                                                                    |           | 2048 MB                           | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |

The following memory options are available from HP:

- 1024-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 256 MB) 202170-B21
- 2048-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 512 MB) 202171-B21
- 4096-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 1024 MB) 202172-B21
- 8192-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 2048 MB) 202173-B21

Expand your memory capacity with the DL580 G2 Hot Plug Memory Expansion Board. Provides 8 additional DIMM slots for powering memory-intensive applications.

- Hot Plug Memory Expansion Board 203320-B21

HP ProLiant DL580 G2 1.40 GHz 1P Model

Standard Memory

1024 MB 200MHz Double Data Rate (DDR) SDRAM (PC1600 Registered SDRAM Memory with Advanced ECC functionality)

Standard Memory Plus Optional Memory and Optional memory board

Up to 25,600-MB memory is available with the optional installation of PC1600 Registered ECC SDRAM Memory kits and a second, optional memory board.

Standard Memory Replaced with Optional Memory and optional memory board

Up to 32,768-MB of memory is available with the removal of the standard 1024-MB of memory, the optional installation PC1600 Registered ECC SDRAM Memory kits, and a second, optional memory board.

NOTE: Memory must be added in banks of four DIMMs. This chart does not represent all possible memory configurations.

| Standard Memory Summary |         | Standard Memory Board (Slots) |        |        |        |       |       |       |       |
|-------------------------|---------|-------------------------------|--------|--------|--------|-------|-------|-------|-------|
|                         |         | 1                             | 2      | 3      | 4      | 5     | 6     | 7     | 8     |
| Standard                | 1024 MB | 256 MB                        | 256 MB | 256 MB | 256 MB | Empty | Empty | Empty | Empty |





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Memory

| Optional Memory Summary                                                   |           | Standard Memory Board (Slots)     |        |        |        |        |        |        |        |
|---------------------------------------------------------------------------|-----------|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Optional (Standard Memory Plus Optional Memory Board and Optional Memory) | 25,600 MB | 1                                 | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|                                                                           |           | 256 MB                            | 256 MB | 256 MB | 256 MB | 2048MB | 2048MB | 2048MB | 2048MB |
|                                                                           |           | Optional 2nd Memory Board (Slots) |        |        |        |        |        |        |        |
|                                                                           |           | 1                                 | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|                                                                           |           | 2048MB                            | 2048MB | 2048MB | 2048MB | 2048MB | 2048MB | 2048MB | 2048MB |

| Maximum Memory Summary                                                             |           | Standard Memory Board (Slots)     |         |         |         |         |         |         |         |
|------------------------------------------------------------------------------------|-----------|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Maximum (Standard Memory Replaced with Optional Memory with Optional Memory board) | 32,768 MB | 1                                 | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
|                                                                                    |           | 2048 MB                           | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |
|                                                                                    |           | Optional 2nd Memory Board (Slots) |         |         |         |         |         |         |         |
|                                                                                    |           | 1                                 | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
|                                                                                    |           | 2048 MB                           | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB | 2048 MB |

The following memory options are available from HP:

- |                                                                |            |
|----------------------------------------------------------------|------------|
| ● 1024-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 256 MB)  | 202170-B21 |
| ● 2048-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 512 MB)  | 202171-B21 |
| ● 4096-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 1024 MB) | 202172-B21 |
| ● 8192-MB PC1600 Registered ECC SDRAM Memory Kit (4 x 2048 MB) | 202173-B21 |

Expand your memory capacity with the DL580 G2 Hot Plug Memory Expansion Board. Provides 8 additional DIMM slots for powering memory-intensive applications.

- |                                   |            |
|-----------------------------------|------------|
| ● Hot Plug Memory Expansion Board | 203320-B21 |
|-----------------------------------|------------|

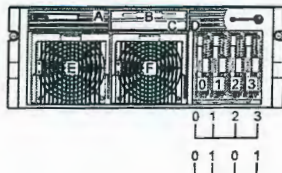




# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Storage



- A Diskette Drive eject button
- B Ejectable: 24x IDE CD-ROM (Slimline)
- C Ejectable: 1.44-MB Diskette Drive (Slimline)
- D CD-ROM Drive eject button
- E 800-Watt (low line or high line) Redundant Hot Plug Power Supply
- F 800-Watt (low line or high line) Primary Hot Plug Power Supply
- 0-3 Wide Ultra3 Drive Cage (Duplex or Simplex configurable). Duplex is standard shipping configuration

## Drive Support

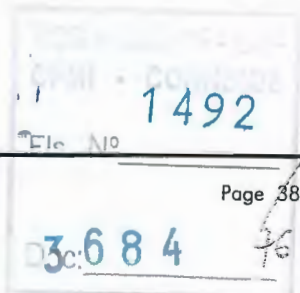
|                                            | Quantity Supported | Position Supported | Controller     |
|--------------------------------------------|--------------------|--------------------|----------------|
| <b>Ejectable Slim Line Drives</b>          |                    |                    |                |
| 1.44-MB slim-line Diskette Drive           | Up to 1            | C                  | Integrated     |
| IDE slim-line CD-ROM Drive                 | Up to 1            | B                  | Integrated IDE |
| Slimline DVD-ROM Drive (8X/24X) Option Kit | Up to 1            | B or C             | Integrated IDE |

## Hard Drives

### Ultra320 Hot Pluggable Drives

|                     | Quantity Supported | Position Supported | Controller                                                                 |
|---------------------|--------------------|--------------------|----------------------------------------------------------------------------|
| 1-inch              | Up to 4            | 0-3                | Smart Array Si Controller (integrated on system board) Ultra3 SCSI Adapter |
| 146.8-GB 10,000 rpm |                    |                    | Smart Array 532 Controller                                                 |
| 72.8-GB 10,000 rpm  |                    |                    | Smart Array 5302/128 Controller                                            |
| 36.4-GB 10,000 rpm  |                    |                    | Smart Array 5304/256 Controller                                            |
| 72.8-GB 15,000 rpm  |                    |                    | Smart Array 5312 Controller                                                |
| 36.4-GB 15,000 rpm  |                    |                    | Smart Array 641 Controller                                                 |
| 72-GB 15,000 rpm    |                    |                    | Smart Array 642 Controller                                                 |
|                     |                    |                    | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                        |
|                     |                    |                    | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter                      |
|                     |                    |                    | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                          |

NOTE: All U320 Universal Hard Drives are backward compatible to U2 or U3 speeds. U320 drives require an optional U320 Smart Array Controller or U320 SCSI HBA to support U320 transfer rates.





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Storage

### External Storage

|                                                                         | Quantity Supported                                                               | Position Supported | Controller                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| StorageWorks Enclosure 4300 Family (supports Ultra2/Ultra3 drives only) | Up to 20 (using Smart Array 5300 Controller)                                     | External           | Smart Array 532 Controller<br>Smart Array 5302/128 Controller<br>Smart Array 5304/256 Controller<br>Smart Array 5312 Controller<br>Smart Array 642 Controller<br>64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter |
| MSA 1000                                                                | Please see the MSA 1000 QuickSpecs below to determine configuration requirements | External           | Please see the MSA 1000 QuickSpecs (URL below) for the latest list of supported HBAs                                                                                                                                                                                                                                               |

MSA 1000: [http://www5.compaq.com/products/quickspecs/11033\\_no/11033\\_na.HTML](http://www5.compaq.com/products/quickspecs/11033_no/11033_na.HTML)

### Maximum Storage Capacity – (External StorageWorks Enclosure Attached)

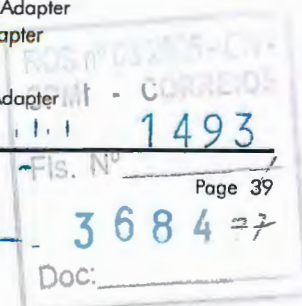
|          |                                                          |
|----------|----------------------------------------------------------|
| Internal | 587.2 GB (4 x 146.8-GB Ultra320 SCSI 1" Drives)          |
| External | 41.104 TB (20 x (14 x 146.8-GB 1" Ultra320 SCSI Drives)) |
| Total    | 41.691 TB                                                |

### Tape Drives

NOTE: For an up-to-date listing of the latest O/S Support details for each of the Tape Drives listed below, please see the following:  
[http://www5.compaq.com/products/quickspecs/North\\_America/10233.html](http://www5.compaq.com/products/quickspecs/North_America/10233.html)

NOTE: For an up-to-date listing of the latest O/S Support details for each of the Tape Storage Systems listed below, please see the following:  
[http://www5.compaq.com/products/quickspecs/North\\_America/10809.html](http://www5.compaq.com/products/quickspecs/North_America/10809.html)

|                                    | Quantity Supported    | Position Supported | Controller                                                                                                                                                                                                                                                                                                                         |
|------------------------------------|-----------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal AIT 100-GB, Hot Plug      | Up to 1               | 0 & 1 or 2 & 3     | Smart Array 5i Controller (integrated on system board)                                                                                                                                                                                                                                                                             |
| Internal AIT 50-GB, Hot Plug       |                       |                    | Smart Array 532                                                                                                                                                                                                                                                                                                                    |
| Internal AIT 35-GB, LVD, Hot Plug  |                       |                    | *NOTE: The Smart Array 532 Controller does not support the AIT 100-GB Hot Plug Tape Drive.                                                                                                                                                                                                                                         |
| Internal 20/40-GB DAT, Hot Plug    |                       |                    | Smart Array 5302/128 Controller<br>Smart Array 5304/256 Controller<br>Smart Array 5312 Controller<br>Smart Array 641 Controller<br>Smart Array 642 Controller<br>64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter |
| External AIT 50-GB Tape Drive      | Up to 2               | External           | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                                                                                                                                                                                                                                                                |
| External AIT 35-GB, LVD Tape Drive |                       |                    | 64-Bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                                                                                                                                                                                         |
| External DAT 72 Tape Drive         |                       |                    |                                                                                                                                                                                                                                                                                                                                    |
| SDLT 110/220-GB, External          | Up to 2               | External           | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                                                                                                                                  |
| SDLT 160/320-GB, External          |                       |                    |                                                                                                                                                                                                                                                                                                                                    |
| DLT VS 40/80-GB, External          | Up to 3               | External           | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                                                                                                                                  |
| External 40/80-GB DLT Enhanced     |                       |                    |                                                                                                                                                                                                                                                                                                                                    |
| External 20/40-GB DLT              |                       |                    |                                                                                                                                                                                                                                                                                                                                    |
| HP StorageWorks AIT 35 GB          | Up to 1 (for a single | External           | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                                                                                                                                                                                                                                                                |





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Storage

|                                                                                                                                                                                                                                                                                                                 |                                                                                                 |          |                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Autoloader                                                                                                                                                                                                                                                                                                      | HBA)<br>Up to 2 (for o dual<br>HBA)                                                             |          | 64-bit/66-MHz Single Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                    |
| SSL2020 AIT Mini-Library                                                                                                                                                                                                                                                                                        | 2 drives per SCSI<br>channel                                                                    | External | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>SAN Access Module for Smart Array 5302 Controller<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter |
| SSL1016 tape autoloader                                                                                                                                                                                                                                                                                         | Up to 2                                                                                         | External | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter<br>64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                      |
| MSL5026DLX (40/80GB DLT-<br>based)<br>MSL5026SL (SDLT-based)<br>Library<br>MSL5052SL (SDLT-based)<br>Library<br>MSL5052S2 (SDLT-based)<br>Library<br>MSL5030L1 (LTO-based)<br>Library<br>MSL5060L1 (LTO-based)<br>Library<br>MSL6030 (Ultrium 460<br>-based) Library<br>MSL6060 (Ultrium 460 -based)<br>Library | 2 drives per SCSI<br>channel                                                                    | External | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                                                                                           |
| ESL9322<br>ESL9322L1<br>ESL9595SL<br>ESL9595<br>ESL9595L1                                                                                                                                                                                                                                                       | Please see the ESL<br>Library QuickSpecs<br>below to determine<br>configuration<br>requirements | External | 64-bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter                                                                                                           |

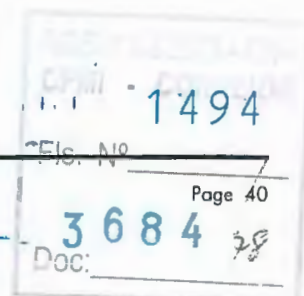
ESL9595SL: [http://www5.compaq.com/products/quickspecs/11332\\_na/11332\\_na.HTML](http://www5.compaq.com/products/quickspecs/11332_na/11332_na.HTML)

ESL9322: [http://www5.compaq.com/products/quickspecs/11628\\_na/11628\\_na.HTML](http://www5.compaq.com/products/quickspecs/11628_na/11628_na.HTML)

ESL9322L1: [http://www5.compaq.com/products/quickspecs/11445\\_na/11445\\_na.HTML](http://www5.compaq.com/products/quickspecs/11445_na/11445_na.HTML)

ESL9595: [http://www5.compaq.com/products/quickspecs/11629\\_na/11629\\_na.HTML](http://www5.compaq.com/products/quickspecs/11629_na/11629_na.HTML)

ESL9595L1: [http://www5.compaq.com/products/quickspecs/11435\\_na/11435\\_na.HTML](http://www5.compaq.com/products/quickspecs/11435_na/11435_na.HTML)



# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## Power Specifications

|                                         |                  |
|-----------------------------------------|------------------|
| Part Number                             | 278535-001       |
| Spare Kit                               | 192201-B21       |
| Operational Input Voltage Range (V rms) | 90 to 264        |
| Frequency Range (Nominal) (Hz)          | 47 to 63 (50/60) |

|                                        |      |      |      |      |      |      |
|----------------------------------------|------|------|------|------|------|------|
| Nominal Input Voltage (Vrms)           | 100  | 115  | 208  | 220  | 230  | 240  |
| Max Rated Output Wattage Rating        | 800  | 800  | 800  | 800  | 800  | 800  |
| Nominal Input Current (A rms)          | 11.7 | 9.9  | 5.2  | 4.9  | 4.7  | 4.5  |
| Max Rated Input Wattage Rating (Watts) | 1143 | 1111 | 1067 | 1067 | 1067 | 1053 |
| Max. Rated VA (Volt-Amp)               | 1166 | 1134 | 1088 | 1088 | 1088 | 1074 |
| Efficiency (%)                         | 70   | 72   | 75   | 75   | 75   | 76   |
| Power Factor                           | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Leakage Current (mA)                   | .43  | .50  | .90  | .96  | 1.00 | 1.04 |
| Maximum Inrush Current (A peak)        | 25   | 25   | 25   | 25   | 25   | 25   |
| Maximum Inrush Current duration        | 20   | 20   | 20   | 20   | 20   | 20   |

## System Specifications

DL580 G2 Fully Configured

Up to 4 Processors, 16 Memory Slots, 4 Hard Drives, 6 PCI Slots, and 2 Hot Plug Power Supplies

|                                                          |                                          |      |      |                                            |      |      |
|----------------------------------------------------------|------------------------------------------|------|------|--------------------------------------------|------|------|
| Nominal Input Voltage (Vrms)                             | 100                                      | 115  | 208  | 220                                        | 230  | 240  |
| Fully Loaded System Input Wattage (W)                    | 954                                      | 928  | 890  | 890                                        | 890  | 879  |
| Fully Loaded System Input Current (A rms)                | 10                                       | 8.5  | 4.4  | 4.1                                        | 4.0  | 3.7  |
| Fully Loaded System Thermal (BTU- Hr)                    | 3253                                     | 3163 | 3063 | 3063                                       | 3063 | 2996 |
| Fully Loaded System VA (Volt-Amp)                        | 1004                                     | 976  | 909  | 909                                        | 909  | 897  |
| System Leakage with all power supplies loaded (mA)       | .87                                      | 1.00 | 1.81 | 1.91                                       | 2.00 | 2.09 |
| System Inrush Current with all power supplies loaded (A) | 50                                       | 50   | 50   | 50                                         | 50   | 50   |
| Power cord requirements                                  | Nema 5-15P to IEC320-C19                 |      |      | Option no./Spare no: 235603-001/237457-001 |      |      |
|                                                          | PDU Jumper Cord IEC320-C19 to IEC320-C20 |      |      | Option no./Spare no: 295633-B21/295508-001 |      |      |
|                                                          | PDU Jumper Cord IEC320-C14 to IEC320-C19 |      |      | Option no./Spare no: 291034-001/292241-001 |      |      |

### NOTES:

ActiveAnswers Power Calculation

Power calculator is LIVE on ActiveAnswers website. This is an external link.

Follow this link:

<http://h30099.www3.hp.com/configurator/powercalcs.asp>

To drill down to calculators:

- Click on: "ProLiant Servers"
- Click on the Server of interest. Example: DL580 G2
- Click on: "Power Calculator" link (You may need to scroll down to see it.)





# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## TechSpecs

### System Unit Rack

Chassis Footprint (HxWxD) 6.94 x 19 x 26.5 in/17.6 x 48.3 x 67.3 cm

Weight 66 lb/29.9 kg

No hard drives installed,  
one power supply

#### Input Requirements

Rated Input Voltage 100 to 120 VAC/  
200 to 240 VAC

Rated Input Frequency 50 to 60 Hz

Input Power 1135W @ 110 VAC/  
1125W @ 220 VAC

Rated Input Current 12A (100 VAC),  
9.8A (120 VAC),  
4.9A (220 VAC)

Max BTU Rating 4000 BTU

Power Supply Output Rated Steady-State Power 800W/800W (lowline/highline)

Power (per power supply) Maximum Peak Power 800W/800W (lowline/highline)

Temperature Range Operating 50° to 95° F/10° to 35° C

Non-operating -20° to 140° F/-29° to 60° C

Shipping -22° to 122° F/-30° to 50° C

Relative Humidity Operating 10% to 70%

(non-condensing) Non-operating 5% to 95%

Maximum Wet Bulb 101.7°F/38.7°C

Temperature

Acoustic Noise

NOTE: Listed are the declared A-weighted sound power levels LWAd and the declared average bystander position sound pressure levels LpAm when operating in a 23° C ambient environment. Noise emissions were measured in accordance with ECMA 74 and declared in accordance with ECMA 109.

Idle (Fixed Disk Drives  
Spinning)

LWAd (BELS) 7.0

LpAm (dBA) 54

NOTE: These values apply to 2U rack configuration. Configuration tested included 2 processors, two 10,000 rpm hard drive, 1 power supplies, 1 power supply fan and 4 CPU fans.

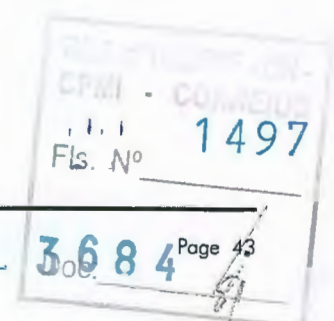


# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## TechSpecs

|                        |                                                     |                                                                                                                   |
|------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 1.44-MB Diskette Drive | Size                                                | 3.5 in                                                                                                            |
|                        | LED Indicators (front panel)                        | Green                                                                                                             |
|                        | Read/Write Capacity per Diskette (high/low density) | 1.44 MB/720 KB formatted                                                                                          |
|                        | Drive Supported                                     | One                                                                                                               |
|                        | Drive Height                                        | One-third                                                                                                         |
|                        | Drive Rotation                                      | 300 rpm                                                                                                           |
|                        | Transfer Rate Synchronous (Maximum) (high/low)      | 500/250 KB/s                                                                                                      |
|                        | Bytes/Sector                                        | 512                                                                                                               |
|                        | Sectors/Track (high/low)                            | 18/9                                                                                                              |
|                        | Tracks/Side (high/low)                              | 80/80                                                                                                             |
|                        | Access Times                                        | Track-to-Track (high/low) 3/6 ms<br>Average (high/low) 169/94 ms<br>Settling Time 15 ms<br>Latency Average 100 ms |
|                        | Cylinders (high/low)                                | 80/80                                                                                                             |
|                        | Read/Write Heads                                    | Two                                                                                                               |



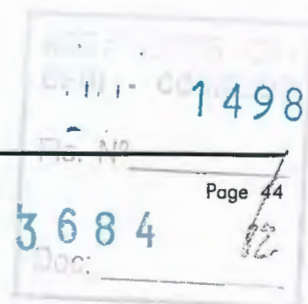


# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## TechSpecs

|                              |                  |                                               |
|------------------------------|------------------|-----------------------------------------------|
| 24X Max (or higher) IDE Disk | Applicable Disk  | CD-DA, CD-ROM (Mode 1 and 2)                  |
| CD-ROM Drive Slim Line       |                  | CD-XA, CD-I (Mode 2, Form 1 and 2)            |
|                              |                  | Photo CD (Single and Multi-session)           |
|                              |                  | Mixed Mode (Audio and Data combined)          |
|                              | Capacity         | 540 MB (Mode 1, 12 cm)                        |
|                              |                  | 650 MB (Mode 2, 12 cm)                        |
|                              | Diameter         | 4.7 x 3.15 in/12 x 8 cm                       |
|                              | Rotational Speed | 4200 rpm maximum                              |
|                              | Center Hole      | 0.6 in/15 mm diameter                         |
|                              | Thickness        | 1.2 mm                                        |
|                              | Track Pitch      | 1.6 $\mu$ m                                   |
| Block Size                   | Mode 1           | 2,048                                         |
|                              | Mode 2           | 2,340, 2,336, 1,024 bytes                     |
|                              | CD-DA            | 2,352 bytes                                   |
|                              | CD-XA            | 2,328 bytes                                   |
| Interface                    | IDE (ATAPI)      |                                               |
| Access Times (typical)       | Random           | 100 ms                                        |
|                              | Full-Stroke      | 2000 ms                                       |
| Audio Output Level           | Line-Out         | 0.7 VRMS at 47 kOhms                          |
|                              | Headphone        | 0.6 VRMS at 32 kOhms (maximum volume)         |
| Data Transfer Rate           | Sustained        | 150 KB/s (sustained 1X)                       |
|                              | Burst            | 2100 to 3600 KB/s                             |
| Cache Buffer                 | 128 KB           |                                               |
| Start-up Time (typical)      | < 7seconds       |                                               |
| Stop Time                    | < 4seconds       |                                               |
| Laser Parameters             | Type             | Semiconductor Laser GaAlAs                    |
|                              | Wave Length      | 780 $\pm$ 25 nm                               |
|                              | Divergence Angle | 53.5° $\pm$ 1.5°                              |
|                              | Output Power     | 0.14 mW                                       |
| Operating Conditions         | Temperature      | 41° to 113°F/5° to 45°C                       |
|                              | Humidity         | 10% to 80%                                    |
| Dimensions                   | (HxWxD, maximum) | 1.69 x 5.75 x 8.19 in/<br>4.29 x 15 x 20.8 cm |
|                              | Weight           | 2.66 lb/1.2 kg                                |



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## TechSpecs

|                                                             |                                  |                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Integrated Lights-Out Standard (integrated on system board) | Architecture                     | 32-bit PCI-based health and remote management ASIC (Application Specific Integrated Circuit)                                                                                                                                                                                                                      |
|                                                             | Processor                        | 32-bit RISC processor core running at 66 MHz                                                                                                                                                                                                                                                                      |
|                                                             | Upgradability                    | Option firmware upgradable via flash ROM.                                                                                                                                                                                                                                                                         |
|                                                             | Video Support                    | Utilizes the host server's embedded video chip. Supports VGA/SVGA, 640 x 480 (256 to 16.7M colors), 800 x 600 (256 to 16.7M colors), 1024 x 768 (256 to 65K colors), 1280 x 1024 (256 colors)                                                                                                                     |
|                                                             | Interfaces                       | One Ethernet network connection (10/100 Mb/s)                                                                                                                                                                                                                                                                     |
|                                                             | Memory                           | 2-MB Flash ROM<br>8-MB SDRAM                                                                                                                                                                                                                                                                                      |
|                                                             | OperatingSystem Support          | Microsoft Windows NT 4.0 Server<br>Windows NT 4.0 Enterprise Edition<br>Windows 2000 Server<br>Windows 2000 Advanced Server<br>Red Hat 7.x,<br>SuSE 7.0,<br>Novell NetWare 5.x, 6.x                                                                                                                               |
|                                                             | Client Browser Support           | Microsoft Internet Explorer 5.5 or later.                                                                                                                                                                                                                                                                         |
|                                                             | iLO Standard Features            | Virtual Text Remote Console<br>Virtual Power Button Control<br>Dedicated LAN Connectivity<br>Automatic IP Configuration via DHCP/DNS/WINS<br>Industry Standard 128-bit Secure Sockets Layer (SSL) Security<br>IML and iLO Event Logging<br>Support for up to 12 user accounts with customizable access privileges |
|                                                             | iLO Advanced Features (optional) | Virtual Graphical Remote Console<br>Virtual Floppy Drive                                                                                                                                                                                                                                                          |



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## TechSpecs

|                                                                                                                                                                           |                                                   |                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------|
| Integrated Smart Array 5i Plus Controller                                                                                                                                 | Data Compatible with all Smart Array Controllers  | Yes                                                                      |
|                                                                                                                                                                           | Instant Upgrades to other Smart Array Controllers | Yes                                                                      |
|                                                                                                                                                                           | Consistent Software Manageability Tools           | Yes                                                                      |
|                                                                                                                                                                           | PCI-X Bus                                         | 64-bit, 100 MHz (integrated on system board)                             |
|                                                                                                                                                                           | PCI-X Peak Data Transfer Rate                     | 800 MB/s                                                                 |
|                                                                                                                                                                           | SCSI Protocols Supported                          | Ultra3, Ultra2                                                           |
|                                                                                                                                                                           | SCSI Peak Data Transfer Rate                      | 160 MB/s per channel                                                     |
| NOTE: For ProLiant servers having TWO internal drive bays on separate SCSI ports: SCSI Peak Data Transfer Rate is 320 MB/s total; 160 MB/s per channel and Channels is 2. |                                                   |                                                                          |
|                                                                                                                                                                           | Channels                                          | 2 (only one connected)                                                   |
| NOTE: For ProLiant servers having two internal drive bays on separate SCSI ports: SCSI Peak Data Transfer Rate is 320 MB/s total; 160 MB/s per channel and Channels is 2. |                                                   |                                                                          |
|                                                                                                                                                                           | SCSI Ports (external/internal)                    | 0/1                                                                      |
| NOTE: For ProLiant servers having two internal drive bays on separate SCSI ports: SCSI Peak Data Transfer Rate is 320 MB/s total; 160 MB/s per channel and Channels is 2. |                                                   |                                                                          |
|                                                                                                                                                                           | Drives Supported (maximum)                        | 2                                                                        |
| NOTE: Maximum is the total number of internal drives on each specific ProLiant server.                                                                                    |                                                   |                                                                          |
|                                                                                                                                                                           | Cache                                             | 64 MB Read and/or Write Cache                                            |
|                                                                                                                                                                           | Battery-Backed Write Cache                        | Yes, with installation of Battery-Backed Write Cache Enabler, up to 64MB |
|                                                                                                                                                                           | RAID Support                                      | 0, 1, 1+0, 5                                                             |
|                                                                                                                                                                           | Logical Drives (maximum)                          | Maximum = total number of drives                                         |
|                                                                                                                                                                           | Online Configuration                              | Yes                                                                      |
|                                                                                                                                                                           | Online Capacity Expansion                         | Yes                                                                      |
|                                                                                                                                                                           | Logical Drive Capacity Extension                  | Yes                                                                      |
|                                                                                                                                                                           | Online Stripe Size Migration                      | Yes                                                                      |
|                                                                                                                                                                           | Online RAID Level Migration                       | Yes                                                                      |
|                                                                                                                                                                           | Online Spare Support                              | Yes                                                                      |
|                                                                                                                                                                           | Automatic Data Recovery                           | Yes                                                                      |
|                                                                                                                                                                           | Drive Roaming                                     | Yes                                                                      |
|                                                                                                                                                                           | Redundant Controllers                             | No                                                                       |



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# QuickSpecs

HP ProLiant DL580 Generation 2 (G2)

## TechSpecs

|                                               |                       |                                                                          |                                                |
|-----------------------------------------------|-----------------------|--------------------------------------------------------------------------|------------------------------------------------|
| Compaq NC7770 PCI-X<br>Gigabit Server Adapter | Network Interface     | 10/100/1000-T                                                            |                                                |
|                                               | Compatibility         | IEEE 802.3 10Base-T<br>IEEE 802.3ab 1000Base-T<br>IEEE 802.3u 100Base-TX |                                                |
|                                               | Data Transfer Method  | 64-bit/133MHz PCI-X                                                      |                                                |
|                                               | Network Transfer Rate | 10Base-T (Half-Duplex)                                                   | 10 Mb/s                                        |
|                                               |                       | 10Base-T (Full-Duplex)                                                   | 20 Mb/s                                        |
|                                               |                       | 100Base-TX (Half-Duplex)                                                 | 100 Mb/s                                       |
|                                               |                       | 100Base-TX (Full-Duplex)                                                 | 200 Mb/s                                       |
|                                               |                       | 1000Base-T (Half-Duplex)                                                 | 1000 Mb/s                                      |
|                                               |                       | 1000Base-T (Full-Duplex)                                                 | 2000 Mb/s                                      |
|                                               | Connector             | RJ-45                                                                    |                                                |
|                                               | Cable Support         | 10Base-T                                                                 | Category 3,4 or 5 UTP<br>up to 328 ft/100 m    |
|                                               |                       | 10/100/1000Base-T                                                        | Category 5 UTP (2 pair);<br>up to 328 ft/100 m |

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## ProLiant DL380 G3

product overview

### » ProLiant home

- » new products
- » retired products
- » special promotions

### » ProLiant DL380 G3

- » product overview
- » q & a
- » quickspecs
- » cabling matrix
- » endorsements
- » benchmarks

[» site map](#)

The ProLiant DL380 G3 is the industry's most versatile 2-way rack-server, offering integrated Lights-Out management, the latest performance technologies, and high-availability features optimized for large data center deployments.

### product overview

- » key benefits
- » whats new
- » quickspecs
- » ideal environ
- » model comp:

### key benefits

The ProLiant DL380 G3 is the next generation of the award-winning dense 2-way server combines integrated Lights-Out (iLO) with the next generation of performance technologies to give customers more control and performance in the same space-saving form factor.

Features like the standard simplex/duplex backplane, six drive bays, three expansion slots (which are hot-pluggable), optional redundant power and cooling, available DC power supply, internal tape drive, and the most robust software support in the industry make this a server that meets a wide range of deployment needs.

- » Next generation performance technologies
- » Industry-leading flexibility and uptime
- » Best-in-class management

### what's new

#### better performance

- Up to 2 Intel Xeon 3.06GHz processors with 1MB L3 cache in addition to the 5
- ServerWorks GC-LE chipset, supporting a 533MHz FSB
- 3 full-length PCI-X expansion slots: 2 hot plug 100MHz and 1 133MHz
- 1GB of 2-way interleaved PC2100, running at 266MHz DDR SDRAM with Ac
- and Online Spare Memory capabilities, expandable to 12 GB
- 2 embedded NC7781 Gigabit Ethernet NIC ports
- Embedded Wide Ultra3 Smart Array 5i Plus RAID controller
- Simplex/duplex backplane, enabling the 6 internal SCSI drives to run on 1 or 2
- Optional transportable Battery-Backed Write Cache enabler for Smart Array 5i
- controller

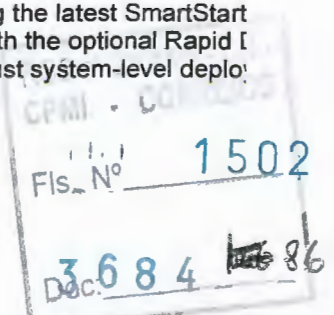
#### superior remote management

- iLO (Integrated Lights-Out) integrates the robust capabilities of the award-winning Insight Lights-Out Edition without the need to consume a slot.

#### easier ownership

- ProLiant Essentials Foundation Pack standard, including the latest SmartStart software and Insight Manager 7 manageability, along with the optional Rapid Deployment toolkit and iLO Advanced, offer customers the most robust system-level deployment and maintenance software in the industry.

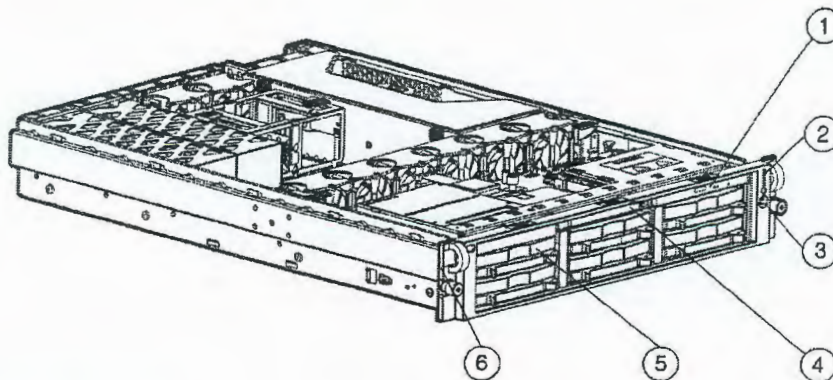
#### quickspecs



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Overview



1. 24X Max CD-ROM (with easy front ejection removal)

2. Front LEDs (show server status)

3. Unit Identification button and LED  
(for easy in rack server identification)

4. 1.44 MB (3.5") Floppy Disk Drive

5. Six 1" Wide Ultra3/Ultra320 SCSI hot plug hard drives and one AIT or  
20/40-GB DAT hot plug tape drive

6. 2U form factor

## What's New

- The ProLiant DL380 G3 is now available with the latest technologies delivering best-in-class performance
- Intel® Xeon 3.06GHz processors available in two versions to satisfy a variety of applications:
  - 3.06 GHz with 512K L2 Cache
  - 3.06 GHz with 512K L2 Cache and 1 MB L3 Cache
- 533MHz Front Side Bus
- 1 GB (expandable to 12GB on all systems greater than 2.8GHz) of 2-way interleaved PC2100 DDR SDRAM, with Advanced ECC and Online Spare capabilities

## Overview

- Windows® 2000 Model
- Integrated Lights-Out (iLO) Management standard on system board
- Five Peer PCI Architecture up to 3.06 GHz processors and a 533MHz Front Side Bus
- ServerWorks GC -LE Chipset
- Integrated Smart Array 5i Plus Controller with optional Battery-Backed Write Cache (BBWC) Enabler option kit
- Three available 64-bit PCI-X slots, including two hot pluggable 100MHz slots and one 133MHz slot
- Two NC7781 PCI-X Gigabit NICs (embedded)
- Support for up to six 1" Wide Ultra3/Ultra320 SCSI hot plug hard drives or for five hot plug hard drives and one AIT hot plug tape drive
- User configurable single/dual channel drive backplane
- Internal hot plug capacity 880.8 GB standard (6 x 146.8 GB 1" HD)
- 400-Watt Hot Plug Power Supply (with optional redundancy)
- Hot Pluggable Fans (with optional redundancy)
- Sliding rails and cable management arm for easy serviceability and in-rack tool-less access to major components
- Automatic Server Recovery (ASR), ROM Based Setup Utility (RBSU), Insight Manager 7, Status LEDs including system health and UID and SmartStart
- Protected by HP Services, including a three-year, Next Business Day, on-site limited Global warranty and extended Pre-Failure Warranty, which covers processors, memory, and hard drives - Certain restrictions and exclusions apply. Consult the HP Customer Support Center at 1-800-345-1518 for details.





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Standard Features

|                                             |                                             |
|---------------------------------------------|---------------------------------------------|
| Processor                                   | Intel Xeon Processor 3.06 GHz/533 MHz-1GB   |
| One of the following<br>depending on Model: | Intel Xeon Processor 3.06 GHz/533MHz -512KB |
|                                             | Intel Xeon Processor 2.8 GHz/400MHz -512KB  |
|                                             | Intel Xeon Processor 2.4 GHz/400MHz -512KB  |

|              |                      |
|--------------|----------------------|
| Cache Memory | 512-KB Level 2 cache |
|              | 1-MB Level 3 cache   |

|                               |                               |
|-------------------------------|-------------------------------|
| Upgradability<br>(per server) | Upgradable to dual processing |
|-------------------------------|-------------------------------|

|         |                                                                                                                                                                                                      |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chipset | ServerWorks GC -LE Chipset                                                                                                                                                                           |
|         | NOTE: For more information regarding ServerWorks, please see the following URL:<br><a href="http://www.serverworks.com/products/overview.html">http://www.serverworks.com/products/overview.html</a> |
|         | NOTE: This Web site is available in English only.                                                                                                                                                    |

|                                             |          |                                                                                                                                                                 |
|---------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Memory                                      | Standard | 1 GB of 2-way interleaved PC2100 DDR SDRAM running at 266MHz on 3.06GHz models with Advanced ECC and Online Spare capabilities                                  |
| One of the following<br>depending on Model: | Maximum  | 12 GB                                                                                                                                                           |
|                                             | Standard | 512 MB of 2-way interleaved capable PC2100 DDR SDRAM running at 200MHz on 2.8GHz models and lower, with Advanced ECC capabilities and Online Spare capabilities |
|                                             | Maximum  | 6 GB                                                                                                                                                            |

|                    |                                          |
|--------------------|------------------------------------------|
| Network Controller | Two NC7781 PCI-X Gigabit NICs (embedded) |
|--------------------|------------------------------------------|

|                 |                               |                             |
|-----------------|-------------------------------|-----------------------------|
| Expansion Slots | I/O (3 Total, 3 available)    | PCI Voltage:                |
|                 | 64-bit/100 MHz Hot Plug PCI 2 | 3.3 Volt or universal cards |
|                 | 64-bit/133 MHz Non Hot Plug 1 |                             |
|                 | PCI                           |                             |

|                    |                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Storage Controller | Smart Array 5i Plus Controller (integrated on system board)                                                                                                                                                                                        |
|                    | NOTE: For complete list of devices supported the Smart array 5i Controller see the following:<br><a href="http://www5.compaq.com/products/quickspecs/11063_na/11063_na.HTML">http://www5.compaq.com/products/quickspecs/11063_na/11063_na.HTML</a> |

|         |                          |                                                                                                                                                                                                                                                                                                                               |
|---------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Storage | Diskette Drives          | 1.44 MB                                                                                                                                                                                                                                                                                                                       |
|         | CD-ROM                   | 24x IDE CD-ROM (Universal Media Bay)                                                                                                                                                                                                                                                                                          |
|         | Hard Drives              | None                                                                                                                                                                                                                                                                                                                          |
|         |                          | NOTE: The system can be operated in single channel (using either the embedded Smart Array 5i Plus controller or a PCI-based controller) or dual channel (with the first 2 drives on 1 channel, driven by the Smart Array 5i Plus controller and 4 drives driven by either the Smart Array 5i Plus or a PCI-based controller). |
|         | Maximum Internal Storage | 880.8 GB (6 x 146.8 GB Ultra 320 1")                                                                                                                                                                                                                                                                                          |





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Standard Features

|            |                         |               |
|------------|-------------------------|---------------|
| Interfaces | Serial                  | 1             |
|            | Pointing Device (Mouse) | 1             |
|            | Graphics                | 1             |
|            | Keyboard                | 1             |
|            | External SCSI (VHDCI)   | 1             |
|            | Network RJ-45           | 3 (1 for iLO) |
|            | USB                     | 2             |

NOTE: Please see the following URL for additional information regarding USB support:  
<http://www.compaq.com/products/servers/platforms/usb-support.html>

NOTE: This Web site is available in English only.

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|          |                                                                      |
|----------|----------------------------------------------------------------------|
| Graphics | Integrated ATI Rage XL Video Controller with 8-MB SDRAM Video Memory |
|----------|----------------------------------------------------------------------|

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|             |                       |
|-------------|-----------------------|
| Form Factor | Rack (2U), (3.5-inch) |
|-------------|-----------------------|

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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Standard Features

### ProLiant Essentials Foundation Pack Software

#### Insight Manager 7

Insight Manager 7 helps maximize system uptime and performance and reduces the cost of maintaining the IT infrastructure by providing proactive notification of problems before those problems result in costly downtime and reduced productivity. Insight Manager 7 is easy to set up and provides rapid access to detailed fault and performance information gathered by the Management Agents. One-click-access to the Integrated Lights-Out or Remote Insight Lights Out Edition board allows systems administrators to take full graphical control of ProLiant servers in remote locations or lights-out data centers. Finally, Insight Manager 7 in concert with the Version Control Agents and Version Control Repository Manager enables systems administrators to version manage and update system software across groups of ProLiant servers.

#### SmartStart

SmartStart is a tool that simplifies server setup, providing a rapid way to deploy reliable and consistent server configurations. For more information, please visit the SmartStart Web site at:

<http://www.hp.com/servers/smartstart>

SmartStart version supported (minimum): SmartStart 6.0.

#### Management Agents

The Management Agents form the foundation for HP's Intelligent Manageability strategy. They provide direct, browser-based access to in-depth instrumentation built into HP servers, workstations, desktops, and portables, and send alerts to Insight Manager 7 and other enterprise management applications in case of subsystem or environmental failures. For additional information about the Management Agents and other management products from, HP please visit the management website at:

<http://www.hp.com/servers/manage>

#### ActiveUpdate

ActiveUpdate is a web-based application that keeps IT managers directly connected to HP for proactive notification and delivery of the latest software updates.

#### ROMPaq, support software, and configuration utilities

The latest software, drivers, and firmware fully optimized and tested for your ProLiant server and options.

#### Survey Utility and diagnostics utilities

The most advanced configuration analysis, reporting and troubleshooting utilities used by HP and at your fingertips.

#### Optional ProLiant Essentials Value Packs

Optional software offerings that selectively extend the functionality of an Adaptive Infrastructure to address specific business problems and needs:

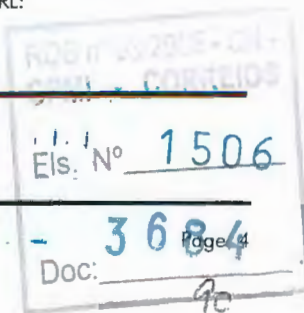
- Rapid Deployment Pack – an automated solution for multi-server deployment and provisioning, enabling companies to quickly and easily adapt to changing business demands.
- Workload Management Pack – provides easier management of complex environments, improving overall server utilization and enabling Windows 2000 customers for the first time to confidently deploy multiple applications on a single multiprocessor ProLiant Server.
- Integrated Lights-Out Advanced Pack – upgrades the Integrated Lights-Out processor to full virtual presence and control with graphical console and virtual media.
- Recovery Server Option Pack – entry-level high availability software that will provide reliable protection and increased uptime against server hardware and operating system failures.
- Performance Management Pack – a performance management solution that identifies and explains hardware performance bottlenecks on ProLiant servers and attached options enabling users to better utilize their valuable resources.

NOTE: Flexible and volume quantity license kits are available for ProLiant Essentials Value Packs. Refer to <http://www.hp.com/servers/proliantessentials> or the various ProLiant Essentials Value Pack product QuickSpecs for more information.

NOTE: For more information regarding ProLiant Essentials Software, please see the following URL:

<http://www.hp.com/servers/proliantessentials>

NOTE: These Web sites are available in English only.



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Standard Features

Industry Standard Compliance

- ACPI 1.0b Compliant
- PCI 2.2 Compliant
- WOL Support
- Microsoft® Logo certifications
- USB 1.1

## Manageability

- Insight Manager 7
- Redundant ROM
- Remote Flash ROM
- Integrated Lights Out Support
- Management Agent
- Automatic Server Recovery (ASR)
- Remote Insight Lights-Out Edition II (optional)
- Integrated Management Log
- Drive Parameter Tracking (with Smart Array Controllers)
- Dynamic Sector Repairing (with Smart Array Controllers)
- Hot Spare Boot

(NOTE: Upon the event of a failed processor or VRM in a multi-processing environment, the system will automatically reboot and use the remaining good processor(s).)

Pre-Failure Warranty (covers processors, hard drives and memory)

## Security

- Power-on password
- Keyboard password
- Diskette drive control
- Diskette boot control
- QuickLock, Network Server Mode
- Serial interface control
- Administrator's password
- Disk configuration lock

## Server Power Cords

One Lowline NEMA power cord and One Highline IEC Power cord ships standard

## Power Supply

400 Watt, CE Mark Compliant

Optional Hot Plug AC Redundant Power Supply and DC Redundant Power Supply

## System Fans

5 fans ship standard. 8 total supported internally

NOTE: The additional 3 fans are available via Option Kit (PN 293048-B21).

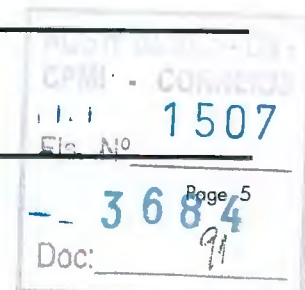
## Required Cabling

For required cabling information, refer to the Web site at:  
<http://www.compaq.com/products/servers/proliantDL380>

NOTE: This Web site is available in English only.

## HP Factory Express Capabilities

HP Factory Express gives you the flexibility to choose from a full menu of factory capabilities all in one manufacturing facility, in one process, with one touch giving you full control and access to HP's World class manufacturing facility anytime. This approach provides you the speed to deploy your IT needs, with total quality assurance, reliability, and predictability to lower your total cost of ownership by letting HP install, rack, and customize your software and hardware options for you.





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Standard Features

### OS Support

Microsoft Windows NT® Server  
Microsoft Windows 2000  
Novell NetWare  
Caldera OpenUNIX 8  
LINUX (Red Hat, SuSE)

NOTE: For a more complete and up-to-date listing of supported OSs and versions, please visit our OS Support Matrix at:  
[ftp://ftp.compaq.com/pub/products/servers/os-support-matrix-310.pdf](http://ftp.compaq.com/pub/products/servers/os-support-matrix-310.pdf).

NOTE: For an up-to-date listing of the latest drivers available for the ProLiant DL380 G3, please see:  
<http://www.compaq.com/support/files/server/us/index.html>.

NOTE: For a more complete and up-to-date information on Linux support, please visit HP Linux Web site at:  
<http://h18000.www1.hp.com/products/servers/linux/hpLinuxcert.html>

NOTE: These Web sites are available in English only.

### Rack Airflow Requirements

#### ● Rack 9000 and 10000 series Cabinets

The increasing power of new high-performance processor technology requires increased cooling efficiency for rack-mounted servers. The 9000 and 10000 Series Racks provide enhanced airflow for maximum cooling, allowing these racks to be fully loaded with servers using the latest processors.

#### ● Rack 7000 series Cabinets

When installing a server with processors running at speeds of 550 MHz or greater in Rack 7000 series racks with glass doors (165753-001 (42U), and 163747-001 (22U)), the new processor technology requires the installation of High Airflow Rack Door Inserts (327281-B21 (42U), 327281-B22 (42U 6 pack), or 157847-B21 (22U)) to promote enhanced airflow for maximum cooling.

CAUTION: If a third-party rack is used, observe the following additional requirements to ensure adequate airflow and to prevent damage to the equipment:

- Front and rear doors: If your 42U server rack includes closing front and rear doors, you must allow 830 square inches (5,350 sq cm) of hole evenly distributed from top to bottom to permit adequate airflow (equivalent to the required 64 percent open area for ventilation).
- Side: The clearance between the installed rack component and the side panels of the rack must be a minimum of 2.75 inches (7 cm).

CAUTION: Always use blanking panels to fill all remaining empty front panel U-spaces in the rack. This arrangement ensures proper airflow. Using a rack without blanking panels results in improper cooling that can lead to thermal damage.

NOTE: For additional information, refer to the Setup and Installation Guide or the Documentation CD provided with the server, or to the server documentation located in the Support section at the following URL:

<http://www5.compaq.com/products/servers/proliantdl380/index.html>

NOTE: This Web site is available in English only.

### Rack Kit

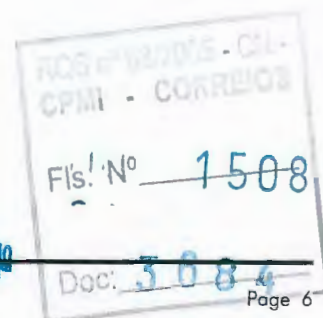
Tool-free support for racks with square mounting holes (including Compaq/HP 7000, 9000, 10000 and H9 series), with an adjustment range of 24" - 36".

### Telco Rack Support

#### DL380 G3 Telco Rack Kit:

Support for all 2-post Telco racks requires the use of the standard rack kit and an additional option kit from Rack Solutions (<http://www.racksolutions.com/hp>)

NOTE: This Web site is available in English only.



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Standard Features

### HP Factory Express Capabilities

HP Factory Express gives you the flexibility to choose from a full menu of factory capabilities all in one manufacturing facility, in one process, with one touch giving you full control and access to HP's World class manufacturing facility anytime. This approach provides you the speed to deploy your IT needs, with total quality assurance, reliability, and predictability to lower your total cost of ownership by letting HP install, rack, and customize your software and hardware options for you.

NOTE: Factory Express Engineered Solution Level 6 is a custom solutions available through Factory Express. Please contact a your local reseller or Account Manager.

### Service and Support

HP Services provides a three-year, limited warranty, including Pre-Failure Warranty (coverage of hard drives, memory and processors) fully supported by a worldwide network of resellers and service providers. HP technical assistance is available 7x24, toll free in the United States and Canada. Telephone support services may be covered under warranty or available for an additional fee.

NOTE: Limited Warranty includes 3 year Parts, 3 year Labor, 3-year on-site support.

A full range of Care Pack packaged hardware and software services:

- Installation and start up
- Extended coverage hours and enhanced response times
- System management and performance services
- Availability and recovery services

NOTE: For more information, customer/resellers can contact: <http://www.hp.com/services/carepack>

Please see the following URL regarding Warranty Information For Your HP Products:  
[http://www.compaq.com/support/warranty\\_upgrades/web\\_statements/176738.html](http://www.compaq.com/support/warranty_upgrades/web_statements/176738.html).

For additional information regarding Worldwide Limited Warranty and Technical Support, please see the following URL:  
<ftp://ftp.compaq.com/pub/supportinformation/ejourney/176738.pdf>.

NOTE: These Web sites are available in English only.

NOTE: Certain restrictions and exclusions apply. Consult the HP Customer Support Center at 1-800-345-1518 for details



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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Models

DL380R03 X3.06-  
1MB/533, 1GB  
333704-001

|                    |                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Processor          | (1) Intel Xeon Processor 3.06 GHz standard (up to 2 supported)                                                                    |
| Cache Memory       | 1-MB level 3 cache                                                                                                                |
| Memory             | 1 GB (Standard) to 12 GB (Maximum) of 2-way interleaved capable PC2100 DDR SDRAM running at 266MHz with Advanced ECC capabilities |
| Network Controller | (2) NC7781 PCI-X Gigabit NIC (embedded)                                                                                           |
| Storage Controller | Smart Array 5i Plus Controller (integrated on system board)                                                                       |
| Hard Drives        | None ship standard                                                                                                                |
| Internal Storage   | 880.8 GB max (with optional hard drives)                                                                                          |
| Optical Drive      | 24x IDE CD-ROM (Universal Media Bay)                                                                                              |
| Form Factor        | Rack (2U), (3.5-inch)                                                                                                             |

DL380R03 X3.06-  
1MB/533, 1GB  
310587-001

|                    |                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Processor          | (1) Intel Xeon Processor 3.06 GHz standard (up to 2 supported)                                                                     |
| Cache Memory       | 512-KB level 2 cache                                                                                                               |
| Memory             | 1 GB (Standard) to 12 GB (Maximum) of 2-way interleaved capable PC2100 DDR SDRAM running at 266MHz, with Advanced ECC capabilities |
| Network Controller | (2) NC7781 PCI-X Gigabit NIC (embedded)                                                                                            |
| Storage Controller | Smart Array 5i Plus Controller (integrated on system board)                                                                        |
| Hard Drives        | None ship standard                                                                                                                 |
| Internal Storage   | 880.8 GB max (with optional hard drives)                                                                                           |
| Optical Drive      | 24x IDE CD-ROM (Universal Media Bay)                                                                                               |
| Form Factor        | Rack (2U), (3.5-inch)                                                                                                              |

DL380R03 X2.8-512KB,  
512MB, W2K  
331441-001

|                    |                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Processor          | (1) Intel Xeon Processor 2.8 GHz standard (up to 2 supported)                                                                       |
| Cache Memory       | 512-KB level 2 cache                                                                                                                |
| Memory             | 512 MB (Standard) to 6 GB (Maximum) of 2-way interleaved capable PC2100 DDR SDRAM running at 200MHz, with Advanced ECC capabilities |
| Network Controller | (2) NC7781 PCI-X Gigabit NIC (embedded) 10/100/1000 WOL (Wake on LAN) (embedded)                                                    |
| Storage Controller | Smart Array 5i Plus Controller (integrated on system board)                                                                         |
| Hard Drives        | None ship standard                                                                                                                  |
| Internal Storage   | 880.8 GB max (with optional hard drives)                                                                                            |
| Optical Drive      | 24x IDE CD-ROM (Universal Media Bay)                                                                                                |
| Form Factor        | Rack (2U), (3.5-inch)                                                                                                               |
| OS                 | Windows 2000 Server + 5 CALs standard with W2K model (not pre-installed)                                                            |

DL380R03 X2.8-  
512KB/400, 512MB  
301111-001

|                    |                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Processor          | (1) Intel Xeon Processor 2.8 GHz standard (up to 2 supported)                                                                       |
| Cache Memory       | 512-KB level 2 cache                                                                                                                |
| Memory             | 512 MB (Standard) to 6 GB (Maximum) of 2-way interleaved capable PC2100 DDR SDRAM running at 200MHz, with Advanced ECC capabilities |
| Network Controller | (2) NC7781 PCI-X Gigabit NIC (embedded)                                                                                             |
| Storage Controller | Smart Array 5i Plus Controller (integrated on system board)                                                                         |
| Hard Drives        | None ship standard                                                                                                                  |
| Internal Storage   | 880.8 GB max (with optional hard drives)                                                                                            |
| Optical Drive      | 24x IDE CD-ROM (Universal Media Bay)                                                                                                |
| Form Factor        | Rack (2U), (3.5-inch)                                                                                                               |



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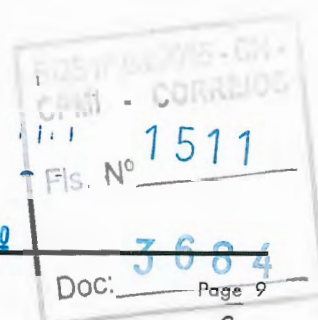
# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Models

DL380R03 X2.4-  
512KB/400, 512MB  
257917-001

|                    |                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Processor          | (1) Intel Xeon Processor 2.4 GHz standard (up to 2 supported)                                                                       |
| Cache Memory       | 512-KB level 2 cache                                                                                                                |
| Memory             | 512 MB (Standard) to 6 GB (Maximum) of 2-way interleaved capable PC2100 DDR SDRAM running at 200MHz, with Advanced ECC capabilities |
| Network Controller | (2) NC7781 PCI-X Gigabit NIC (embedded)                                                                                             |
| Storage Controller | Smart Array 5i Plus Controller (integrated on system board)                                                                         |
| Hard Drives        | None ship standard                                                                                                                  |
| Internal Storage   | 880.8 GB max (with optional hard drives)                                                                                            |
| Optical Drive      | 24x IDE CD-ROM (Universal Media Bay)                                                                                                |
| Form Factor        | Rack (2U), (3.5-inch)                                                                                                               |





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

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## Options

|                                     |                                                                                      |            |
|-------------------------------------|--------------------------------------------------------------------------------------|------------|
| ProLiant DL380 G3<br>Unique Options | DL380 G3 Redundant Fan Option Kit                                                    | 293048-B21 |
|                                     | NOTE: Hot Plug Redundant Fan Option Kit (PN 293048-B21) contains three fans per kit. |            |
|                                     | Hot Plug AC Redundant Power Supply Module (NEMA cord)                                | 313054-001 |
|                                     | Hot Plug AC Redundant Power Supply Module (IEC cord)                                 | 313054-B21 |

|                                                                                                                                                                                                                                                                                                            |                                                                                                           |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|------------|
| ProLiant Essentials<br>Value Pack Software                                                                                                                                                                                                                                                                 | Rapid Deployment Pack, 1 User, V1.x                                                                       | 267196-B21 |
|                                                                                                                                                                                                                                                                                                            | NOTE: This license allows 1 server to be managed and deployed via the Deployment Server.                  |            |
|                                                                                                                                                                                                                                                                                                            | Rapid Deployment Pack, 10 Users, V1.x                                                                     | 269817-B21 |
|                                                                                                                                                                                                                                                                                                            | NOTE: This license allows 10 servers to be managed and deployed via the Deployment Server.                |            |
|                                                                                                                                                                                                                                                                                                            | ProLiant Essentials Workload Management Pack (Featuring Compaq Resource Partitioning Manager version 2.0) | 303284-B21 |
|                                                                                                                                                                                                                                                                                                            | Flexible Quantity License Kit                                                                             | 302127-B21 |
|                                                                                                                                                                                                                                                                                                            | License-Only - for use with a Master License Agreement                                                    | 302128-B21 |
|                                                                                                                                                                                                                                                                                                            | ProLiant Essentials Recovery Server Option Pack                                                           | 280189-B21 |
|                                                                                                                                                                                                                                                                                                            | ProLiant Essentials Performance Management Pack v2.0, Single License                                      | 306696-B21 |
|                                                                                                                                                                                                                                                                                                            | ProLiant Essentials Integrated Lights-Out Advanced Pack                                                   | 263825-B21 |
| (Featuring: sophisticated virtual administration features for ultimate control of servers in the data centers and remote sites)                                                                                                                                                                            |                                                                                                           |            |
| NOTE: Flexible and volume quantity license kits are available for ProLiant Essentials Value Packs. Refer to <a href="http://www.hp.com/servers/proliantessentials">http://www.hp.com/servers/proliantessentials</a> or the various ProLiant Essentials Value Pack product QuickSpecs for more information. |                                                                                                           |            |
| NOTE: For more information regarding ProLiant Essentials Software, please see the following URL: <a href="http://www.hp.com/servers/proliantessentials">http://www.hp.com/servers/proliantessentials</a>                                                                                                   |                                                                                                           |            |
| NOTE: These Web sites are available in English only.                                                                                                                                                                                                                                                       |                                                                                                           |            |

|          |                             |            |
|----------|-----------------------------|------------|
| Software | HP digital asset protection | 302316-001 |
|----------|-----------------------------|------------|

|           |                                                                                                                                                                                                                                     |            |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Processor | Intel Xeon X3.06-1GB/533MHz Processor Option Kit                                                                                                                                                                                    | 333713-B21 |
|           | NOTE: The 3.06GHz processor option kits are not backwards compatible; they cannot be used to upgrade systems purchased with 2.4 or 2.8GHz processors.                                                                               |            |
|           | Intel Xeon 3.06 GHz-512KB/533MHz Processor Option Kit                                                                                                                                                                               | 257916-B21 |
|           | NOTE: The 3.06GHz processor option kits are not backwards compatible; they cannot be used to upgrade systems purchased with 2.4 or 2.8GHz processors.                                                                               |            |
|           | Intel Xeon 2.80 GHz-512KB/400MHz Processor Option Kit                                                                                                                                                                               | 257915-B21 |
|           | NOTE: This processor option kit (PN 257915-B21) is not forwards compatible; it cannot be used in systems purchased with 3.06GHz processors. This processor option kit supports the ProLiant ML370 G3 and ProLiant DL380 G3 servers. |            |
|           | Intel Xeon 2.40 GHz-512KB/400MHz Processor Option Kit                                                                                                                                                                               | 257913-B21 |
|           | NOTE: This processor option kit (PN 257913-B21) is not forwards compatible; it cannot be used in systems purchased with 3.06GHz processors. This processor option kit supports the ProLiant ML370 G3 and ProLiant DL380 G3 servers. |            |

|        |                                                                                                                    |            |
|--------|--------------------------------------------------------------------------------------------------------------------|------------|
| Memory | 512MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2 x 256 MB)                                                | 300678-B21 |
|        | 1024MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2 x 512 MB)                                               | 300679-B21 |
|        | 2048-MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x1024 MB)                                               | 300680-B21 |
|        | 4096MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x 2048 MB)                                               | 300682-B21 |
|        | NOTE: The 4096MB of Advanced ECC PC2100 DDR Memory kit (300682-B21) can only be used in 3.06GHz and faster models. |            |



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## Options

|                |                                               |            |
|----------------|-----------------------------------------------|------------|
| Optical Drives | Slimline DVD-ROM (8x24x) Option Kit (Servers) | 264007-B21 |
|                | Slimline CD-RW/DVD-ROM Combo Option Kit       | 331903-B21 |

|             |                                                   |            |
|-------------|---------------------------------------------------|------------|
| Hard Drives | <i>Ultra 320 SCSI – Universal Hot Plug</i>        |            |
|             | 36.4GB 10,000 rpm, U320 Universal Hard Drive, 1"  | 286713-B22 |
|             | 72.8GB 10,000 rpm, U320 Universal Hard Drive, 1"  | 286714-B22 |
|             | 146.8GB 10,000 rpm, U320 Universal Hard Drive, 1" | 286716-B22 |
|             | 18.2GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286775-B22 |
|             | 36.4GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286776-B22 |
|             | 72.8GB 15,000 rpm, U320 Universal Hard Drive, 1"  | 286778-B22 |

NOTE: All U320 Universal Hard Drives are backward compatible to U2 or U3 speeds. U320 drives require an optional U320 Smart Array Controller or U320 SCSI HBA to support U320 transfer rates.

NOTE: Please see the Hard Drive QuickSpecs for Technical Specifications such as capacity, height, width, interface, transfer rate, seek time, physical configuration, and operating temperature:

U320 Hard Drive QS:

[http://www5.compaq.com/products/quickspecs/11531\\_na/11531\\_na.HTML](http://www5.compaq.com/products/quickspecs/11531_na/11531_na.HTML)



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HP ProLiant DL380 Generation 3 (G3)

## Options

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Storage Controllers | Battery Backed Write Cache Enabler Option Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 255514-B21 |
|                     | Smart Array 532 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 225338-B21 |
|                     | Smart Array 5302/128 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 283552-B21 |
|                     | Smart Array 5304/256 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 283551-B21 |
|                     | Smart Array 6402/128 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 273915-B21 |
|                     | Smart Array 5312 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 238633-B21 |
|                     | Smart Array 641 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 291966-B21 |
|                     | Smart Array 642 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 291967-B21 |
|                     | RAID ADG Upgrade for Smart Array 5302                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 288601-B21 |
|                     | Ultra3 Channel Expansion Module for Smart Array 5300 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 153507-B21 |
|                     | 128-MB Cache Module for Smart Array 5302 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 153506-B21 |
|                     | 256-MB Battery-Backed Cache Module                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 254786-B21 |
|                     | NOTE: This 256-MB Battery-Backed Cache Module supports the Smart Array 5300 series controllers, MSA 1000 and the Smart Array Cluster Storage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |
|                     | 256MB Cache Upgrade for SA-6402                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 273913-B21 |
|                     | NOTE: This 256-MB Battery-Backed Cache Module upgrade kit supports the Smart Array 6400 series controller only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |
|                     | 64 MB Battery Backed Write Cache Enabler                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 291969-B21 |
|                     | NOTE: This 64 MB BBWC supports the Smart Array 641 Controller and Smart Array 642 Controller.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |
|                     | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 268351-B21 |
|                     | 64-Bit/66-MHz Dual Channel Wide Ultra3 SCSI Adapter, Alternate OS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 284688-B21 |
|                     | NOTE: Please see the following Controller or SCSI Adapter QuickSpecs for Technical Specifications such as PCI Bus, PCI Peak Data Transfer Rate, SCSI Protocols supported, SCSI Peak Data Transfer Rate, Channels, SCSI Ports, Drives supported, Cache, RAID support, and additional information:<br><a href="http://www5.compaq.com/products/quickspecs/11063_na/11063_na.HTML">http://www5.compaq.com/products/quickspecs/11063_na/11063_na.HTML</a> (Smart Array 5i Plus)<br><a href="http://www5.compaq.com/products/quickspecs/10851_na/10851_na.HTML">http://www5.compaq.com/products/quickspecs/10851_na/10851_na.HTML</a> (Smart Array 532)<br><a href="http://www5.compaq.com/products/quickspecs/10640_na/10640_na.HTML">http://www5.compaq.com/products/quickspecs/10640_na/10640_na.HTML</a> (Smart Array 5300 Series)<br><a href="http://www5.compaq.com/products/quickspecs/11328_na/11328_na.HTML">http://www5.compaq.com/products/quickspecs/11328_na/11328_na.HTML</a> (Smart Array 5312)<br><a href="http://www5.compaq.com/products/quickspecs/11587_na/11587_na.HTML">http://www5.compaq.com/products/quickspecs/11587_na/11587_na.HTML</a> (Smart Array 6402)<br><a href="http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML">http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML</a> (Smart Array 641)<br><a href="http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML">http://www5.compaq.com/products/quickspecs/11563_na/11563_na.HTML</a> (Smart Array 642)<br><a href="http://www5.compaq.com/products/quickspecs/10429_na/10429_na.HTML">http://www5.compaq.com/products/quickspecs/10429_na/10429_na.HTML</a> (SCSI Adapter)<br><a href="http://www5.compaq.com/products/quickspecs/11555_na/11555_na.HTML">http://www5.compaq.com/products/quickspecs/11555_na/11555_na.HTML</a> (U320 Adapter) |            |
| Communications      | NC3134 Fast Ethernet NIC 64 PCI Dual Port 10/100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 138603-B21 |
|                     | NC3135 Fast Ethernet Module Dual 10/100 Upgrade Module for NC3134                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 138604-B21 |
|                     | NC6170 Dual Port PCI-X 1000SX Gigabit Server Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 313879-B21 |
|                     | NC6770 PCI-X Gigabit Server Adapter, 1000-SX                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 244949-B21 |
|                     | NC7131 Gigabit Server Adapter, 64-bit/66Mhz, PCI, 10/100/1000-T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 158575-B21 |
|                     | NC7132 10/100/1000-T Upgrade Module for NC3134                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 153543-B21 |
|                     | NC7170 Dual Port PCI-X 1000T Gigabit Server Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 313881-B21 |
|                     | NC7770 PCI-X Gigabit Server Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 244948-B21 |
|                     | NOTE: Any NC31XX, NC61XX, NC71XX or NC77XX NIC can be used for redundancy with the embedded NC7781 Network Controller.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
| Redundant Options   | DC Power Supply for the DL380 (48V)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 268290-B21 |
|                     | NOTE: The ProLiant DL380 G3 ships standard with a 100-240 volt auto-switching AC power supply. Each 48-volt DC option kit (PN 268290-B21) contains one power supply. Therefore, to convert to redundant DC power supplies, two must be purchased.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Options

|                   |                                                       |            |
|-------------------|-------------------------------------------------------|------------|
| Redundant Options | Hot Plug AC Redundant Power Supply Module (NEMA cord) | 313054-001 |
|                   | Hot Plug AC Redundant Power Supply Module (IEC cord)  | 313054-B21 |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Management Options | Remote Insight Lights-Out Edition II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 227251-001 |
|                    | <p>NOTE: USB Virtual Media Not Supported.</p> <p>NOTE: The RILOE II USB Virtual Media feature is not supported on the 2.40 and 2.80 GHz versions of the ProLiant DL380 G3 and ProLiant ML370 G3 servers. The RILOE II cannot be used to connect the local client floppy and CD devices as USB virtual devices to the remote server. All other RILOE II features are supported on these servers. The non-USB based RILOE II Virtual Floppy feature is still supported, allowing you to perform functions such as remote ROM upgrades and server deployment. The Virtual Floppy feature requires loading the floppy image in to the RILOE II. For more details, please refer to the user guide of the RILOE II.</p> |            |

|          |                                                                             |            |
|----------|-----------------------------------------------------------------------------|------------|
| Security | HP/Atalla AXL600L SSL Accelerator Card for ProLiant Servers                 | 524545-B21 |
|          | Compaq AXL300 Accelerator PCI Card (HW SSL Encryption) for ProLiant Servers | 227933-B21 |

## Monitors

### Essential Series

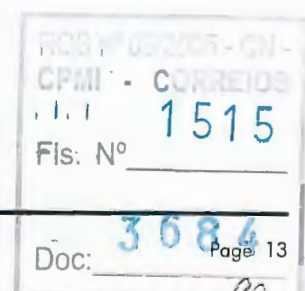
|                                                            |            |
|------------------------------------------------------------|------------|
| Compaq S9500 CRT Monitor (19-inch, Carbon/Silver)          | 261615-003 |
| Compaq S7500 CRT Monitor (17-inch, Carbon/Silver)          | 261606-001 |
| Compaq S5500 CRT Monitor (15-inch Carbon/Silver)           | 261602-001 |
| Compaq TFT1501 Flat Panel Monitor (15-inch, Carbon/Silver) | 301042-003 |
| Compaq TFT1701 Flat Panel Monitor (17-inch, Carbon/Silver) | 292847-003 |

### Advantage Series

|                                                                                                   |            |
|---------------------------------------------------------------------------------------------------|------------|
| Compaq V7550 CRT Color Monitor (17-inch, Carbon/Silver)                                           | 261611-003 |
| Compaq TFT1720 Flat Panel Monitor (17-inch, Carbon/Silver)                                        | 295926-003 |
| Compaq FT1720M Flat Panel Monitor (17-inch, Carbon/Silver, includes speaker, USB port, headphone) | 301958-003 |
| Compaq TFT1520 Flat Panel Monitor (15-inch, Carbon/Silver)                                        | 295925-003 |
| Compaq TFT1520M Flat Panel Monitor (15-inch, Carbon/Silver includes speaker, USB port, headphone) | 301957-003 |

### Performance Series

|                                                            |            |
|------------------------------------------------------------|------------|
| HP P930 CRT Monitor (19-inch, Flat-screen, Carbon/Silver)  | 302268-003 |
| HP P1130 CRT Monitor (21-inch, Flat-screen, Carbon/Silver) | 302270-003 |
| HP L1825 Flat Panel Monitor (18-inch, Carbon/Silver)       | 303486-003 |
| HP L2025 Flat Panel Monitor (20-inch, Carbon/Silver)       | 303102-003 |
| Compaq TFT1825 Flat Panel Monitor (18-inch, Carbon/Silver) | 296751-003 |
| Compaq TFT2025 Flat Panel Monitor (20-inch, Carbon/Silver) | 285550-003 |
| TFT5110R Flat Panel Monitor (Carbon)                       | 281683-B21 |





### Options

#### Tape Drives

NOTE: External tape devices, including both tape drives and tape arrays/enclosures, can be directly connected to the VHDCI SCSI port located on the back of the server. Use of a SCSI adapter to connect these devices is optional, not required.

##### Internal and External DAT Tape Drives

HP StorageWorks 20/40-GB DAT DDS-4 Tape Drive, External (Carbon) 157770-002

HP StorageWorks Internal 20/40-GB DAT, Hot Plug (Carbon) 215488-B21

NOTE: Please see the 20/40-GB DAT Tape Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10426\\_na/10426\\_na.HTML](http://www5.compaq.com/products/quickspecs/10426_na/10426_na.HTML)

##### Internal and External DAT 72 Tape Backup Drives

HP StorageWorks DAT 72e External (Carbon) Q1527A

HP StorageWorks DAT 72h Internal Hot Plug (Carbon) Q1529A

NOTE: Please see the DAT 72 Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11597\\_na/11597\\_na.HTML](http://www5.compaq.com/products/quickspecs/11597_na/11597_na.HTML)

##### Internal and External AIT Tape Drives

HP StorageWorks External AIT 35-GB, LVD Tape Drive (Carbon) 216885-001

HP StorageWorks Internal AIT 35-GB, LVD Hot Plug (Carbon) 216886-B21

NOTE: Please see the AIT 35-GB, LVD Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10712\\_na/10712\\_na.HTML](http://www5.compaq.com/products/quickspecs/10712_na/10712_na.HTML)

HP StorageWorks AIT 50-GB Tape Drive, External (Carbon) 157767-002

HP StorageWorks Internal AIT 50-GB, Hot Plug (Carbon) 215487-B21

HP StorageWorks AIT 50-GB Tape Drive, 3U Rackmount 274333-B21

NOTE: Please see the AIT 50-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10425\\_na/10425\\_na.HTML](http://www5.compaq.com/products/quickspecs/10425_na/10425_na.HTML)

HP StorageWorks External AIT 100-GB Tape Drive (Carbon) 249160-001

HP StorageWorks Internal AIT 100-GB, Hot Plug (Carbon) 249161-B21

NOTE: Please see the AIT 100-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11062\\_na/11062\\_na.HTML](http://www5.compaq.com/products/quickspecs/11062_na/11062_na.HTML)

##### External DLT Tape Drives

HP StorageWorks External 20/40-GB DLT Drive (opal) 340744-B22

NOTE: Please see the 20/40-GB DLT Drive QuickSpecs for additional options such as data and cleaning cartridges, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10234\\_na/10234\\_na.HTML](http://www5.compaq.com/products/quickspecs/10234_na/10234_na.HTML)

HP StorageWorks 40/80-GB DLT Tape Drive, External (Carbon) 146197-B22

HP StorageWorks Rackmount DLT 40/80, 3U (Single Drive) 274332-B21

HP StorageWorks Rackmount DLT 40/80, Dual Drive 3U (Two Drives) 274335-B21

HP StorageWorks Rackmount DLT 40/80, Tape Array III, 5U (Four Drives) 274337-B21

NOTE: Please see the 40/80-GB DLT Drive QuickSpecs for additional options such as host bus adapters, controllers, cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10658\\_na/10658\\_na.HTML](http://www5.compaq.com/products/quickspecs/10658_na/10658_na.HTML)

##### External LTO Ultrium Tape Drives

### Options

HP StorageWorks Ultrium 215 Tape Drive for ProLiant, External (Carbon) Q1544A

NOTE: Please see the HP StorageWorks Ultrium 215 Tape Drive QuickSpecs for additional options such as controllers, and other related items, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://h18006.www1.hp.com/products/quickspecs/11678\\_na/11678\\_na.html](http://h18006.www1.hp.com/products/quickspecs/11678_na/11678_na.html)

HP StorageWorks LTO Ultrium 230 Tape Drive, External (Carbon) Q1516A

NOTE: Please see the HP StorageWorks LTO Ultrium Tape Drive QuickSpecs for additional options such as controllers, and other related items, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11415\\_na/11415\\_na.HTML](http://www5.compaq.com/products/quickspecs/11415_na/11415_na.HTML)

HP StorageWorks Ultrium 460 Tape Drive for ProLiant, External (Carbon) Q1519A

NOTE: Please see the HP StorageWorks Ultrium 460 Tape Drives for ProLiant QuickSpecs for additional options such as data and cleaning cartridges, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11530\\_na/11530\\_na.HTML](http://www5.compaq.com/products/quickspecs/11530_na/11530_na.HTML)

#### Internal and External SDLT Tape Drives

HP StorageWorks SDLT 110/220, External (Carbon) 192103-002

HP StorageWorks Rackmount SDLT 110/220, 3U (Single Drive) 274331-B21

HP StorageWorks Rackmount SDLT 110/220, Dual-Drive, 3U (Two Drives) 274334-B21

HP StorageWorks Rackmount SDLT 110/220, Tape Array III, 5U (Four Drives) 274336-B21

NOTE: Please see the SDLT 110/22-0GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and media, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10772\\_na/10772\\_na.HTML](http://www5.compaq.com/products/quickspecs/10772_na/10772_na.HTML)

HP StorageWorks SDLT 160/320, External (carbon) 257319-001

NOTE: Please see the SDLT 160/320-GB Tape Drive QuickSpecs for additional options such as adapters, controllers, and media, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11406\\_na/11406\\_na.HTML](http://www5.compaq.com/products/quickspecs/11406_na/11406_na.HTML)

#### External DAT Autoloader

20/40-GB DAT 8 Cassette Autoloader External (Opal) 166505-001

NOTE: Please see the 20/40-GB DAT DDS-4 8 Cassette Autoloader QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/10518\\_na/10518\\_na.HTML](http://www5.compaq.com/products/quickspecs/10518_na/10518_na.HTML)

#### AIT Autoloader

HP StorageWorks AIT 35 GB Autoloader, Rackmount (Carbon) 280349-001

NOTE: The Integrated Smart Array 5I Controller does not support the AIT 35-GB Autoloader.

NOTE: Please see the AIT 35-GB Autoloader QuickSpecs for additional options such as adapters, controllers, and cassettes, and for an up-to-date listing of the latest O/S Support details, please see the following:

[http://www5.compaq.com/products/quickspecs/11404\\_na/11404\\_na.HTML](http://www5.compaq.com/products/quickspecs/11404_na/11404_na.HTML)

#### HP StorageWorks 1/8 Autoloader

HP StorageWorks 1/8 Autoloader, Rackmount kit C9266R

#### Rackmount Tape Drive Kits

3U Rackmount Kit 274338-B21

NOTE: The 3U Rackmount Kit (PN 274338-B21) can support up to (2) full-height or (4) half-height tape drives and compatible with multiple Single-Ended and LVD SCSI Tape Drives including the 12/24-GB DAT, 20/40-GB DAT, AIT 35-GB LVD, AIT 50-GB, 20/40-GB DLT, 40/80-GB DLT, and the SDLT 110/220-GB Tape Drives.

5U Rackmount Kit 274339-B21

NOTE: The 5U Rackmount Kit (PN 274339-B21) can support up to (4) full-height tape drives and is compatible with all DLT/SDLT tape drives including the 20/40-GB DLT, 35/70-GB DLT, 40/80-GB DLT, and the SDLT 110/220-GB tape drives.

NOTE: Please see the Rackmount Tape Drive Kits QuickSpecs for additional information regarding



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Options

these kits, please see the following:

[http://www5.compaq.com/products/quickspecs/10854\\_na/10854\\_na.HTML](http://www5.compaq.com/products/quickspecs/10854_na/10854_na.HTML)

### **Rackmount Tape Drive Cable Kits**

LVD Cable Kit, VHDCI/HD68

168048-B21

NOTE: For use with the 3U RM Storage Enclosure and DLT Tape Array III only.

LVD Cable Kit, HD68/HD68

242381-B21

NOTE: For use with the 3U RM Storage Enclosure and DLT Tape Array III only.

## Tape Automation

### **StorageWorks MSL6000 and MSL5000 Departmental tape libraries**

#### **MSL6060L1 - LTO Ultrium 1 based departmental library up to 4 drives and 60 slots**

MSL6060, 0 DRV, Ultrium 460, RM Library

331196-B23

MSL6060, 2 DRV, Ultrium 460, RM Library

331196-B21

MSL6060, 2 DRV, Ultrium 460, embedded Fibre, RM Library

331196-B22

NOTE: Please see the StorageWorks MSL6060 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11608\\_na/11608\\_na.HTML](http://www5.compaq.com/products/quickspecs/11608_na/11608_na.HTML)

#### **MSL5060L1 - LTO Ultrium 1 based departmental library up to 4 drives and 60 slots**

MSL5060, 0 DRV, Ultrium 230, RM Library

301899-B21

MSL5060, 2 DRV, Ultrium 230, RM Library

301899-B22

MSL5060, 2 DRV, Ultrium 230, embedded Fibre, RM Library

301899-B23

NOTE: Please see the StorageWorks MSL5060 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11438\\_na/11438\\_na.HTML](http://www5.compaq.com/products/quickspecs/11438_na/11438_na.HTML)

#### **MSL5052S2 - SDLT160 based departmental library up to 4 drives and 52 slots**

MSL5052S2, 0 DRV, SDLT 160/320, RM Library

255102-B21

MSL5052S2, 2 DRV, SDLT 160/320, RM Library

293474-B21

MSL5052S2, 2 DRV, SDLT 160/320, RM Library with embedded FC router option

293474-B24

NOTE: Please see the StorageWorks MSL5052S2 Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11442\\_na/11442\\_na.HTML](http://www5.compaq.com/products/quickspecs/11442_na/11442_na.HTML)

#### **MSL6030 - LTO Ultrium 1 based departmental library up to 4 drives and 60 slots**

MSL6030, 0 DRV, RM Library

330731-B21

MSL6030, 1 DRV, LTO Ultrium 460, RM Library

330731-B22

MSL6030, 2 DRV, LTO Ultrium 460, RM Library

330731-B23

MSL6030, 1 DRV, LTO Ultrium 460, embedded Fibre, RM Library

330731-B24

MSL 6030, 2 DRV, LTO Ultrium 460, embedded Fibre, RM Library

330731-B25

NOTE: Please see the StorageWorks MSL6030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11625\\_na/11625\\_na.HTML](http://www5.compaq.com/products/quickspecs/11625_na/11625_na.HTML)

#### **MSL5030L1 - LTO Ultrium 1 mid-range library up to 2 drives and 30 slots**

MSL5030, 0 DRV, RM Library

301897-B21

MSL5030, 1 DRV, LTO Ultrium 230, RM Library

301897-B22

MSL5030, 2 DRV, LTO Ultrium 230, RM Library

301897-B23

MSL5030, 1 DRV, LTO Ultrium 230, embedded Fibre, RM Library

301897-B24

MSL 5030, 2 DRV, LTO Ultrium 230, embedded Fibre, RM Library

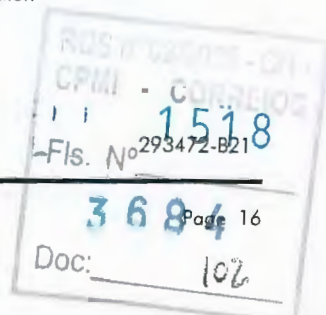
301897-B25

NOTE: Please see the StorageWorks MSL5030 LTO Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11439\\_na/11439\\_na.HTML](http://www5.compaq.com/products/quickspecs/11439_na/11439_na.HTML)

#### **MSL5026S2 - SDLT160 based mid-range library up to 2 drives and 26 slots**

MSL5026S2, 0 DRV, RM Library



# QuickSpecs

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## Options

|                                                                           |            |
|---------------------------------------------------------------------------|------------|
| MSL5026S2, 1 DRV, SDLT 160/320, RM Library                                | 293472-B22 |
| MSL5026S2, 2 DRV, SDLT 160/320, RM Library                                | 293472-B23 |
| MSL5026S2, 1 DRV, SDLT 160/320, RM Library with embedded FC router option | 293472-B24 |
| MSL5026S2, 2 DRV, SDLT 160/320, RM Library with embedded FC router option | 293472-B25 |

NOTE: Please see the StorageWorks MSL5026SL Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11453\\_na/11453\\_na.HTML](http://www5.compaq.com/products/quickspecs/11453_na/11453_na.HTML)

**MSL5026SL Graphite - SDLT110 based mid-range library up to 2 drives and 26 slots**

|                                    |            |
|------------------------------------|------------|
| MSL5026SL, 1 DRV SDLT RM, graphite | 302512-B21 |
| MSL5026SL, 2 DRV SDLT RM, graphite | 302512-B22 |

NOTE: Please see the StorageWorks MSL5026SL Graphite Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/11440\\_na/11440\\_na.HTML](http://www5.compaq.com/products/quickspecs/11440_na/11440_na.HTML)

**MSL5026SL Opal - SDLT110 based mid-range library up to 2 drives and 26 slots**

|                                                                                    |            |
|------------------------------------------------------------------------------------|------------|
| MSL5026, 0 DR, LVD, RM                                                             | 231979-B21 |
| <b>MSL5026DLX- 40/80GB DLT based mid-range library up to 2 drives and 26 slots</b> |            |
| MSL5026DLX, 1 40/80GB DLT, LVD, RM                                                 | 231891-B21 |
| MSL5026DLX, 2 40/80GB DLT, LVD, RM                                                 | 231891-B22 |

NOTE: Please see the StorageWorks MSL5026DLX Library QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/10860\\_na/10860\\_na.HTML](http://www5.compaq.com/products/quickspecs/10860_na/10860_na.HTML)

**MSL6000 and MSL5000 Add-on drives & accessories**

|                                                                                                                                                |            |
|------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| MSL5000 SDLT 160/320 Upgrade DRV (MSL5052S2 & MSL5026S2 only)                                                                                  | 293475-B21 |
| MSL Ultrium 460 upgrade drive in hot plug canister                                                                                             |            |
| MSL5000 LTO Ultrium 1 Upgrade DRV (MSL5060L1 & MSL5030L1 only)                                                                                 | 301901-B21 |
| MSL5000 SDLT 110/220 Upgrade DRV                                                                                                               | 231823-B22 |
| MSL5000 40/80GB DLT Upgrade DRV                                                                                                                | 231823-B21 |
| MSL5000 Dual Magazine LTO (2 X 15 slot magazines)                                                                                              | 301902-B21 |
| MSL5000 Dual Magazine DLT (2 X 13 slot magazines)                                                                                              | 232136-B21 |
| MSL Universal passthrough mechanism                                                                                                            | 304825-B21 |
| MSL5026, 5U Pass through extender (required one for each unit connected to the stack, for third and additional units) - for MSL5026 & MSL5030  | 231824-B22 |
| MSL5052, 10U Pass-Through Extender (required one for each unit connected to the stack, for third and additional units) - for MSL5052 & MSL5060 | 231824-B23 |

**SSL2020 - AIT50 based library with up to 2 drives and 20 slots**

|                                                     |            |
|-----------------------------------------------------|------------|
| SSL2020 AIT Mini-Library 1 drive, 20 slot Table Top | 175195-B21 |
| SSL2020 AIT Mini-Library 2 drive, 20 slot Table Top | 175195-B22 |
| SSL2020 AIT Mini-Library 1 drive, 20 slot Rackmount | 175196-B21 |
| SSL2020 AIT Mini-Library 2 drive, 20 slot Rackmount | 175196-B22 |
| SSL2020 AIT Library Pass Thru with Transport        | 175312-B21 |

**Add-on drives and accessories**

|                                                         |            |
|---------------------------------------------------------|------------|
| SSL2020 AIT Library Pass Thru Extender                  | 175312-B22 |
| AIT 50GB Drive Add-On LVD Drive for SSL2020 AIT Library | 175197-B21 |
| 19 Slot Magazine for SSL2020 AIT Library                | 175198-B21 |
| AIT 50-GB Data Cassette (5 pack)                        | 152841-001 |
| AIT Cleaning Cassette                                   | 402374-B21 |

NOTE: Please see the SSL2020 Automated AIT Tape Library Solution QuickSpecs for additional information including Upgrade Kits, Accessories, and SCSI Cable Kits and additional options needed for a complete solution at:

[http://www5.compaq.com/products/quickspecs/10580\\_na/10580\\_na.HTML](http://www5.compaq.com/products/quickspecs/10580_na/10580_na.HTML)





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Options

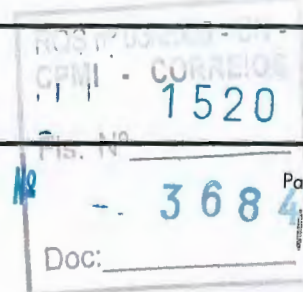
|                             |                                                                                                                                                                    |            |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Smart Array Cluster Storage | Smart Array Cluster Storage                                                                                                                                        | 201724-B21 |
|                             | Smart Array Cluster Storage Redundant Controller Option Kit                                                                                                        | 218252-B21 |
|                             | 4-Port Shared Storage Module with Smart Array Multipath Software for Smart Array Cluster Storage                                                                   | 292944-B21 |
|                             | 128-MB Cache Module for Smart Array 5302 Controller                                                                                                                | 153506-B21 |
|                             | NOTE: 128-MB Cache Module for Smart Array 5302 Controller (PN 153506-B21) is an upgrade cache module (128 MB Standard) for Smart Array Cluster Storage Controller. |            |
|                             | 256-MB Battery-Backed Cache Module                                                                                                                                 | 254786-B21 |

NOTE: Please see the Smart Array Cluster Storage QuickSpecs for additional information including configuration steps and additional options needed for a complete solution at:  
[http://www5.compaq.com/products/quickspecs/11050\\_na/11050\\_na.HTML](http://www5.compaq.com/products/quickspecs/11050_na/11050_na.HTML)

## Cluster Options

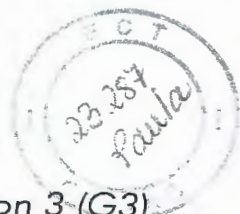
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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| ProLiant Cluster HA/F100 for MSA1000 v2                                                                                                                                                                                                                                                       | 252408-B22 |
| ProLiant Cluster HA/F200 for MSA1000 v2                                                                                                                                                                                                                                                       | 252409-B22 |
| NOTE: For additional information regarding the ProLiant Cluster for HA/F100, HA/F200 for MSA1000 please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11035_na/11035_na.html">http://www5.compaq.com/products/quickspecs/11035_na/11035_na.html</a> |            |
| ProLiant Cluster HA/F500 Enhanced Kit for Enterprise Virtual Array                                                                                                                                                                                                                            | 254623-B22 |
| ProLiant Cluster HA/F500 Basic Kit for Enterprise Virtual Array                                                                                                                                                                                                                               | 313047-B21 |
| NOTE: For additional information regarding the ProLiant Cluster for HA/F100, HA/F200 for MSA1000 please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11055_na/11055_na.html">http://www5.compaq.com/products/quickspecs/11055_na/11055_na.html</a> |            |
| ProLiant Cluster HA/F500 for MA8000 Basic Kit                                                                                                                                                                                                                                                 | 103250-B26 |
| ProLiant Cluster HA/F500 for MA8000 Enhanced Kit                                                                                                                                                                                                                                              | 379937-B26 |
| ProLiant Cluster HA/F500 for MA8000 Enhanced DT Kit                                                                                                                                                                                                                                           | 164227-B24 |
| NOTE: For additional information regarding the ProLiant Cluster for HA/F500 for MSA8000 please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/10232_na/10232_na.html">http://www5.compaq.com/products/quickspecs/10232_na/10232_na.html</a>          |            |
| ProLiant Cluster HA/L100 – LifeKeeper for Linux                                                                                                                                                                                                                                               | 303523-B22 |
| NOTE: For additional information regarding the ProLiant Cluster HA/L100 LifeKeeper for Linux, please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11533_na/11533_na.html">http://www5.compaq.com/products/quickspecs/11533_na/11533_na.html</a>    |            |
| HP Serviceguard for Linux ProLiant Cluster                                                                                                                                                                                                                                                    | 305199-B21 |
| NOTE: Kit includes 2 licenses, documentation and an Ethernet crossover cable.                                                                                                                                                                                                                 |            |
| HP Serviceguard for Linux License                                                                                                                                                                                                                                                             | 307554-B21 |
| NOTE: Kit includes single license version and documentation.                                                                                                                                                                                                                                  |            |
| NOTE: For additional information regarding the HP Serviceguard for Linux License, please see the following QuickSpecs at:<br><a href="http://www5.compaq.com/products/quickspecs/11518_na/11518_na.html">http://www5.compaq.com/products/quickspecs/11518_na/11518_na.html</a>                |            |

|                         |                                                                                                          |            |
|-------------------------|----------------------------------------------------------------------------------------------------------|------------|
| External Storage - Rack | StorageWorks Enclosure Model 4314R (rack-mountable)                                                      | 190209-001 |
|                         | StorageWorks Enclosure Model 4354R (rack-mountable)                                                      | 190211-001 |
|                         | NOTE: The StorageWorks Enclosure 4300 Family supports the Wide Ultra3, Ultra320 1" Hot Plug Hard Drives. |            |
|                         | StorageWorks Enclosure 4200 Redundant Power Supply Option                                                | 119826-B21 |
|                         | StorageWorks Enclosure 4200 Ultra3 Single Bus I/O Module Option                                          | 190212-B21 |
|                         | StorageWorks Enclosure 4200 Ultra3 Dual Bus I/O Module Option                                            | 190213-B21 |
|                         | StorageWorks Enclosure Tower to Rack Conversion Kit                                                      | 150213-B21 |
|                         |                                                                                                          |            |



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)



## Options

|         |                                          |            |
|---------|------------------------------------------|------------|
| MSA1000 | MSA1000                                  | 201723-B22 |
|         | MSA1000 Controller                       | 218231-B22 |
|         | MSA Fibre Channel I/O Module             | 218960-B21 |
|         | MSA1000 Fabric Switch                    | 218232-B21 |
|         | MSA1000 Fibre Channel Adapter (FCA) 2101 | 245299-B21 |
|         | HP StorageWorks msa hub 2/3              | 286763-B21 |

NOTE: Please see the StorageWorks by Compaq Modular SAN Array 1000 QuickSpecs for additional options and configuration information at:

[http://www5.compaq.com/products/quickspecs/11033\\_na/11033\\_na.HTML](http://www5.compaq.com/products/quickspecs/11033_na/11033_na.HTML)

|                        |                                                     |            |
|------------------------|-----------------------------------------------------|------------|
| Network Storage Router | M2402 2FCX 4SCSI LVD Network Storage Router         | 262653-B21 |
|                        | M2402 2FCX 4SCSI HVD Network Storage Router         | 262654-B21 |
|                        | M2402 4 channel LVD SCSI Module                     | 262659-B21 |
|                        | M2402 4 channel HVD SCSI Module                     | 262660-B21 |
|                        | M2402 2 channel FC Module                           | 262661-B21 |
|                        | MSL5000 Embedded Router Fibre Option Kit - Graphite | 262672-B21 |
|                        | MSL5026 Embedded Router Fibre Option Kit - Opal     | 286694-B21 |

|                                                                |                    |            |
|----------------------------------------------------------------|--------------------|------------|
| StorageWorks Modular Array 8000/Enterprise Modular Array 12000 | EMA12000 D14 60Hz  | 175990-B21 |
|                                                                | EMA12000 S14 60Hz  | 175991-B21 |
|                                                                | MA8000 60Hz        | 175992-B21 |
|                                                                | EMA12000 Blue 60Hz | 175993-B21 |

NOTE: Options include controller, solution kits, ACS. MA8000/EMA12000 includes controller shelf, drive shelves and cabinet. Packaging upgrade to RA8000/ESA12000.

NOTE: Please see the StorageWorks MA8000/EMA12000 QuickSpecs for FC Hubs, FC switches, platform software, host adapters, disks and options for complete solutions at:

[http://www5.compaq.com/products/quickspecs/10545\\_na/10545\\_na.HTML](http://www5.compaq.com/products/quickspecs/10545_na/10545_na.HTML)

|                                                |                          |            |
|------------------------------------------------|--------------------------|------------|
| StorageWorks Enterprise Modular Array 16000 FC | EMA16000 D14 60Hz (opal) | 238792-B21 |
|                                                | EMA16000 S14 60Hz (opal) | 238791-B21 |

NOTE: Models include: Dual HSG80 controllers in each Model 2200 enclosure (2 pairs per single bus configuration, 4 pairs per dual bus configuration) with 1GB cache per controller pair, and 12 14-bay drive enclosures with redundant power supplies. Configure-to-Order (CTO) builds are available. Options include ACS, platform kits and software by HP.

NOTE: Please see the StorageWorks EMA16000 QuickSpecs for FC switches, platform software, host adapters, disks and options for complete solutions at:

[http://www5.compaq.com/products/quickspecs/10812\\_na/10812\\_na.HTML](http://www5.compaq.com/products/quickspecs/10812_na/10812_na.HTML)

|                      |                                                                                                                                                                                                                                             |            |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| StorageWorks Options | StorageWorks Director 2/64                                                                                                                                                                                                                  | 286809-B21 |
|                      | NOTE: Please see the StorageWorks Director 2/64 QuickSpecs for additional information:<br><a href="http://www5.compaq.com/products/quickspecs/11003_na/11003_na.HTML">http://www5.compaq.com/products/quickspecs/11003_na/11003_na.HTML</a> |            |
|                      | StorageWorks SAN Switch 2/8-EL                                                                                                                                                                                                              | 322120-B21 |
|                      | StorageWorks SAN Switch 2/8-EL Upgrade                                                                                                                                                                                                      | 325888-B21 |
|                      | StorageWorks SAN Switch 2/16                                                                                                                                                                                                                | 322118-B21 |
|                      | StorageWorks SAN Switch 2/16-EL Upgrade                                                                                                                                                                                                     | 288250-B21 |



ROS 1521  
CPMI - CORREIOS



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Options

### UPS and PDU Power Cord Matrix

Please see the UPS and PDU cable matrix that lists cable descriptions, requirements, and specifications for UPS and PDU units:

<ftp://ftp.compaq.com/pub/products/servers/ProLiantstorage/power-protection/powercordmatrix.pdf>.

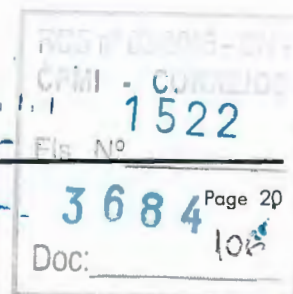
NOTE: This Web site is available in English only.

### Uninterruptible Power Systems – Rack

|                                                                                                           |            |
|-----------------------------------------------------------------------------------------------------------|------------|
| HP UPS R1500 XR (1440VA, 1340 Watt), Low Voltage                                                          | 204404-001 |
| HP UPS R3000 XR (2880VA, 2700 Watt), Low Voltage                                                          | 192186-001 |
| HP UPS R3000 XR (3000VA, 2700 Watt), High Voltage                                                         | 192186-002 |
| Rack-Mountable UPS R6000 (6000VA, 6000 Watt) High Voltage                                                 | 347207-001 |
| HP UPS R12000 XR N+x (200-240V) (hardwired)                                                               | 207552-B22 |
| NOTE: UPS R6000 has a hardwired input; and the UPS R12000 XR has a hardwired input and output connection. |            |

### UPS Options

|                                                                                                                       |            |
|-----------------------------------------------------------------------------------------------------------------------|------------|
| SNMP Serial Port Card                                                                                                 | 192189-B21 |
| NOTE: Supports tower and rack UPS XR models. This card does not support the 500, 700, and 6000VA UPSs (non-XR models) |            |
| Six Port Card                                                                                                         | 192185-B21 |
| NOTE: Supports tower and rack UPS XR models. This card does not support the 500, 700, and 6000VA UPSs (non-XR models) |            |
| High to Low Voltage Transformer (250VA)                                                                               | 388643-B21 |
| NOTE: Supports R6000 UPS series only. 2.5 amps @ 125 Volts max output across two NEMA 5-15.                           |            |
| Extended Runtime Module, R1500 XR, 2U                                                                                 | 218971-B21 |
| NOTE: 2U each, two ERM maximum.                                                                                       |            |
| Extended Runtime Module, R3000 XR, 2U                                                                                 | 192188-B21 |
| NOTE: 3U each, one ERM maximum.                                                                                       |            |
| Extended Runtime Module, R6000, 3U                                                                                    | 347224-B21 |
| NOTE: 3U each, two ERM maximum.                                                                                       |            |
| Extended Runtime Module, R12000 XR, 4U                                                                                | 217800-B21 |
| NOTE: 4U each, one ERM maximum.                                                                                       |            |
| R12000 XR BackPlate Receptacle Kit, (2) L6-30R                                                                        | 325361-001 |
| NOTE: The R12000 XR BackPlate Kit has a hardwired input.                                                              |            |
| R12000 XR BackPlate Receptacle Kit, (2) IEC-309R                                                                      | 325361-B21 |
| NOTE: The R12000 XR BackPlate Kit has a hardwired input.                                                              |            |
| SNMP-EN Adapter                                                                                                       | 347225-B21 |
| NOTE: Supports R6000 UPS series only.                                                                                 |            |
| Multi-Server UPS Card                                                                                                 | 123508-B21 |
| NOTE: Supports R6000 UPS series only.                                                                                 |            |
| Scalable UPS Card                                                                                                     | 123509-B21 |
| NOTE: Supports R6000 UPS series only.                                                                                 |            |



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)



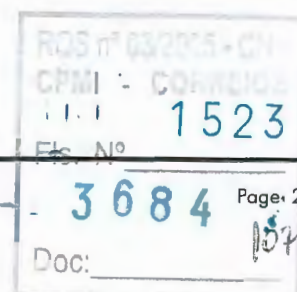
## Options

|                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                  |            |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Modular PDUs 1U/0U<br>(Up to 32 outlets)<br>NOTE: 1U/0U mounting brackets shipped with the unit (optimized for 10000 and 9000 series racks). | HP Modular Power Distribution Units (mPDU), Low Volt Model, 24A (100-127 VAC)                                                                                                                                                                                                                                                                    | 252663-D71 |
|                                                                                                                                              | NOTE: This mPDU (252663-D71) may also be used to connect the low volt model of the UPS R3000 XR.                                                                                                                                                                                                                                                 |            |
|                                                                                                                                              | HP Modular Power Distribution Units (mPDU), High Volt Model, 24A (200-240 VAC)                                                                                                                                                                                                                                                                   | 252663-D72 |
|                                                                                                                                              | HP Modular Power Distribution Units (mPDU), High Volt Model, 40A (200-240 VAC)                                                                                                                                                                                                                                                                   | 252663-B21 |
|                                                                                                                                              | NOTE: This mPDU (252663-B21), 40A model has a hardwired input.                                                                                                                                                                                                                                                                                   |            |
|                                                                                                                                              | HP Modular Power Distribution Units (mPDU), High Volt Model, 16A (200-240 VAC)                                                                                                                                                                                                                                                                   | 252663-B24 |
|                                                                                                                                              | NOTE: This PDU has a detachable input power cord and allows for adaptability to country specific power requirements. This model may also be used with the high volt UPSs R3000 XR and R6000 For North America, need to order cable PN 340653-001.                                                                                                |            |
|                                                                                                                                              | NOTE: Please see the following Modular Power Distribution Unit (Zero-U/1U Modular PDUs) QuickSpecs for additional options including shorter jumper cables and country specific power cords:<br><a href="http://www5.compaq.com/products/quickspecs/11041_na/11041_na.HTML">http://www5.compaq.com/products/quickspecs/11041_na/11041_na.HTML</a> |            |

|             |                                                                                                                                                                                                       |            |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| PDU Options | Third Party Modular PDU Mounting Kit                                                                                                                                                                  | 310777-B21 |
|             | NOTE: This kit allows you to mount the Modular PDUs in racks other than the 9000/10000 Series racks (any racks using the standard 19"rail). For more details please refer the Modular PDU QuickSpecs. |            |
|             | 4.5' IEC C 13 to IEC C14 PDU Jumper Cable (1 per pack)                                                                                                                                                | 142257-006 |
|             | 4.5' IEC C 13 to IEC C14 PDU Jumper Cable (15 per pack)                                                                                                                                               | 142257-007 |

|             |                                       |            |
|-------------|---------------------------------------|------------|
| USB Options | USB Easy Access Keyboard (carbon)     | 267146-008 |
|             | USB Easy Access Keyboard (carbonite)  | DC168B#ABA |
|             | USB 2-Button Scroll Mouse (carbon)    | 195255-B25 |
|             | USB 2-Button Scroll Mouse (carbonite) | DC172B     |
|             | USB Floppy                            | 304707-B21 |

Rack Builder Please see the Rack Builder for configuration assistance at <http://www.compaq.com/rackbuilder/>





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)



## Options

### HP Rack 10000 Series (Graphite Metallic)

|                                             |            |
|---------------------------------------------|------------|
| HP S10614 (14U) Rack Cabinet - Shock Pallet | 292302-B22 |
| HP 10842 (42U, 800mm wide) - Pallet         | 257415-B21 |
| HP 10842 (42U, 800mm wide) - Shock Pallet   | 257415-B22 |
| HP 10647 (47U) - Pallet                     | 245160-B21 |
| HP 10647 (47U) - Crated                     | 245160-B23 |
| HP 10642 (42U) - Pallet                     | 245161-B21 |
| HP 10642 (42U) - Shock Pallet               | 245161-B22 |
| HP 10642 (42U) - Crated                     | 245161-B23 |
| HP 10636 (36U) - Pallet                     | 245162-B21 |
| HP 10636 (36U) - Shock Pallet               | 245162-B22 |
| HP 10636 (36U) - Crated                     | 245162-B23 |
| HP 10622 (22U) - Pallet                     | 245163-B21 |
| HP 10622 (22U) - Shock Pallet               | 245163-B22 |
| HP 10622 (22U) - Crated                     | 245163-B23 |

NOTE: -B21 (pallet) used to ship empty racks shipped on a truck

-B22 (shock pallet) used to ship racks with equipment installed (by custom systems, VARs and Channels)

-B23 (crated) used for air shipments of empty racks

NOTE: It is mandatory to use a shock pallet in order to ship racks with equipment installed.

NOTE: Please see the Rack 10000 QuickSpecs for Technical Specifications such as height, width, depth, weight, and color:

[http://www5.compaq.com/products/quickspecs/10995\\_na/10995\\_na.HTML](http://www5.compaq.com/products/quickspecs/10995_na/10995_na.HTML)

NOTE: For additional information regarding Rack Cabinets, please see the following URL:

<http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html>

NOTE: This Web site is available in English only.

### Rack 9000 Series (opal)

|                                |            |
|--------------------------------|------------|
| Rack 9142 (42U) - Pallet       | 120663-B21 |
| Rack 9142 (42U) - Shock Pallet | 120663-B22 |
| Rack 9142 (42U) - Crated       | 120663-B23 |

NOTE: -B21 (pallet) used to ship empty racks shipped on a truck

-B22 (shock pallet) used to ship racks with equipment installed (by custom systems, VARs and Channels)

-B23 (crated) used for air shipments of empty racks

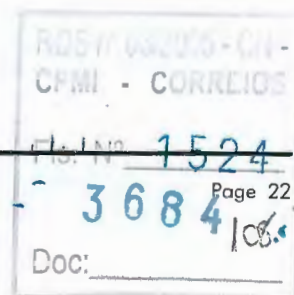
NOTE: Please see the Rack 9000 QuickSpecs for Technical Specifications such as height, width, depth, weight, and color:

[http://www5.compaq.com/products/quickspecs/10366\\_na/10366\\_na.HTML](http://www5.compaq.com/products/quickspecs/10366_na/10366_na.HTML)

NOTE: For additional information regarding Rack Cabinets, please see the following URL:

<http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html>

NOTE: This Web site is available in English only.



### Options

#### Rack Options for HP Rack 10000 Series

|                                                                                                                                                                                                                                                                               |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Blanking Panels – Graphite (Multi)                                                                                                                                                                                                                                       | 253214-B26 |
| NOTE: Contains one each of 1U, 2U, 4U and 8U.                                                                                                                                                                                                                                 |            |
| Rack Blanking Panels – Graphite (1U)                                                                                                                                                                                                                                          | 253214-B21 |
| NOTE: The Rack Blanking Panels (PN 253214-B21) contains 10 each of (1U).                                                                                                                                                                                                      |            |
| Rack Blanking Panels – Graphite (2U)                                                                                                                                                                                                                                          | 253214-B22 |
| NOTE: The Rack Blanking Panels (PN 253214-B22) contains 10 each of (2U).                                                                                                                                                                                                      |            |
| Rack Blanking Panels – Graphite (3U)                                                                                                                                                                                                                                          | 253214-B23 |
| NOTE: The Rack Blanking Panels (PN 253214-B23) contains 10 each of (3U).                                                                                                                                                                                                      |            |
| Rack Blanking Panels – Graphite (4U)                                                                                                                                                                                                                                          | 253214-B24 |
| NOTE: The Rack Blanking Panels (PN 253214-B24) contains 10 each of (4U).                                                                                                                                                                                                      |            |
| Rack Blanking Panels – Graphite (5U)                                                                                                                                                                                                                                          | 253214-B25 |
| NOTE: The Rack Blanking Panels (PN 253214-B25) contains 10 each of (5U).                                                                                                                                                                                                      |            |
| 800mm Wide Stabilizer Kit (Graphite)                                                                                                                                                                                                                                          | 255488-B21 |
| NOTE: Supported by the Rack 10842 cabinet only.                                                                                                                                                                                                                               |            |
| 600mm Stabilizer Kit – Graphite                                                                                                                                                                                                                                               | 246107-B21 |
| Baying Kit for Rack 10000 series (Carbon)                                                                                                                                                                                                                                     | 248929-B21 |
| 42U Side Panel – Graphite Metallic                                                                                                                                                                                                                                            | 246099-B21 |
| 110V Fan Kit (Graphite)                                                                                                                                                                                                                                                       | 257413-B21 |
| NOTE: Roof Mount Includes power cord with IEC320-C13 to Nema 5-15P.                                                                                                                                                                                                           |            |
| 220V Fan Kit (Graphite)                                                                                                                                                                                                                                                       | 257414-B21 |
| NOTE: Roof Mount Includes power cord with IEC320-C13 to Nema 6-15P.                                                                                                                                                                                                           |            |
| 36U Side Panel – Graphite Metallic                                                                                                                                                                                                                                            | 246102-B21 |
| 47U Side Panel – Graphite Metallic                                                                                                                                                                                                                                            | 255486-B21 |
| 9000/10000 Series Offset Baying Kit (42U)                                                                                                                                                                                                                                     | 248931-B21 |
| NOTE: This kit can be used to connect 9000 and 10000 series racks of the same U height together. Kit contents include hardware for connecting racks and a panel to cover the 100mm gap at the rear of the two racks.                                                          |            |
| NOTE: For additional information regarding Rack Options, please see the following URL:<br><a href="http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html">http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html</a> |            |
| NOTE: This Web site is available in English only.                                                                                                                                                                                                                             |            |



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Options

|                                      |                                                                                                                                                                                                                                                                                |            |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Options for Rack<br>9000 Series | Baying/Coupling Kit                                                                                                                                                                                                                                                            | 120669-B21 |
|                                      | 42U Side Panel                                                                                                                                                                                                                                                                 | 120670-B21 |
|                                      | NOTE: The 42U Side Panel (PN 120670-B21) supports the Compaq Rack 9142 and Compaq Rack 9842.                                                                                                                                                                                   |            |
|                                      | 36U Side Panel                                                                                                                                                                                                                                                                 | 120671-B21 |
|                                      | NOTE: The 36U Side Panel (PN 120671-B21) supports the Compaq Rack 9136.                                                                                                                                                                                                        |            |
|                                      | 600mm Stabilizer Option Kit                                                                                                                                                                                                                                                    | 120673-B21 |
|                                      | 800mm Stabilizer Option Kit (Opal)                                                                                                                                                                                                                                             | 234493-B21 |
|                                      | NOTE: The 800mm Stabilizer Kit (PN 234493-B21) supports the Rack 9842 only.                                                                                                                                                                                                    |            |
|                                      | 9142 Extension Kit                                                                                                                                                                                                                                                             | 120679-B21 |
|                                      | NOTE: The 9142 Extension Kit (PN 120679-B21) supports the Compaq Rack 9142 only.                                                                                                                                                                                               |            |
|                                      | 9142 Split Rear Door                                                                                                                                                                                                                                                           | 254045-B21 |
|                                      | NOTE: The 9142 Split Rear Door (PN 254045-B21) supports the 600 mm wide, 42U 9000 series rack.                                                                                                                                                                                 |            |
|                                      | 9136 Extension Kit                                                                                                                                                                                                                                                             | 218216-B21 |
|                                      | 9142 Short Rear Door                                                                                                                                                                                                                                                           | 218217-B21 |
|                                      | NOTE: The 9142 Short Rear Door (PN 218217-B21) supports the Compaq Rack 9142 only.                                                                                                                                                                                             |            |
|                                      | 9136 Short Rear Door                                                                                                                                                                                                                                                           | 218218-B21 |
|                                      | Rack Blanking Panel (Multi)                                                                                                                                                                                                                                                    | 169940-B21 |
|                                      | NOTE: Kit includes four panels in 1U, 2U, 4U, and 8U.                                                                                                                                                                                                                          |            |
|                                      | Rack Blanking Panels (1U)                                                                                                                                                                                                                                                      | 189453-B21 |
|                                      | NOTE: The Rack Blanking Panels (PN 189453-B21) contains 10 each of (1U).                                                                                                                                                                                                       |            |
|                                      | Rack Blanking Panels (2U)                                                                                                                                                                                                                                                      | 189453-B22 |
|                                      | NOTE: The Rack Blanking Panels (PN 189453-B22) contains 10 each of (2U).                                                                                                                                                                                                       |            |
|                                      | Rack Blanking Panels (3U)                                                                                                                                                                                                                                                      | 189453-B23 |
|                                      | NOTE: The Rack Blanking Panels (PN 189453-B23) contains 10 each of (3U).                                                                                                                                                                                                       |            |
|                                      | Rack Blanking Panels (4U)                                                                                                                                                                                                                                                      | 189453-B24 |
|                                      | NOTE: The Rack Blanking Panels (PN 189453-B24) contains 10 each of (4U).                                                                                                                                                                                                       |            |
|                                      | Rack Blanking Panels (5U)                                                                                                                                                                                                                                                      | 189453-B25 |
|                                      | NOTE: The Rack Blanking Panels (PN 189453-B25) contains 10 each of (5U).                                                                                                                                                                                                       |            |
|                                      | 9000/10000 Series Offset Baying Kit (42U)                                                                                                                                                                                                                                      | 248931-B21 |
|                                      | NOTE: This kit can be used to connect 9000 and 10000 series racks of the same U height together. Kit contents include hardware for connecting racks and a panel to cover the 100mm gap at the rear of the two racks.                                                           |            |
|                                      | NOTE: For additional information regarding Rack Cabinets, please see the following URL:<br><a href="http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html">http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html</a> |            |
|                                      | NOTE: This Web site is available in English only.                                                                                                                                                                                                                              |            |

|                                                                                                                                                                                                                                                                                |                                                  |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------|
| Rack Options for Rack<br>7000 Series                                                                                                                                                                                                                                           | High Air Flow Rack Door Insert for 7122          | 157847-B21 |
|                                                                                                                                                                                                                                                                                | High Air Flow Rack Door Insert for 7142          | 327281-B21 |
|                                                                                                                                                                                                                                                                                | High Air Flow Rack Door Insert for 7142 (6 pack) | 327281-B22 |
|                                                                                                                                                                                                                                                                                | Compaq Networking Cable Management Kit           | 292407-B21 |
|                                                                                                                                                                                                                                                                                | Compaq Rack Extension Kit for 7142               | 154392-B21 |
| NOTE: For additional information regarding Rack Cabinets, please see the following URL:<br><a href="http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html">http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html</a> |                                                  |            |
| NOTE: This Web site is available in English only.                                                                                                                                                                                                                              |                                                  |            |

|                       |                             |            |
|-----------------------|-----------------------------|------------|
| Rack Options for Rack | Monitor Utility Shelf- opal | 303606-B21 |
|-----------------------|-----------------------------|------------|



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HP ProLiant DL380 Generation 3 (G3)

## Options

7000, 9000 and 10000 Series

|                                                              |            |
|--------------------------------------------------------------|------------|
| Ballast Option Kit                                           | 120672-B21 |
| Rack Rail Adapter Kit (25" depth)                            | 120675-B21 |
| 100 kg Sliding Shelf                                         | 234672-B21 |
| Monitor/Utility Shelf - Graphite                             | 253449-B21 |
| Depth Adjustable Fixed Rail                                  | 332558-B21 |
| Cable Management D-Rings Kit                                 | 168233-B21 |
| Console Management Controller (CMC) Option Kit               | 203039-B21 |
| Console Management Controller (CMC) Sensors Option Kit       | 203039-B22 |
| Console Management Controller (CMC) Locking Option Kit       | 203039-B23 |
| Console Management Controller (CMC) Smoke Sensors Option Kit | 203039-B24 |
| Server Console Switch 1 x 2 port (100-230 VAC)               | 120206-001 |
| Server Console Switch 1 x 4 port (100-230 VAC)               | 400336-001 |
| Server Console Switch 1 x 8 port (100-230 VAC)               | 400337-001 |
| Server Console Switch 2 x 8 port (100-230 VAC)               | 400338-001 |
| Server Console Switch 2 x 8 port (48VDC)                     | 400542-B21 |
| IP Console Switch Box, 1x1x16                                | 262585-B21 |
| IP Console Switch Box, 3x1x16                                | 262586-B21 |
| IP Console Interface Adapter, 8 pack                         | 262587-B21 |
| IP Console Interface Adapter, 1 pack                         | 262588-B21 |
| IP Console Expansion Module                                  | 262589-B21 |
| KVM 9 PIN Adapter (4 Pack)                                   | 149361-B21 |
| CPU to Server Console Cable, 12'                             | 110936-B21 |
| CPU to Server Console Cable, 20'                             | 110936-B22 |
| CPU to Server Console Cable, 40'                             | 110936-B23 |
| CPU to Server Console Cable, 3'                              | 110936-B24 |
| CPU to Server Console Cable, 7'                              | 110936-B25 |
| CPU to Server Console Cable (Plenum Rated) 20'               | 149363-B21 |
| CPU to Server Console Cable (Plenum Rated) 40'               | 149364-B21 |
| IP CAT5 Cable 3', 4 pack                                     | 263474-B21 |
| IP CAT5 Cable 6', 8 pack                                     | 263474-B22 |
| IP CAT5 Cable 12', 8 pack                                    | 263474-B23 |
| IP CAT5 Cable 20', 4 pack                                    | 263474-B24 |
| IP CAT5 Cable 40', 1 pack                                    | 263474-B25 |
| Switch Box Connector Kit (115V)                              | 144007-001 |
| Switch Box Connector Kit (230V)                              | 144007-002 |
| TFT5600 Rack Keyboard Monitor                                | 221546-001 |
| Local Access Cable Kit                                       | 232985-B21 |
| 1U Rack Keyboard & Drawer (Carbon)                           | 257054-001 |

NOTE: The 1U Rack Keyboard & Drawer (PN 257054-001) is to be used with the Keyboards for Racks with Trackball (PN 158649-001).

Input Device Adjustable Rails 287139-B21

NOTE: Input Device Adjustable Rails (287139-B21) are for use with the TFT5110R, TFT5600RKM and integrated keyboard/drawer which is used in mounting into third party racks.

Input Device Telco Rail 287138-B21

NOTE: Input Device Adjustable Rails (287138-B21) are for use ONLY with the TFT5110R, TFT5600RKM and integrated keyboard/drawer which is used in mounting into third party racks.

Keyboard/Monitor/Mouse extension cables

NOTE: For additional information regarding Rack Options, please see the following URL:

<http://h18000.www1.hp.com/products/servers/proliantstorage/rack-options/index.html>

NOTE: This Web site is available in English only.



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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Options

|                                            |                                                                                                                                                                        |            |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Rack Options for Third Party Cabinet Racks | Round hole rack cabinet rail kit<br>NOTE: Support for racks with round mounting holes (include HP Rack System /E and HP Systems) with an adjustment range of 24"- 36". | 293052-B21 |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| HP Factory Express | <b>Factory Installation, Racking, and Customization Services</b><br>Factory Express Server Configuration Level 1<br>NOTE: Free Installation of HP Options - Installation of HP Options memory, NICs, hard drives, controllers, processors, I/O cards, pre-install standard OEM OS image, and tape drives. Installation fees will apply to all non-HP certified hardware and asset tags.<br>NOTE: Available on ProLiant ML370 G3 Rack Models Only.                                                                                                                                                | 293355-888 |
|                    | Factory Express Server Configuration Level 2<br>NOTE: Includes Level 1 Customer Intent of a ProLiant server and options configuration, OS installation, custom image download, IP addressing, network setting, and custom packaging. Customer unique requirements (quick restore creation, cd duplication, test reports, real-time reporting of server MAC address, password, and RILOE). Customer access, validation and control through VPN (price/server).<br>NOTE: Available on ProLiant ML370 G3 Rack Models Only.                                                                          | 266326-888 |
|                    | Factory Express Rack Integration Level 3 with 1 - 3 servers or storage enclosures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 325736-888 |
|                    | Factory Express Rack Integration Level 3 with 4 - 9 servers or storage enclosures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 325539-888 |
|                    | Factory Express Rack Integration Level 3 with 10 or more servers or storage enclosures<br>NOTE: Includes Level 1 Customer Intent for standard mounted servers and storage units plus standard cable mgmt, RAID configuration, servers & storage, power distribution, networking gear and accessories (price/ra520ck).<br>NOTE: Available on ProLiant ML370 G3 Rack Models Only.                                                                                                                                                                                                                  | 325735-888 |
|                    | Factory Express Rack Integration Level 4 with 1 - 3 servers or storage enclosures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 325734-888 |
|                    | Factory Express Rack Integration Level 4 with 4 - 9 servers or storage enclosures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 325540-888 |
|                    | Factory Express Rack Integration Level 4 with 10 or more servers or storage enclosures<br>NOTE: Includes Level 2 Customer Intent plus customer defined cable management and naming convention, customer furnished image download, IP addressing, cluster configurations (SQL, External storage RAID). Quick restore creation, cd duplication, test reports, real-time reporting of server MAC address, password, RILOE). Customer access and validation through VPN (price/rack).<br>NOTE: Available on ProLiant ML370 G3 Rack Models Only.                                                      | 325733-888 |
|                    | Factory Express Rack Integration Level 5 with 1 - 3 servers or storage enclosures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 325732-888 |
|                    | Factory Express Rack Integration Level 5 with 4 - 9 servers or storage enclosures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 325541-888 |
|                    | Factory Express Rack Integration Level 5 with 10 or more servers or storage enclosures<br>NOTE: Includes Level 4 Customer Intent plus Custom SW layering and extended test, Customer access, validation and control through VPN, Clustered racks with networking gear and/or external storage array, Start-up installation services custom quote. (price/rack).<br>NOTE: Factory Express Engineered Solution Level 6 is a custom solutions available through Factory Express. Please contact a your local reseller or Account Manager.<br>NOTE: Available on ProLiant ML370 G3 Rack Models Only. | 325731-888 |

|                                                       |                                                                                                                                                                                                                                                                                                                                                                               |                                                        |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Service and Support Offerings (HP Care Pack Services) | <b>Hardware Services 4-Hour On-site Service</b><br>4-Hour On-site Service 5-Day x 13-Hour Coverage, 3 Years (Canadian Part Number)<br>4-Hour On-site Service, 5-Day x 13-Hour, 3 Years (U.S. Part Number)<br>4-Hour On-site Service, 7-Day x 24-Hour Coverage, 3 Years (Canadian Part Number)<br>4-Hour On-site Service, 7-Day x 24-Hour Coverage, 3 Years (U.S. Part Number) | FP-LO3EC-36<br>331066-002<br>FP-LO7EC-36<br>162657-002 |
|                                                       | <b>Installation &amp; Start-up Services</b><br>Hardware Installation (Canadian Part Number)<br>Hardware Installation (U.S. Part Number)                                                                                                                                                                                                                                       | FP-LOINS-EC<br>401792-002                              |



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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Options

|                                                                                                                                                                                                                                                                                                                                                                                                                      |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Installation & Start-Up of a ProLiant server and Microsoft O/S per the Customer Description and/or Data Sheet. To be delivered on a scheduled basis 8am-5pm, M-F, excl. HP holidays. (U.S. Part Number)                                                                                                                                                                                                              | 240014-002  |
| Installation & Start-Up of a ProLiant server and Microsoft O/S per the Customer Description and/or Data Sheet. To be delivered on a scheduled basis 8am-5pm, M-F, excl. HP holidays. (Canadian Part Number)                                                                                                                                                                                                          | FM-MSTEC-02 |
| Installation & Start-Up of a ProLiant server and Linux O/S per the Customer Description and/or Data Sheet. To be delivered on a scheduled basis 8am-5pm, M-F, excl. HP holidays. (U.S. Part Number)                                                                                                                                                                                                                  | 331072-002  |
| Installation & Start-Up of a ProLiant server and Linux O/S per the Customer Description and/or Data Sheet. To be delivered on a scheduled basis 8am-5pm, M-F, excl. HP holidays. (Canadian Part Number)                                                                                                                                                                                                              | FM-LSTEC-02 |
| <b>Support Plus</b>                                                                                                                                                                                                                                                                                                                                                                                                  |             |
| Onsite HW support, 8am-9pm, M-F, 4hr response and Microsoft O/S SW Tech support offsite, onsite at HP's discretion, 8am-9pm, M-F 2hr response time excl. HP holidays. (U.S. Part Number)                                                                                                                                                                                                                             | 239929-002  |
| Onsite HW support, 8am-9pm, M-F, 4hr response and Microsoft O/S SW Tech support offsite, onsite at HP's discretion, 8am-9pm, M-F 2hr response time excl. HP holidays. (Canadian Part Number)                                                                                                                                                                                                                         | FM-M01E2-36 |
| Onsite HW support, 8am-9pm, M-F, 4hr response and Linux O/S SW Tech support offsite, onsite at HP's discretion, 8am-9pm, M-F 2hr response time excl. HP holidays. (U.S. Part Number)                                                                                                                                                                                                                                 | 331070-002  |
| Onsite HW support, 8am-9pm, M-F, 4hr response and Linux O/S SW Tech support offsite, onsite at HP's discretion, 8am-9pm, M-F 2hr response time excl. HP holidays. (Canadian Part Number)                                                                                                                                                                                                                             | FM-L01E2-36 |
| <b>Support Plus 24</b>                                                                                                                                                                                                                                                                                                                                                                                               |             |
| Onsite HW support 24x7, 4hr response and Microsoft O/S SW Tech support offsite, onsite at HP's discretion, 24x7 2hr response time incl. HP holidays. (U.S. Part Number)                                                                                                                                                                                                                                              | 239931-002  |
| Onsite HW support 24x7, 4hr response and Microsoft O/S SW Tech support offsite, onsite at HP's discretion, 24x7 2hr response time incl. HP holidays. (Canadian Part Number)                                                                                                                                                                                                                                          | FM-M02E2-36 |
| Onsite HW support 24x7, 4hr response and Linux O/S SW Tech support offsite, onsite at HP's discretion, 24x7 2hr response time incl. HP holidays. (U.S. Part Number)                                                                                                                                                                                                                                                  | 331071-002  |
| Onsite HW support 24x7, 4hr response and Linux O/S SW Tech support offsite, onsite at HP's discretion, 24x7 2hr response time incl. HP holidays. (Canadian Part Number)                                                                                                                                                                                                                                              | FM-L02E2-36 |
| <b>CarePak Priority Services for ProLiant Servers - Priority Silver</b>                                                                                                                                                                                                                                                                                                                                              |             |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday - Friday, 8AM - 5PM local time, 2-hr response after hours for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive patch notification, 1 System Healthcheck per year (2-5-2 Part Number for Canada) | FM-M04E2-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                           | FM-M24E2-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday - Friday, 8AM - 5PM local time, 2-hr response after hours for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review (2-5-2 Part Number for Canada)                                                                                                                 | FM-N04E2-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Novell NetWare Operating System (2-5-2 Part Number for Canada)                                                                                                                                                                                                                                                              | FM-N24E2-36 |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday - Friday, 8AM - 5PM local time, 2-hr response after hours for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System, Technical Account Manager, Technical Newsletter, SW activity review, proactive patch notification, 1 System Healthcheck per year (6-3 Part Number for U.S.)     | 239933-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Windows NT, Windows 2000, Professional, Server or Advanced Server Operating System (6-3 Part Number for U.S.)                                                                                                                                                                                                               | 239935-002  |
| 24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Software Support, 1-hr response, Monday - Friday, 8AM - 5PM local time, 2-hr response after hours for Novell NetWare Operating System, Technical Account Manager, Technical Newsletter, SW activity review (6-3 Part Number for U.S.)                                                                                                                     | 239973-002  |





# QuickSpecs

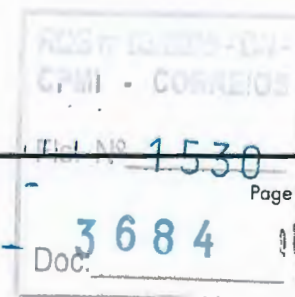
HP ProLiant DL380 Generation 3 (G3)

## Options

24 x 7 HW, 4-hr response, Named HW engineer; 24 x 7 Silver Subsequent System Support for Novell NetWare Operating System (6-3 Part Number for U.S.)

239975-002

NOTE: For more information, customer/resellers can contact <http://www.hp.com/services/carepack>



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Memory

HP ProLiant Model DL380 Generation 3 (G3) 3.06GHz Models

### Standard Memory

1 GB PC2100 Registered DDR SDRAM DIMM Memory running at 266MHz comes installed (2 x 512-MB SDRAM)

### Standard Memory Plus Optional Memory

Up to 9,216-MB memory is available with the optional installation of PC2100 Registered DDR SDRAM DIMM Memory Option Kit

### Standard Memory Replaced with Optional Memory

Up to 12,288-MB of memory is available with the removal of the standard 512-MB of memory and the optional installation of PC2100 Registered DDR SDRAM DIMM Memory Option Kit

NOTE: Chart does not represent all possible configurations.

| Memory   |          | Slot   |        |        |        |        |        |
|----------|----------|--------|--------|--------|--------|--------|--------|
|          |          | 1      | 2      | 3      | 4      | 5      | 6      |
| Standard | 1024MB   | 512MB  | 512MB  | Empty  | Empty  | Empty  | Empty  |
| Optional | 8,960MB  | 512MB  | 512MB  | 2048MB | 2048MB | 2048MB | 2048MB |
| Maximum  | 12,288MB | 2048MB | 2048MB | 2048MB | 2048MB | 2048MB | 2048MB |

NOTE: In the online spare configuration, the ROM automatically configures the last populated bank as the spare memory. If only banks A and B are populated, bank B is the spare bank. If banks A, B, and C are populated, bank C is the spare bank. Online spare memory is configured through RBSU.

Following are memory options available from HP:

- 4096MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x 2048 MB) 300682-B21  
NOTE: The 4096MB of Advanced ECC PC2100 DDR Memory kit (300682-B21) can only be used in 3.06GHz and faster models.
- 2048-MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x1024MB) 300680-B21
- 1024-MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2 x 512MB) 300679-B21
- 512-MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2 x 256MB) 300678-B21

HP ProLiant Model DL380 Generation 3 (G3) 2.8GHz and 2.4GHz Models

### Standard Memory

512MB PC2100 Registered DDR SDRAM DIMM Memory running at 200MHz comes installed (2 x 256-MB SDRAM)

### Standard Memory Plus Optional Memory

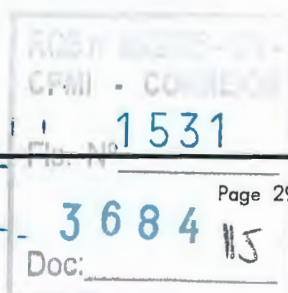
Up to 4,608-MB memory is available with the optional installation of PC2100 Registered DDR SDRAM DIMM Memory Option Kit

### Standard Memory Replaced with Optional Memory

Up to 6,144-MB of memory is available with the removal of the standard 256-MB of memory and the optional installation of PC2100 Registered DDR SDRAM DIMM Memory Option Kit

NOTE: Chart does not represent all possible configurations.

| Memory   |         | Slot   |        |        |        |        |        |
|----------|---------|--------|--------|--------|--------|--------|--------|
|          |         | 1      | 2      | 3      | 4      | 5      | 6      |
| Standard | 512MB   | 256MB  | 256MB  | Empty  | Empty  | Empty  | Empty  |
| Optional | 4,608MB | 256MB  | 256MB  | 1024MB | 1024MB | 1024MB | 1024MB |
| Maximum  | 6,144MB | 1024MB | 1024MB | 1024MB | 1024MB | 1024MB | 1024MB |





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Memory

NOTE: In the online spare configuration, the ROM automatically configures the last populated bank as the spare memory. If only banks A and B are populated, bank B is the spare bank. If banks A, B, and C are populated, bank C is the spare bank. Online spare memory is configured through RBSU.

Following are memory options available from HP:

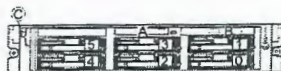
- |                                                                       |            |
|-----------------------------------------------------------------------|------------|
| ● 2048-MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x1024MB) | 300680-B21 |
| ● 1024-MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit 2 x 512MB) | 300679-B21 |
| ● 512-MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2 x 256MB) | 300678-B21 |



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Storage



|       |                                                                                                                                        |
|-------|----------------------------------------------------------------------------------------------------------------------------------------|
| 0 - 5 | Six 6" Wide Ultra3 SCSI hot plug hard drive bays                                                                                       |
| A     | 1.44-MB Diskette Drive                                                                                                                 |
| B     | 24x IDE CD-ROM (Universal Media Bay)                                                                                                   |
| C     | Six 1" Wide Ultra3/Ultra320 SCSI hot plug hard drives or for five hot plug hard drives and one AIT or 20/40-GB DAT hot plug tape drive |

## Drive Support

### Removable Media

|                                             | Quantity Supported | Position Supported | Controller     |
|---------------------------------------------|--------------------|--------------------|----------------|
| 1.44-MB Diskette Drive                      | 1                  | A                  | Integrated     |
| IDE CD-ROM Drive                            | 1                  | B                  | Integrated IDE |
| Online DVD-ROM (8x24x) Option Kit (Servers) | 1                  | B                  | Integrated IDE |

### Hard Drives

#### Ultra320 Hot Pluggable Drives

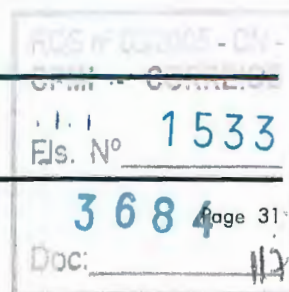
|                     | Quantity Supported | Position Supported | Controller                                             |
|---------------------|--------------------|--------------------|--------------------------------------------------------|
| <u>1-inch</u>       | Up to 6            | 0-5                | Smart Array 5i Controller (integrated on system board) |
| 146.8-GB 10,000 rpm |                    |                    | Smart Array 532 Controller                             |
| 72.8-GB 10,000 rpm  |                    |                    | Smart Array 5302/128 Controller                        |
| 36.4-GB 10,000 rpm  |                    |                    | Smart Array 5304/256 Controller                        |
| 72.8-GB 15,000 rpm  |                    |                    | Smart Array 6402/128 Controller                        |
| 36.4-GB 15,000 rpm  |                    |                    | Smart Array 5312 Controller                            |
| 18.2-GB 15,000 rpm  |                    |                    | Smart Array 641 Controller                             |
|                     |                    |                    | Smart Array 642 Controller                             |
|                     |                    |                    | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |

NOTE: All U320 Universal Hard Drives are backward compatible to U2 or U3 speeds. U320 drives require an optional U320 Smart Array Controller or U320 SCSI HBA to support U320 transfer rates.

### External Storage

|                                                                            | Quantity Supported                                                               | Position Supported | Controller                                                                                                                                                                                       |
|----------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| StorageWorks Enclosure 4300 Family (supports Ultra2/Ultra3 1" drives only) | Up to 13                                                                         | External           | Smart Array 532 Controller<br>Smart Array 5302/128 Controller<br>Smart Array 5304/256 Controller<br>Smart Array 6402/128 Controller<br>Smart Array 5312 Controller<br>Smart Array 642 Controller |
| 3U Rackmount Kit                                                           | Up to 3                                                                          | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                                                                                                                |
| 5U Rackmount Kit                                                           |                                                                                  |                    | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter                                                                                                                                                |
| MSA 1000                                                                   | Please see the MSA 1000 QuickSpecs below to determine configuration requirements | External           | Please see the MSA 1000 QuickSpecs (URL below) for the latest list of supported HBAs                                                                                                             |

MSA 1000: [http://www5.compaq.com/products/quickspecs/11033\\_na/11033\\_na.HTML](http://www5.compaq.com/products/quickspecs/11033_na/11033_na.HTML)





# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Storage

Maximum Storage Capacity – (StorageWorks Enclosure SCSI Attached)

|          |                                               |
|----------|-----------------------------------------------|
| Internal | 880.8 GB (6 x 146.8 GB Ultra 320 1")          |
| External | 26.717 TB (13 x (14 x 146.8 GB Ultra 320 1")) |
| Total    | 27.598 TB                                     |

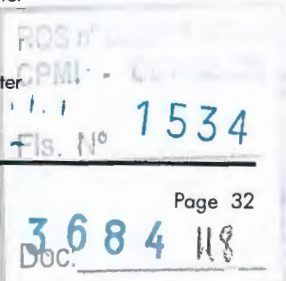
### Tape Drives

NOTE: For an up-to-date listing of the latest O/S Support details for each of the Tape Drives listed below, please see the following:  
[http://www5.compaq.com/products/quickspecs/North\\_America/10233.html](http://www5.compaq.com/products/quickspecs/North_America/10233.html)

NOTE: For an up-to-date listing of the latest O/S Support details for each of the Tape Storage Systems listed below, please see the following:  
[http://www5.compaq.com/products/quickspecs/North\\_America/10809.html](http://www5.compaq.com/products/quickspecs/North_America/10809.html)

NOTE: Please see the Smart Array 5i Controller QuickSpecs for additional information regarding supported options at:  
[http://www5.compaq.com/products/quickspecs/10890\\_NA/10890\\_NA.HTML](http://www5.compaq.com/products/quickspecs/10890_NA/10890_NA.HTML)

|                                      | Quantity Supported                                     | Position Supported | Controller                                             |
|--------------------------------------|--------------------------------------------------------|--------------------|--------------------------------------------------------|
| Internal DAT 20/40                   | Up to 3                                                | 0+1, 2+3, C        | Smart Array 5i Controller (integrated on system board) |
| Internal DAT 72                      |                                                        |                    | Smart Array 532                                        |
|                                      |                                                        |                    | Smart Array 5302/32 Controller                         |
|                                      |                                                        |                    | Smart Array 5302/64 Controller                         |
|                                      |                                                        |                    | Smart Array 5302/128 Controller                        |
|                                      |                                                        |                    | Smart Array 5304/128 Controller                        |
|                                      |                                                        |                    | Smart Array 5304/256 Controller                        |
|                                      |                                                        |                    | Smart Array 6402/128 Controller                        |
|                                      |                                                        |                    | Smart Array 5312 Controller                            |
|                                      |                                                        |                    | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| Internal AIT 100-GB, Hot Plug        | Up to 3                                                | 0+ 1, 2+ 3, C      | Smart Array 5i Controller                              |
| Internal AIT 50-GB, Hot Plug         |                                                        |                    | Smart Array 532 Controller                             |
| Internal AIT 35-GB, LVD, Hot Plug    |                                                        |                    | Smart Array 5302/128 Controller                        |
| Internal 20/40-GB DAT, Hot Plug      |                                                        |                    | Smart Array 5304/256 Controller                        |
|                                      |                                                        |                    | Smart Array 6402/128 Controller                        |
|                                      |                                                        |                    | Smart Array 5312 Controller                            |
|                                      |                                                        |                    | Smart Array 641 Controller                             |
|                                      |                                                        |                    | Smart Array 641 Controller                             |
|                                      |                                                        |                    | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| 20/40-GB DAT DDS-4 8                 | Up to 2                                                | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| Cassette Autoloader (external)       |                                                        |                    |                                                        |
| SSL1016 SDLT160/320 tape autoloader  | Up to 2                                                | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| HP StorageWorks AIT 35 GB Autoloader | Up to 1 (for a single HBA)<br>Up to 2 (for a dual HBA) | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| Ultrium 215, External                | Up to 2                                                | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| Ultrium 230, External                |                                                        |                    |                                                        |
| Ultrium 460, External                |                                                        |                    |                                                        |
| SDLT 110/220-GB, External            | Up to 2                                                | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| SDLT 160/320-GB, External            |                                                        |                    |                                                        |
| External DAT 72                      | 2                                                      | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| AIT 100-GB External                  | 2                                                      | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |
| AIT 50-GB External                   |                                                        |                    |                                                        |
| AIT 35-GB LVD External               |                                                        |                    |                                                        |
| External 40/80-GB DLT Enhanced       | Up to 3                                                | External           | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter      |



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

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## Storage

|                                       |                           |          |                                                   |
|---------------------------------------|---------------------------|----------|---------------------------------------------------|
| SSL2020 AIT Library                   | Up to 5                   | External | SAN Access Module for Smart Array 5302 Controller |
| MSL5026DLX (40/80GB DLT-based)        | 2 drives per SCSI channel | External | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter |
| MSL5026SL (SDLT-based) Library        |                           |          | 64-Bit/133-MHz Dual Channel Ultra320 SCSI Adapter |
| MSL5052SL (SDLT-based) Library        |                           |          |                                                   |
| MSL5030L (LTO-based) Library          |                           |          |                                                   |
| MSL5060S (LTO-based) Library          |                           |          |                                                   |
| MSL6060L1 (Ultrium 460-based) Library |                           |          |                                                   |
| MSL6030 (LTO Ultrium-based) Library   |                           |          |                                                   |



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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## Power Specifications

|                                         |                  |
|-----------------------------------------|------------------|
| Part Number                             | 194989-001       |
| Spare Kit                               | 199382-B21       |
| Operational Input Voltage Range (V rms) | 90 to 264        |
| Frequency Range (Nominal) (Hz)          | 47 to 63 (50/60) |

|                                        |      |      |      |      |      |      |
|----------------------------------------|------|------|------|------|------|------|
| Nominal Input Voltage (Vrms)           | 100  | 115  | 208  | 220  | 230  | 240  |
| Max Rated Output Wattage Rating        | 400  | 400  | 400  | 400  | 400  | 400  |
| Nominal Input Current (A rms)          | 5.8  | 5.0  | 2.7  | 2.5  | 2.4  | 2.3  |
| Max Rated Input Wattage Rating (Watts) | 571  | 563  | 548  | 541  | 541  | 541  |
| Max. Rated VA (Volt-Amp)               | 583  | 575  | 559  | 552  | 552  | 552  |
| Efficiency (%)                         | 70   | 71   | 73   | 74   | 74   | 74   |
| Power Factor                           | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Standby Current (mA)                   | 0.31 | 0.36 | 0.65 | 0.69 | 0.72 | 0.75 |
| Maximum Inrush Current (A peak)        | 50   | 50   | 50   | 50   | 50   | 50   |
| Maximum Inrush Current duration        | 20   | 20   | 20   | 20   | 20   | 20   |

## System Specifications

ProLiant DL380 Generation 3 Fully Configured

Up to 2 Processors, 6 Memory Slots, 6 Hard Drives, 3 PCI Slots, and 2 Hot Plug Power Supplies

|                                                          |                          |      |      |                                             |      |      |
|----------------------------------------------------------|--------------------------|------|------|---------------------------------------------|------|------|
| Nominal Input Voltage (Vrms)                             | 100                      | 115  | 208  | 220                                         | 230  | 240  |
| Fully Loaded System Input Wattage (W)                    | 431                      | 411  | 406  | 400                                         | 395  | 390  |
| Fully Loaded System Input Current (A rms)                | 4.3                      | 3.6  | 2.0  | 1.9                                         | 1.8  | 1.7  |
| Fully Loaded System Thermal (BTU- Hr)                    | 1421                     | 1401 | 1383 | 1365                                        | 1347 | 1330 |
| Fully Loaded System VA (Volt-Amp)                        | 425                      | 419  | 414  | 408                                         | 403  | 398  |
| System Leakage with all power supplies loaded (mA)       | 0.63                     | 0.72 | 1.30 | 1.38                                        | 1.44 | 1.50 |
| System Inrush Current with all power supplies loaded (A) | 100                      | 100  | 100  | 100                                         | 100  | 100  |
| Power cord requirements                                  | Nema 5-15P to IEC320-C13 |      |      | Option no./Spare no.: See Chart below       |      |      |
|                                                          | IEC320-C13 to IEC320-C14 |      |      | Option no./Spare no.: 142259-001/142258-B21 |      |      |

### NOTES:

\* To review typical system power ratings use the Active Answers Power Calculator which is available via the online tool located at URL:

<http://h30099.www3.hp.com/configurator/powercalcs.asp>

To drill down to calculators:

- Click on: "ProLiant Servers"
- Click on the Server of interest. Example: DL380 G3
- Click on: "Power Calculator" link. (You may need to scroll down to see it.)

|                                                               |                       |
|---------------------------------------------------------------|-----------------------|
| Power Cords (Nema 5-15P to IEC320-C13)                        |                       |
| Country                                                       |                       |
| Standard Power Cord Part Number/Option Power Cord Part Number | 163719-002/227099-001 |
| Power Cords (IEC320-C13 to IEC320-C14)                        |                       |
| Standard Power Cord Part Number/Option Power Cord Part Number | 142263-003/142257-003 |



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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## TechSpecs

|                                       |                                                 |                                                   |
|---------------------------------------|-------------------------------------------------|---------------------------------------------------|
| System Unit                           | Dimensions (HxWxD)                              | 3.38 x 17.50 x 25.75 in (8.59 x 44.45 x 65.41 cm) |
| Weight                                | Maximum:                                        | 60 lb (27.22 kg)                                  |
|                                       | No drives:                                      | 47.18 lb (20.41 kg)                               |
| Input Requirements (per power supply) | Range Line Voltage                              | 90 to 132 VAC/180 to 265 VAC                      |
|                                       | Nominal Line Voltage                            | 100 to 120 VAC/220 to 240 VAC                     |
|                                       | Rated Input Current                             | 6A (110V) to 3A (220V)                            |
|                                       | Rated Input Frequency                           | 50 to 60 Hz                                       |
|                                       | Rated Input Power                               | 600W                                              |
| BTU Rating                            |                                                 | 1,475 BTU/HR                                      |
| SCSI Connectors                       |                                                 | One external VHDCI connector                      |
| Power Supply                          | Rated Steady-State Power                        | 400W                                              |
| Output Power (per power supply)       | Maximum Peak Power                              | 400W                                              |
| Temperature Range                     | Operating                                       | 50° to 95° F (10° to 35° C)                       |
|                                       | Shipping                                        | -40° to 158° F (-40° to 70° C)                    |
| Relative Humidity (non-condensing)    | Operating                                       | 10% to 90%                                        |
|                                       | Shipping                                        | 5% to 95%                                         |
| Maximum Wet Bulb Temperature          |                                                 | 82.4° F (28° C)                                   |
| Acoustic Noise                        | Idle Minimum (Fixed Disk Drives Spinning)       |                                                   |
|                                       | L WAd (BELS)                                    | 7.0                                               |
|                                       | L pAm (dBA)                                     | 55                                                |
|                                       | Operating Minimum (Random Seeks to Fixed Disks) |                                                   |
|                                       | L WAd (BELS)                                    | 7.0                                               |
|                                       | L pAm (dBA)                                     | 55                                                |
| Acoustic Noise                        | Idle Maximum (Fixed Disk Drives Spinning)       |                                                   |
|                                       | L WAd (BELS)                                    | 7.2                                               |
|                                       | L pAm (dBA)                                     | 56                                                |
|                                       | Operating Maximum (Random Seeks to Fixed Disks) |                                                   |
|                                       | L WAd (BELS)                                    | 7.3                                               |
|                                       | L pAm (dBA)                                     | 57                                                |



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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## TechSpecs

|                        |                                                               |                                    |                         |
|------------------------|---------------------------------------------------------------|------------------------------------|-------------------------|
| 1.44-MB Diskette Drive | Size                                                          | 3.5 in                             |                         |
|                        | LED Indicators<br>(front panel)                               | Green                              |                         |
|                        | Read/Write Capacity<br>per Diskette<br>(high/mid/low density) | 1.44 MB/1.2 MB/720 KB<br>formatted |                         |
|                        | Drive Supported                                               | One                                |                         |
|                        | Drive Height                                                  | 0.50 in (1.27 cm)                  |                         |
|                        | Drive Rotation                                                | 300/360/300 rpm                    |                         |
|                        | Transfer Rate<br>(high/mid/low)                               | 500/500/250 KB/s                   |                         |
|                        | Bytes/Sector                                                  | 512                                |                         |
|                        | Sectors/Track<br>(high/mid/low)                               | 18/15/9                            |                         |
|                        | Tracks/Side (high/low)                                        | 80/80                              |                         |
|                        | Access Times                                                  | Track-to-Track<br>(high/mid/low)   | 3/3/6 ms                |
|                        |                                                               | Average<br>(high/mid/low)          | 174/94/94 ms            |
|                        |                                                               | Settling Time                      | 15 ms                   |
|                        |                                                               | Latency Average                    | 100 ms /83.3 ms /100 ms |
|                        | Cylinders (high/low)                                          | 80/80                              |                         |
|                        | Read/Write Heads                                              | Two                                |                         |

# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## TechSpecs

|                                                      |                           |                  |                                                                                                                                                                 |
|------------------------------------------------------|---------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24X Max IDE<br>CD-ROM Drive<br>(Universal Media Bay) | Disk                      | Applicable Disk  | CD-DA, CD-ROM (Mode 1 and 2)<br>CD-XA, CD-I (Mode 2, Form 1 and 2)<br>CD-I Ready, CD Extra, Video CD, CD-Bridge<br>Photo CD (Single and Multi-session)<br>CD-WO |
|                                                      |                           | Capacity         | 550 MB (Mode 1, 12 cm)<br>640 MB (Mode 2, 12 cm)                                                                                                                |
|                                                      |                           | Diameter         | 4.7 in, 3.15 in/12in, 8 cm                                                                                                                                      |
|                                                      |                           | Rotational Speed | 4200 rpm maximum                                                                                                                                                |
|                                                      |                           | Center Hole      | 0.6 in/1.524 cm diameter                                                                                                                                        |
|                                                      |                           | Thickness        | 0.047 in/0.12 cm                                                                                                                                                |
|                                                      |                           | Track Pitch      | 1.6 $\mu$ m                                                                                                                                                     |
|                                                      | Block Size                | Mode 0           | 2,368, 2,352 bytes                                                                                                                                              |
|                                                      |                           | Mode 1           | 2,352, 2,340, 2,336, 2,048 bytes                                                                                                                                |
|                                                      |                           | Mode 2           | 2,352, 2,340, 2,336, 2,048 bytes                                                                                                                                |
|                                                      | Interface                 | IDE (ATAPI)      |                                                                                                                                                                 |
|                                                      | Access Times<br>(typical) | Random           | < 140 ms                                                                                                                                                        |
|                                                      |                           | Full-Stroke      | < 300 ms                                                                                                                                                        |
|                                                      | Data Transfer Rate        | Sustained        | 150 KB/s (sustained 1X)                                                                                                                                         |
|                                                      |                           | Burst            | 2100 to 4800 KB/s                                                                                                                                               |
|                                                      | Cache Buffer              | 128 KB           |                                                                                                                                                                 |
|                                                      | Start-up Time (typical)   | < 10 seconds     |                                                                                                                                                                 |
|                                                      | Stop Time                 | < 5 seconds      |                                                                                                                                                                 |
|                                                      | Operating Conditions      | Temperature      | 41° to 120° F (5° to 55° C)                                                                                                                                     |
|                                                      |                           | Humidity         | 10% to 80%                                                                                                                                                      |
|                                                      | Dimensions                | (HxWxD, maximum) | 0.51 x 5.24 x 5.2 in (1.3 x 13.31 x 13.21 cm)                                                                                                                   |
|                                                      |                           | Weight           | < 340 g                                                                                                                                                         |



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# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## TechSpecs

### Integrated Smart Array 5i Plus Controller

Data Compatible with all Yes  
Smart Array Controllers

Instant Upgrades to other Yes  
Smart Array Controllers

Consistent Software Yes  
Manageability Tools

PCI-X Bus 64-bit, 100 MHz (integrated on system board)

PCI-X Peak Data 800 MB/s  
Transfer Rate

SCSI Protocols Supported Ultra3, Ultra2

SCSI Peak Data 160 MB/s per channel

Transfer Rate NOTE: For ProLiant servers having two internal drive bays on separate SCSI ports:  
SCSI Peak Data Transfer Rate is 320 MB/s total; 160 MB/s per channel and Channels is 2.

Channels 2

NOTE: For ProLiant servers having two internal drive bays on separate SCSI ports: SCSI  
Peak Data Transfer Rate is 320 MB/s total; 160 MB/s per channel and Channels is 2.

SCSI Ports 0/2

(external/internal)

NOTE: For ProLiant servers having two internal drive bays on separate SCSI ports: SCSI  
Peak Data Transfer Rate is 320 MB/s total; 160 MB/s per channel and Channels is 2.

Drives Supported Maximum = total number of drives

(maximum)

NOTE: Maximum is the total number of internal drives on each specific ProLiant server.

Cache 64 MB Read and/or Write Cache

Battery-Backed Write Cache Yes, with installation of Battery-Backed Write Cache Enabler, up to 64MB

RAID Support 0, 1, 1+0, 5

Logical Drives Maximum = total number of drives  
(maximum)

Online Configuration Yes

Online Capacity Yes

Expansion

Logical Drive Capacity Yes

Extension

Online Stripe Size Yes

Migration

Online RAID Level Yes

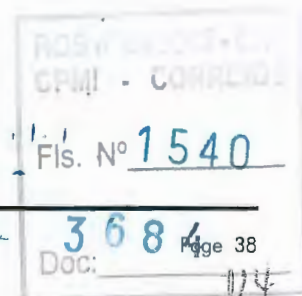
Migration

Online Spare Support Yes

Automatic Data Recovery Yes

Drive Roaming Yes

Redundant Controllers No



# QuickSpecs

HP ProLiant DL380 Generation 3 (G3)

## TechSpecs

|                                                                            |                       |                                 |                                                   |
|----------------------------------------------------------------------------|-----------------------|---------------------------------|---------------------------------------------------|
| NC7781 PCI-X Gigabit<br>NIC (embedded)<br>10/100/1000 WOL<br>(Wake On LAN) | Network Interface     | 10Base-T/100Base-TX/1000 BaseTX |                                                   |
|                                                                            | Compatibility         | IEEE 802.3/802.3u compliant     |                                                   |
|                                                                            | Data Transfer Method  | 64-bit bus-master PCI-X         |                                                   |
|                                                                            | Network Transfer Rate | 10Base-T (Half-Duplex),         | 10 Mb/s                                           |
|                                                                            |                       | 10Base-T (Full-Duplex)          | 20 Mb/s                                           |
|                                                                            |                       | 100Base-TX (Half-Duplex)        | 100 Mb/s                                          |
|                                                                            |                       | 100Base-TX (Full-Duplex)        | 200 Mb/s                                          |
|                                                                            |                       | 1000Base-TX (Half-Duplex)       | 1000 Mb/s                                         |
|                                                                            |                       | 1000Base-TX (Full-Duplex)       | 2000 Mb/s                                         |
|                                                                            | Connector             | RJ-45                           |                                                   |
|                                                                            | Cable Support         | 10Base-T                        | Categories 3, 4 or 5 UTP;<br>up to 328 ft (100 m) |
|                                                                            |                       | 100Base-TX                      | Category 5 UTP; up to 328 ft (100 m)              |
|                                                                            |                       | 1000BaseTX                      | Category 5 UTP; up to 328 ft (100 m)              |

|                  |                      |                                 |
|------------------|----------------------|---------------------------------|
| Video Controller | Controller Chip      | ATI RAGE XL                     |
|                  | Video DRAM           | 8 MB Video SDRAM                |
|                  | Data Transfer Method | 32-bit PCI                      |
|                  | Support Resolution   | Supported Color Depths:         |
|                  |                      | 640 x 480 16.7M, 64K, 256, 16   |
|                  |                      | 800 x 600 16.7M, 64K, 256, 16   |
|                  |                      | 1024 x 768 16.7M, 64K, 256, 16  |
|                  |                      | 1152 x 864 16.7M, 64K, 256, 16  |
|                  |                      | 1280 x 1024 16.7M, 64K, 256, 16 |
|                  | Connector            | VGA                             |

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Integrated lights-out management and enterprise-class uptime, optimized for a variety of application usages - still in a 2U form factor.

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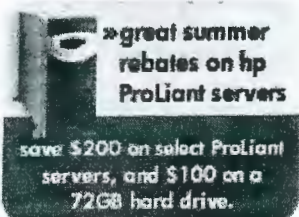
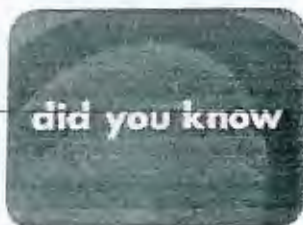
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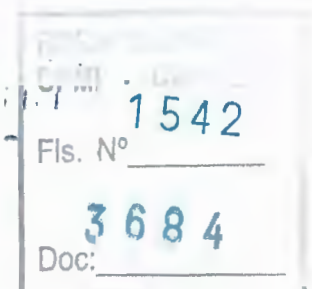


ProLiant DL380 - density-optimized for rack mount environments

|                                |      |   |      |    |       |     |     |      |     |
|--------------------------------|------|---|------|----|-------|-----|-----|------|-----|
| DL380 G3                       | 3.06 | 2 | 1024 | 12 | 880.8 | N/A | 2U  | buy» | new |
| other ProLiant DL380 offerings |      |   |      |    |       |     |     |      |     |
| » DL380 G3 packaged cluster    | 2.8  | 2 | 1024 | 12 | 1000  | N/A | 2U  | buy» |     |
| » DL380 G3 - Racked            | 3.06 | 2 | 1024 | 12 | 1000  | N/A | 14U |      | new |

<sup>1</sup> maximum internal storage  
\* optional

Buy online or call HP at 1-800-282-6672

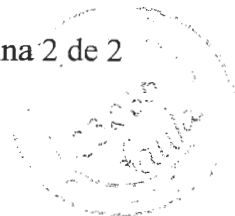


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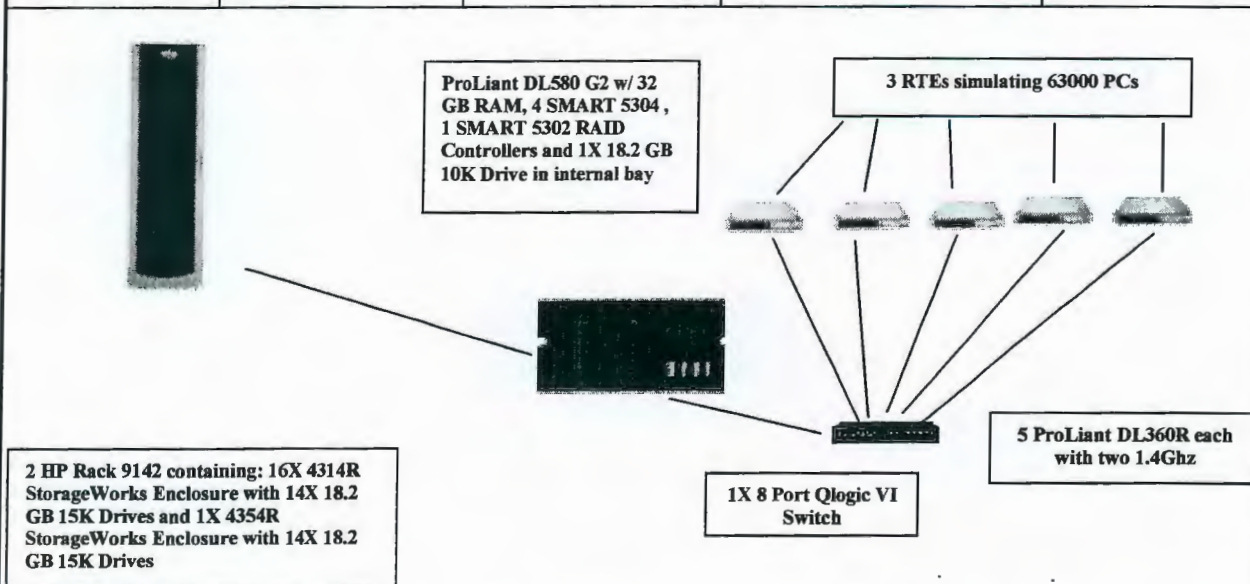
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|-------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|----------------------------------------|---------------------------------------------|
| Hewlett-Packard<br>Company                                              |                                                           | ProLiant DL580 G2/2GHz 4P<br>C/S with 5 ProLiant DL360R |                                        | TPC-C Rev. 5.0<br>Report Date: Nov 19, 2002 |
| Total System Cost                                                       |                                                           | TPC-C Throughput                                        |                                        | Availability Date                           |
| \$413,764                                                               |                                                           | 77,905.18                                               |                                        | Dec 31, 2002                                |
| Processors                                                              | Database Manager                                          | Operating System                                        | Other Software                         | Number of Users                             |
| 4 Intel Xeon<br>2.0 GHz – Server<br>10 Pentium III 1.4<br>GHz – Clients | Microsoft SQL<br>Server 2000<br>Enterprise<br>Edition SP3 | Windows .NET<br>Enterprise Server<br>2003               | Microsoft Visual C++<br>Microsoft COM+ | 62000                                       |



| System Components | Server    |                                        | Each Client |                                      |
|-------------------|-----------|----------------------------------------|-------------|--------------------------------------|
|                   | Quantity  | Description                            | Quantity    | Description                          |
| Processor         | 4         | 2.0 GHz Intel Xeon w/ 2M Cache         | 2           | 1.4GHz Pentium III w/ 512K cache     |
| Memory            | 16        | 2 GB DDR                               | 4           | 128MB                                |
| Disk Controllers  | 1         | HP Integrated 5i Smart Controller      | 1           | Integrated SMART 5i Array Controller |
|                   | 4,1       | HP SMART 5304,5302 Array Controller    |             |                                      |
| Disk Drives       | 14<br>225 | 36 GB SCSI Drive<br>18.2 GB SCSI Drive | 1           | 18.2 GB SCSI Drive                   |
| Total Storage     |           | 4286.26 GB                             |             | 18.2 GB                              |
| Tape Drives       | 1         | 12/24 GB DAT                           |             |                                      |

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| Hewlett-Packard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     | HP ProLiant DL580 G2/2GHz-4P |            | TPC-C Rev. 5.0                |                |                    |           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------|------------|-------------------------------|----------------|--------------------|-----------|
| Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     | Client/Server                |            | Report Date:                  |                | 19-Nov-02          |           |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Part Number         | Third Party                  | Unit Price | Qty                           | Extended Price | 3 yr. Maint. Price |           |
| Server Hardware                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     | Brand Pricing                |            |                               |                |                    |           |
| ProLiant DL580 X1600 2P X2GB, Integrated Smart Array Controller E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 202176-001          | 1                            | 19,499     | 1                             | 19,499         |                    |           |
| 2.0 GHz 1M processor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 226776-B21          | 1                            | 6,199      | 2                             | 12,398         |                    |           |
| 8GB (4x2GB) DDR ECC 200MHz Memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 202173-B21          | 1                            | 25,909     | 4                             | 103,636        |                    |           |
| StorageWorks Enclosure Model 4314R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 190209-001          | 1                            | 2,955      | 16                            | 47,280         |                    |           |
| StorageWorks Enclosure Model 4354                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 190211-001          | 1                            | 3,523      | 1                             | 3,523          |                    |           |
| Smart Array 5304/128 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 158939-B21          | 1                            | 2,099      | 4                             | 8,396          |                    |           |
| Smart Array 5302/84 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 124992-B21          | 1                            | 1,399      | 1                             | 1,399          |                    |           |
| V570 Color Monitor - 15 inch CRT - Opal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 228113-001          | 1                            | 169        | 1                             | 169            |                    |           |
| HP Mouse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 170299-B21          | 1                            | 23         | 1                             | 23             |                    |           |
| HP Enhanced Keyboard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 122660-006          | 1                            | 44         | 1                             | 44             |                    |           |
| 12/24-Gigabyte DAT Drive (internal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 295513-B22          | 1                            | 682        | 1                             | 682            |                    |           |
| HP Rack Model 9142 (42U - Opal) - Flat Pallet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 120663-B21          | 1                            | 1,352      | 2                             | 2,704          |                    |           |
| HP Rack Sidewall Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 120670-B21          | 1                            | 212        | 1                             | 212            |                    |           |
| UPS R3000 XR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 192186-001          | 1                            | 1,703      | 1                             | 1,703          |                    |           |
| 18.2-GB Pluggable 1" Universal WideUltra3 10K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 142673-B22          | 1                            | 319        | 1                             | 319            |                    |           |
| 18.2-GB Pluggable 1" Universal WideUltra3 15K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 188122-B22          | 1                            | 399        | 224                           | 89,376         |                    |           |
| 18.2-GB Pluggable 1" Universal WideUltra3 15K HDD (10% spares)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 188122-B22          | 1                            | 399        | 23                            |                | 9,177              |           |
| 36.4-GB Pluggable 1" Universal WideUltra3 15K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 232916-B22          | 1                            | 619        | 14                            | 8,666          |                    |           |
| 36.4-GB Pluggable 1" Universal WideUltra3 15K HDD (2 spares)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 232916-B22          | 1                            | 619        | 2                             |                | 1,238              |           |
| FM-M1724-36 3YR 24X7 4HR 500 SERIES SVR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 401782-002          | 1                            | 1,795      | 1                             |                | 1,795              |           |
| FM-4E724-36 3YR 24X7/4HR EMPTY DISK ENCL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 171242-002          | 1                            | 157        | 17                            |                | 2,669              |           |
| Qlogic QLA-2350 Fibre-Channel VI Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | QLA2350-BK          | 3                            | 2,095      | 1                             | 2,095          |                    |           |
| Subtotal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                              |            |                               | 302,124        | 14,879             |           |
| Server Software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                              |            |                               |                |                    |           |
| Microsoft SQL Server 2000 Enterprise Edition(per processor)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 810-00845 Microsoft | 2                            | 16,541     | 4                             | 66,164         | 5,850              |           |
| Microsoft Visual C++ 6.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 048-00317 Microsoft | 2                            | 549        | 1                             | 549            | Incl Above         |           |
| Microsoft Windows .NET Enterprise Server 2003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | NA Microsoft        | 2                            | 2,699      | 1                             | 2,699          | Incl Above         |           |
| Subtotal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                              |            |                               | 69,412         | 5,850              |           |
| Client Hardware                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                              |            |                               |                |                    |           |
| ProLiant DL360R01 P1.4GHz 512KB 128MB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 233271-001          | 1                            | 2,679      | 5                             | 13,395         |                    |           |
| Dual Integrated Gigabit NIC, Integrated Smart Array Controller 5i                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |                              |            |                               |                |                    |           |
| 1.40GHz PIII Processor Option Kit (DL360 G2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 201099-B21          | 1                            | 1,099      | 5                             | 5,495          |                    |           |
| 128 MB 133 DIMM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 128277-B21          | 1                            | 149        | 15                            | 2,235          |                    |           |
| V570 Color Monitor - 15 inch CRT - Opal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 228113-001          | 1                            | 169        | 5                             | 845            |                    |           |
| HP Mouse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 170299-B21          | 1                            | 23         | 5                             | 115            |                    |           |
| HP Enhanced Keyboard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 122660-006          | 1                            | 44         | 5                             | 220            |                    |           |
| 18.2-GB Pluggable 1" Universal WideUltra3 10K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 142673-B22          | 1                            | 319        | 5                             | 1,595          |                    |           |
| FM-EL724-36 3YR 24X7 4HR ENTRY 300 SVR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 162675-002          | 1                            | 750        | 5                             |                | 3,750              |           |
| Qlogic QLA-2350 Fibre-Channel VI Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | QLA2350-BK          | 3                            | 2,095      | 7                             | 14,665         |                    |           |
| Subtotal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                              |            |                               | 38,565         | 3,750              |           |
| Client Software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                              |            |                               |                |                    |           |
| Microsoft Windows 2000 Server                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | C11-00821 Microsoft | 2                            | 738        | 5                             | 3,690          | Incl. Above        |           |
| Subtotal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                              |            |                               | 3,690          | 0                  |           |
| User Connectivity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |                              |            |                               |                |                    |           |
| Qlogic SANBox-1 8-Port Switch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SANBOX2-8P          | 3                            | 8,750      | 3                             | 26,250         |                    |           |
| Subtotal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                              |            |                               | 26,250         | 0                  |           |
| Large Purchase and Cash discount (See Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     | 16.0%                        | 1          |                               |                |                    |           |
| Total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                              |            |                               | \$391,666      | \$22,098           |           |
| Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated components. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the TPC benchmark pricing specifications. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank you. |                     |                              |            | Three-Year Cost of Ownership: |                |                    | \$413,764 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                              |            | IpmC Rating:                  |                |                    | 77905.18  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                              |            | \$ / IpmC:                    |                |                    | \$5.32    |
| Pricing: 1=HP Direct 2=Microsoft 3=Qlogic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                              |            |                               |                |                    |           |
| Note 1 = Discount based on HP Direct guidance and large cash purchase level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                     |                              |            |                               |                |                    |           |
| Note: The benchmark results and test methodology were audited by Lorna Livingtree of Performance Metrics, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                              |            |                               |                |                    |           |

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## Numerical Quantities Summary

**MQTH, Computed Maximum Qualified Throughput**

**77905.18 tpmC**

### Response Times (in seconds)

|                                | Average | 90%  | Maximum |
|--------------------------------|---------|------|---------|
| New-Order                      | 0.38    | 0.63 | 7.60    |
| Payment                        | 0.30    | 0.54 | 8.08    |
| Order-Status                   | 0.32    | 0.56 | 5.87    |
| Delivery (interactive portion) | 0.10    | 0.11 | 0.43    |
| Delivery (deferred portion)    | 0.16    | 0.22 | 0.63    |
| Stock-Level                    | 0.86    | 1.23 | 9.25    |
| Menu                           | 0.10    | 0.11 | 1.09    |

### Transaction Mix, in percent of total transaction

|              |        |
|--------------|--------|
| New-Order    | 44.96% |
| Payment      | 43.01% |
| Order-Status | 4.01%  |
| Delivery     | 4.02%  |
| Stock-Level  | 4.01%  |

### Emulation Delay (in seconds)

|                        | Resp.Time | Menu |
|------------------------|-----------|------|
| New-Order              | 0.10      | 0.10 |
| Payment                | 0.10      | 0.10 |
| Order-Status           | 0.10      | 0.10 |
| Delivery (interactive) | 0.10      | 0.10 |
| Stock-Level            | 0.10      | 0.10 |

### Keying/Think Times (in seconds)

|                        | Min.       | Average     | Max.         |
|------------------------|------------|-------------|--------------|
| New-Order              | 18.00/0.00 | 18.02/12.02 | 18.05/120.21 |
| Payment                | 3.00/0.00  | 3.02/12.01  | 3.05/120.21  |
| Order-Status           | 2.00/0.00  | 2.01/10.00  | 2.04/100.21  |
| Delivery (interactive) | 2.00/0.00  | 2.01/5.02   | 2.05/50.21   |
| Stock-Level            | 2.00/0.00  | 2.01/5.02   | 2.04/50.21   |

### Test Duration

|                                                                |             |
|----------------------------------------------------------------|-------------|
| Ramp-up time                                                   | 30 minutes  |
| Measurement interval                                           | 120 minutes |
| Transactions (all types) completed during measurement interval | 20,792,598  |
| Ramp down time                                                 | 5 minutes   |

### Checkpointing

|                       |            |
|-----------------------|------------|
| Number of checkpoints | 4          |
| Checkpoint interval   | 30 minutes |

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# TPC Transaction Processing Performance Council

The TPC defines transaction processing and database benchmarks and delivers trusted results to the industry.

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## TPC-C Result Highlights



HP ProLiant DL580-G2/2GHz 4P

### Benchmark Stats

|                |           |
|----------------|-----------|
| Result ID:     | 102112002 |
| Result Status: | In Review |
| TPC-C Rev:     | 5.0       |
| Report Date:   | 11/19/02  |

### System Information

|                     |                                                  |
|---------------------|--------------------------------------------------|
| Total System Cost   | 413,764 US \$                                    |
| TPC-C Throughput    | 77,905                                           |
| Price/Performance   | 5.32 US \$                                       |
| Availability Date   | 12/31/02                                         |
| Database Manager    | Microsoft SQL Server 2000 Enterprise Ed. SP3     |
| Operating System    | Microsoft Windows Server 2003 Enterprise Edition |
| Transaction Monitor | Microsoft COM+                                   |

### Server Information

|            |                       |
|------------|-----------------------|
| CPU:       | Intel Xeon MP 2.0 GHz |
| # of CPUs: | 4                     |
| Cluster:   | N                     |

### Client Information

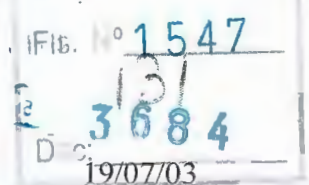
|                  |                          |
|------------------|--------------------------|
| # of clients:    | 5                        |
| CPU:             | Intel Pentium III 1.4GHz |
| CPUs per client: | 2                        |

- Executive Summary (79 KB)
- Full Disclosure Report (1038 KB)

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## TPC-C Result Highlights

**HP ProLiant DL380G3-2P**

### Benchmark Stats

|                |           |
|----------------|-----------|
| Result ID:     | 103053003 |
| Result Status: | In Review |
| TPC-C Rev:     | 5.1       |
| Report Date:   | 05/29/03  |

### System Information

|                     |                                                  |
|---------------------|--------------------------------------------------|
| Total System Cost   | 160,353 US \$                                    |
| TPC-C Throughput    | 43,231                                           |
| Price/Performance   | 3.71 US \$                                       |
| Availability Date   | 05/27/03                                         |
| Database Manager    | Microsoft SQL Server 2000 Enterprise Ed. SP3     |
| Operating System    | Microsoft Windows Server 2003 Enterprise Edition |
| Transaction Monitor | Microsoft COM+                                   |

### Server Information

|            |                    |
|------------|--------------------|
| CPU:       | Intel Xeon 3.06Ghz |
| # of CPUs: | 2                  |
| Cluster:   | N                  |

### Client Information

|                  |                    |
|------------------|--------------------|
| # of clients:    | 1                  |
| CPU:             | Intel Xeon 2.4 GHz |
| CPUs per client: | 2                  |

- Executive Summary (78 KB)
- Full Disclosure Report (1107 KB)

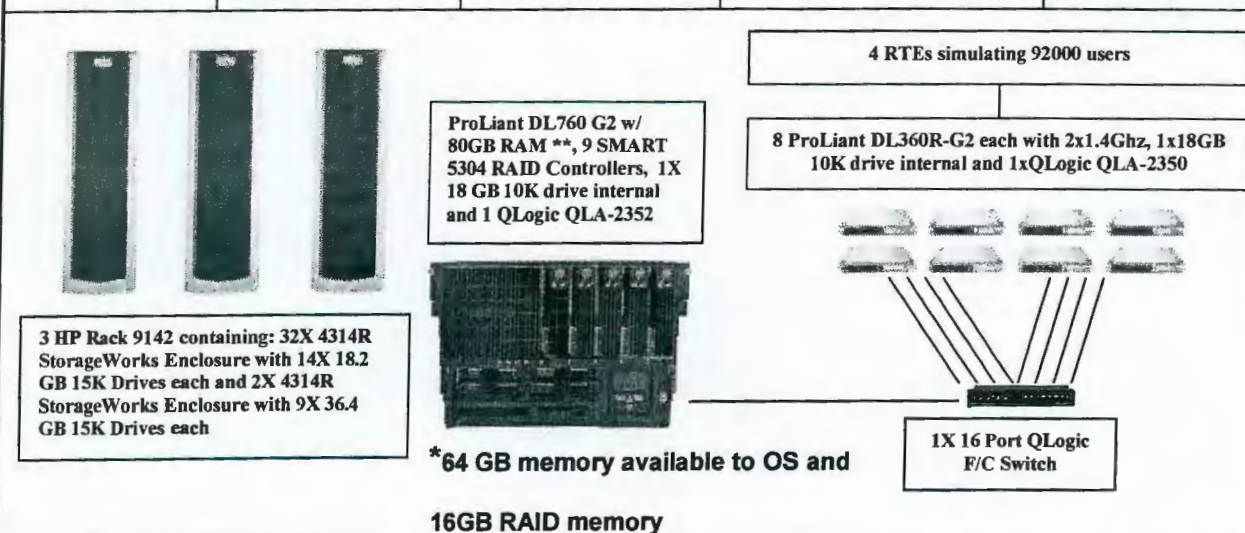
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|                             |                                 |                   |                          |
|-----------------------------|---------------------------------|-------------------|--------------------------|
| Hewlett-Packard<br>Company  | HP ProLiant DL760-G2 8P         |                   | TPC-C Rev. 5.0           |
|                             | C/S with 8 HP ProLiant DL360-G2 |                   | Report Date: Dec 6, 2002 |
| Total System Cost           | TPC-C Throughput                | Price/Performance | Availability Date        |
| <b>\$884,216</b>            | <b>115,025.75</b>               | <b>\$7.69</b>     | <b>May 30, 2003*</b>     |
| *All Hardware Available Now |                                 |                   |                          |

|                                                                            |                                                               |                                                         |                                        |                 |
|----------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------|----------------------------------------|-----------------|
| Processors                                                                 | Database Manager                                              | Operating System                                        | Other Software                         | Number of Users |
| 8 Intel Xeon MP<br>2.0 GHz – Server<br>16 x Pentium III<br>1.4GHz – Client | Microsoft SQL<br>Server 2000<br>Enterprise Edition<br>SP3 QFE | Microsoft Windows<br>Server 2003,<br>Datacenter Edition | Microsoft Visual C++<br>Microsoft COM+ | <b>92000</b>    |



| System Components | Server   |                                    | Each Client |                                     |
|-------------------|----------|------------------------------------|-------------|-------------------------------------|
|                   | Quantity | Description                        | Quantity    | Description                         |
| Processor         | 8        | 2GHz Xeon MP w/<br>2MB Cache       | 2           | 1.4GHz Pentium III<br>w/ 256K cache |
| Memory            | 40       | 2 GB                               | 2           | 1GB                                 |
| Disk Controllers  | 9        | SMART 5304/128<br>Array Controller | 1           | Integrated SMART 5i<br>Controller   |
|                   | 1        | Integrated SMART 5i                |             |                                     |
| Disk Drives       | 1        | 18GB 10K SCSI Drive                | 1           | 18GB 10K SCSI<br>Drive              |
|                   | 448      | 18GB 15K SCSI Drive                |             |                                     |
|                   | 18       | 36GB 15K SCSI Drives               |             |                                     |
| Total Storage     |          | 8198.66 GB                         |             | 18 GB                               |
| Tape Drives       | 1        | 12/24 GB DAT                       |             |                                     |

Notes: This result was found to have an Insignificant Deviation from the TPC-C specification in that it was not considered "orderable" at the time of publication. It is now fully orderable. No changes to the Full Disclosure Report were required.

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| Hewlett-Packard Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  | HP ProLiant DL760G2-8P |                           | TPC-C Rev. 5.0 |     |                  |                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------|---------------------------|----------------|-----|------------------|--------------------|
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  | Part Number            | Third Party Brand Pricing | Unit Price     | Qty | Extended Price   | 3 yr. Maint. Price |
| <b>Server Hardware</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                        |                           |                |     |                  |                    |
| HP ProLiant DL760 X2000 4P X4GB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 171206-B21       | 1                      |                           | 59,500         | 1   | 59,500           |                    |
| 4P 2.0 GHz 2M processor option kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 287520-B21       | 1                      |                           | 30,000         | 1   | 30,000           |                    |
| 2GB 133MHz SDRAM option kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 317093-B21       | 1                      |                           | 5,250          | 40  | 210,000          |                    |
| NC7131 Gigabit Server Adapter PCI, 64/66 10/100/1000-T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 158575-B21       | 1                      |                           | 221            | 1   | 221              |                    |
| StorageWorks Enclosure Model 4314R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 190209-001       | 1                      |                           | 2,955          | 34  | 100,470          |                    |
| Smart Array 5304/128 Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 158939-B21       | 1                      |                           | 2,052          | 9   | 18,468           |                    |
| S5500 15 carbon / silver monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 261602-001       | 1                      |                           | 149            | 1   | 149              |                    |
| HP Mouse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 231947-B21       | 1                      |                           | 5              | 1   | 5                |                    |
| HP Enhanced Keyboard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 265977-001       | 1                      |                           | 12             | 1   | 12               |                    |
| 12/24-Gigabyte DAT Drive (Internal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 295513-B22       | 1                      |                           | 682            | 1   | 682              |                    |
| HP Rack Model 9142 (42U - Open) - Flat Pallet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 120663-B21       | 1                      |                           | 1,321          | 3   | 3,963            |                    |
| HP Rack Sidewall Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 120670-B21       | 1                      |                           | 207            | 1   | 207              |                    |
| Baying Kit - 9000 Series racks (36U and 42U)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 120669-B21       | 1                      |                           | 83             | 2   | 166              |                    |
| UPS R1500 XR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 204404-001       | 1                      |                           | 866            | 1   | 866              |                    |
| 18.2-GB Pluggable 1" Universal WideUltra3 10K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 142673-B22       | 1                      |                           | 311            | 1   | 311              |                    |
| 16.4-GB Pluggable 1" Universal WideUltra3 15K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 232916-B22       | 1                      |                           | 605            | 18  | 10,890           |                    |
| 36.4-GB Pluggable 1" Universal WideUltra3 15K HDD (2 apax)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 232916-B22       | 1                      |                           | 605            | 2   |                  | 1,210              |
| 18.2-GB Pluggable 1" Universal WideUltra3 15K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 188122-B22       | 1                      |                           | 390            | 448 | 174,720          |                    |
| 18.2-GB Pluggable 1" Universal WideUltra3 15K HDD (10% z)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 188122-B22       | 1                      |                           | 390            | 45  |                  | 17,550             |
| FM-HE724-36 3YR 24X7 4HR 700 SERIES SVR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 401784-002       | 1                      |                           | 3,390          | 1   |                  | 3,390              |
| FM-4E724-36 3YR 24X7/4HR EMPTY DISK ENCL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 171242-002       | 1                      |                           | 157            | 34  |                  | 5,338              |
| Qlogic QLA-2352 2-channel Fibre-Channel VI Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | QLA-2352         | 3                      |                           | 3,595          | 3   | 10,785           |                    |
| 5M LC to LC Cable Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 221692-B22       | 1                      |                           | 82             | 2   | 164              |                    |
| 2GB Small Form Pluggable Adapter Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 221470-B21       | 1                      |                           | 369            | 2   | 738              |                    |
| <b>Subtotal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                        |                           |                |     | <b>622,317</b>   | <b>27,488</b>      |
| <b>Server Software</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                        |                           |                |     |                  |                    |
| Database Server Support Package                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | PRO-PRORS-16U-01 | Microsoft 2            |                           | 1,950          | 3   |                  | 5,850              |
| Microsoft SQL Server 2000 Enterprise Edition(per processor)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 810-00846        | Microsoft 2            |                           | 16,541         | 8   | 132,328          | Incl Above         |
| Visual C++ .NET Standard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 254-00170        | Microsoft 2            |                           | 109            | 1   | 109              | Incl Above         |
| Microsoft Windows .NET Server Datacenter Edition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 317517-B21       | 1                      |                           | 27,899         | 1   | 27,899           | 46,500             |
| <b>Subtotal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                        |                           |                |     | <b>160,336</b>   | <b>52,350</b>      |
| <b>Client Hardware</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                        |                           |                |     |                  |                    |
| HP ProLiant DL360R01 P1.4GHz 512KB 128MB Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 233271-001       | 1                      |                           | 1,925          | 8   | 15,400           |                    |
| 1.40GHz PIII Processor Option Kit (DL360 G2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 233273-B21       | 1                      |                           | 717            | 8   | 5,736            |                    |
| 2GB 133MHz SDRAM DIMM Memory (2x1GB)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 201695-B21       | 1                      |                           | 1,398          | 8   | 11,184           |                    |
| S5500 15 carbon / silver monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 261602-001       | 1                      |                           | 149            | 8   | 1,192            |                    |
| HP Mouse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 231947-B21       | 1                      |                           | 5              | 8   | 40               |                    |
| HP Enhanced Keyboard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 265977-001       | 1                      |                           | 12             | 8   | 96               |                    |
| 18.2-GB Pluggable 1" Universal WideUltra3 10K HDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 142673-B22       | 1                      |                           | 311            | 8   | 2,488            |                    |
| FM-EL724-36 3YR 24X7 4HR 300 SERIES SVR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 162657-002       | 1                      |                           | 1,450          | 8   |                  | 11,600             |
| Qlogic QLA-2350 Fibre-Channel VI Adapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | QLA2350-BK       | 3                      |                           | 2,095          | 10  | 20,950           |                    |
| 5M LC to LC Cable Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 221692-B22       | 1                      |                           | 82             | 8   | 656              |                    |
| 2GB Small Form Pluggable Adapter Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 221470-B21       | 1                      |                           | 389            | 8   | 2,952            |                    |
| <b>Subtotal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                        |                           |                |     | <b>60,694</b>    | <b>11,600</b>      |
| <b>Client Software</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                        |                           |                |     |                  |                    |
| Microsoft Windows 2000 Server                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | C11-00821        | Microsoft 2            |                           | 738            | 8   | 5,904            | Incl. Above        |
| <b>Subtotal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                        |                           |                |     | <b>5,904</b>     | <b>0</b>           |
| <b>User Connectivity</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                        |                           |                |     |                  |                    |
| Qlogic SANBox-2 16-Port Switch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | SANBOX 2/16      | 3                      |                           | 17,995         | 3   | 53,985           |                    |
| <b>Subtotal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                        |                           |                |     | <b>53,985</b>    | <b>0</b>           |
| <b>Large Purchase and Net 30 discount (See Note 1)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                        |                           |                |     | <b>16.0%</b>     | <b>1</b>           |
| <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |                        |                           |                |     | <b>\$799,032</b> | <b>\$85,184</b>    |
| <p>Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated components. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the TPC benchmark pricing specifications. If you find that the stated prices are not available according to these terms, please inform the TPC at <a href="mailto:pricing@tpc.org">pricing@tpc.org</a>. Thank you.</p> <p>Pricing: 1=HP Direct 2=Microsoft 3=Qlogic</p> <p>Note 1 = Discount based on HP Direct guidance and large cash purchase level.</p> <p>Note: The benchmark results and test methodology were audited by Lorna Livingtree of Performance Metrics, Inc.</p> |                  |                        |                           |                |     |                  |                    |
| <b>Three-Year Cost of Ownership:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                        |                           |                |     | <b>\$884,216</b> |                    |
| <b>tpmC Rating:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                        |                           |                |     | <b>115025.75</b> |                    |
| <b>\$ / tpmC:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                        |                           |                |     | <b>\$7.69</b>    |                    |

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## Numerical Quantities Summary

**MQTH, Computed Maximum Qualified Throughput**

**115025.75 tpmC**

### Response Times (in seconds)

**Average**

**90%**

**Maximum**

|                                |      |      |        |
|--------------------------------|------|------|--------|
| New-Order                      | 0.35 | 0.63 | 325.98 |
| Payment                        | 0.30 | 0.58 | 125.99 |
| Order-Status                   | 0.31 | 0.59 | 48.97  |
| Delivery (interactive portion) | 0.11 | 0.11 | 27.23  |
| Delivery (deferred portion)    | 0.16 | 0.21 | 2.36   |
| Stock-Level                    | 0.66 | 1.06 | 49.95  |
| Menu                           | 0.11 | 0.11 | 55.89  |

### Transaction Mix, in percent of total transaction

|              |        |
|--------------|--------|
| New-Order    | 44.92% |
| Payment      | 43.05% |
| Order-Status | 4.00%  |
| Delivery     | 4.01%  |
| Stock-Level  | 4.01%  |

### Emulation Delay (in seconds)

**Resp.Time**

**Menu**

|                        |      |      |
|------------------------|------|------|
| New-Order              | 0.10 | 0.10 |
| Payment                | 0.10 | 0.10 |
| Order-Status           | 0.10 | 0.10 |
| Delivery (interactive) | 0.10 | 0.10 |
| Stock-Level            | 0.10 | 0.10 |

### Keying/Think Times (in seconds)

**Min.**

**Average**

**Max.**

|                        |            |             |              |
|------------------------|------------|-------------|--------------|
| New-Order              | 18.00/0.00 | 18.02/12.06 | 18.04/120.62 |
| Payment                | 3.00/0.00  | 3.02/12.07  | 3.04/120.62  |
| Order-Status           | 2.00/0.00  | 2.02/10.06  | 2.04/100.62  |
| Delivery (interactive) | 2.00/0.00  | 2.02/5.07   | 2.05/50.61   |
| Stock-Level            | 2.00/0.00  | 2.02/5.06   | 2.04/50.61   |

### Test Duration

|                                                                |             |
|----------------------------------------------------------------|-------------|
| Ramp-up time                                                   | 36 minutes  |
| Measurement interval                                           | 120 minutes |
| Transactions (all types) completed during measurement interval | 30,724,787  |
| Ramp down time                                                 | 30 minutes  |

### Checkpointing

|                       |            |
|-----------------------|------------|
| Number of checkpoints | 4          |
| Checkpoint interval   | 30 minutes |

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# TPC Transaction Processing Performance Council

The TPC defines transaction processing and database benchmarks and delivers trusted results to the industry.

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## TPC-C Result Highlights

**HP Proliant DL760-G2 8P**

### Benchmark Stats

|                |           |
|----------------|-----------|
| Result ID:     | 102120902 |
| Result Status: | In Review |
| TPC-C Rev:     | 5.0       |
| Report Date:   | 12/06/02  |

### System Information

|                     |                                                  |
|---------------------|--------------------------------------------------|
| Total System Cost   | 884,216 US \$                                    |
| TPC-C Throughput    | 115,026                                          |
| Price/Performance   | 7.69 US \$                                       |
| Availability Date   | 05/30/03                                         |
| Database Manager    | Microsoft SQL Server 2000 Enterprise Ed. SP3     |
| Operating System    | Microsoft Windows Server 2003 Datacenter Edition |
| Transaction Monitor | Microsoft COM+                                   |

### Server Information

|            |                       |
|------------|-----------------------|
| CPU:       | Intel Xeon MP 2.0 GHz |
| # of CPUs: | 8                     |
| Cluster:   | N                     |

### Client Information

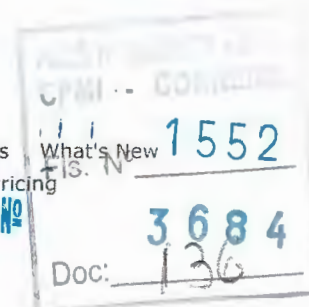
|                  |                          |
|------------------|--------------------------|
| # of clients:    | 8                        |
| CPU:             | Intel Pentium III 1.4GHz |
| CPUs per client: | 2                        |

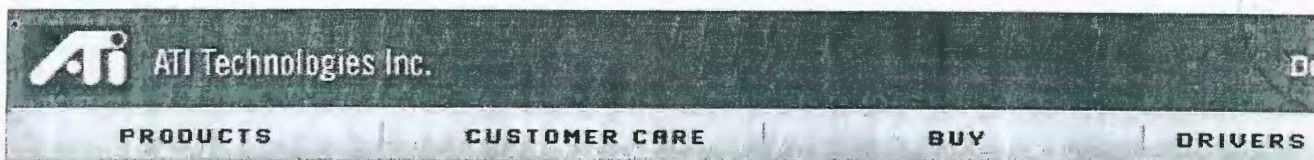
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- Full Disclosure Report (2030 KB)

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[Partner List](#)

[Product Overview](#)

[Software Support](#)

[On-Line resource center](#)



## Features

### Package Specifications

- Package, Size: 272 BGA, 27mm x 27mm

### Graphics Processor Specifications

- Process technology, Core Voltage: 0.25um, 2.5V
- Graphics Clock: 83MHz

### Memory Specifications

- Memory Clock, Max Memory Path: 125 MHz, 64-bit width
- I/O Type, VDDC: 3.3V (LVTTTL)
- Maximum Memory Configuration: 8 MB External Memory

### Bus Specifications

- AGP bus support / PCI bus support: AGP 2X (3.3V) / PCI 2.2

### Output

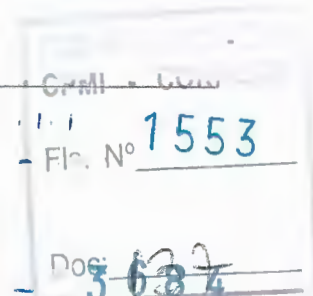
- CRT: Triple 8-bit palette DAC, 230 MHz
- Integrated TMDS: DVI, DFP and VESA P&D interface
- Support for 24bit TTL

### Resolution Support

- Max 2D/3D resolution: 1600x1200
- Max color depth: 16.7M Colors
- TMDS: 1024x768

### Driver Support

- Windows® 98SE
  - Windows® ME
  - Windows® NT
  - Windows® XP
  - Linux
- (Please see your technical contact for alternate OS support)







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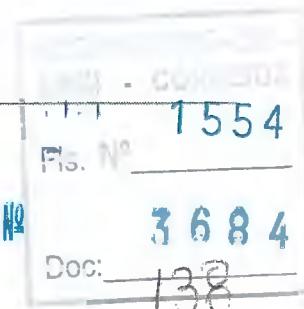
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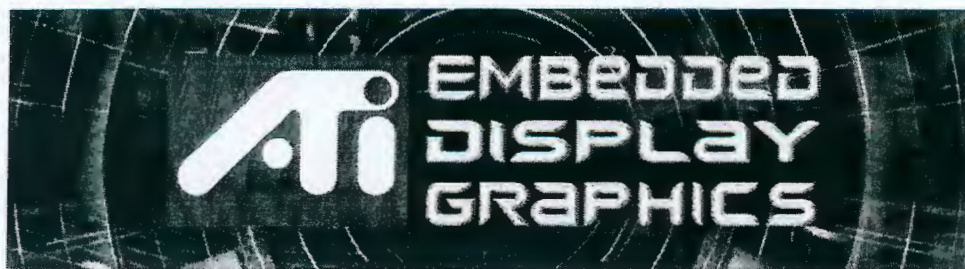
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- Windows® 98SE
  - Windows® ME
  - Windows® NT
  - Windows® XP
  - Linux
- (Please see your technical contact for alternate OS support)





23x52  
Rush

## RAGE™ XL Product Snapshot

*Delivering strong 2D/3D/video acceleration, RAGE™ XL is ideal for situations where small package sizes are crucial, ease of integration is a must and upgrade ability is a necessity*

### Package Specifications

- **Package, Size:** 272 BGA, 27mm x 27mm

### Graphics Processor Specifications

- **Process technology, Core Voltage:** 0.25um, 2.5V
- **Graphics Clock:** 83 MHz

### Memory Specifications

- **Maximum Memory Configuration:** 8MB External Memory
- **I/O Type, VDDC:** 3.3V (LVTTTL)
- **Memory Clock, Max Memory Path:** 125 MHz, 64 bit width

### Bus Specifications

- **AGP bus support/ PCI bus support::** AGP 2X (3.3V)/ PCI 2.2

### Outputs

- **CRT:** Triple 8-bit palette DAC, 230MHz
- **Integrated TMDS:** DVI, DFP and VESA P&D interface
- **Support for 24bit TTL**

### Resolution Support

- **Max 2D/3D resolution:** 1600x1200
- **Max color depth:** 16.7M Colors
- **TMDS:** 1024x768

### Driver Support

- Win 98/ME/NT/2000/XP, Linux (Please see your technical contact for alternate OS support)

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## Features

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- Graphics Clock: 83MHz

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- I/O Type, VDDC: 3.3V (LVTTTL)
- Maximum Memory Configuration: 8 MB External Memory

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- Integrated TMDS: DVI, DFP and VESA P&D interface
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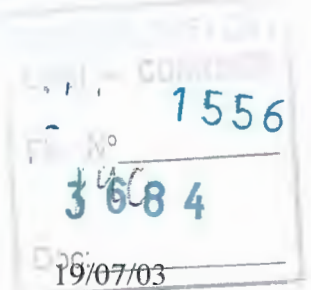
## Resolution Support

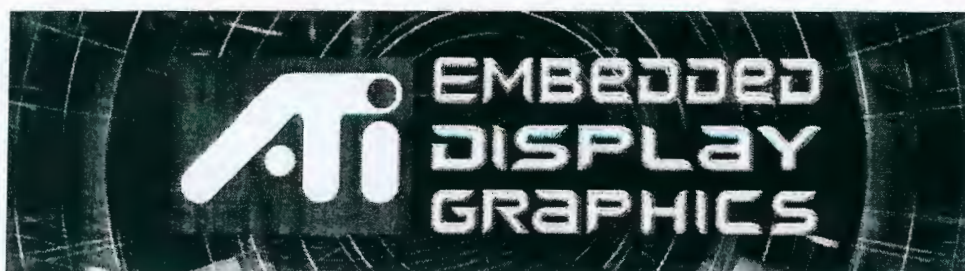
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- TMDS: 1024x768

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- Windows® 98SE
- Windows® ME
- Windows® NT
- Windows® XP
- Linux

(Please see your technical contact for alternate OS support)





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*Delivering strong 2D/3D/video acceleration, RAGE™ XL is ideal for situations where small package sizes are crucial, ease of integration is a must and upgrade ability is a necessity*

### Package Specifications

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- **Process technology, Core Voltage:** 0.25um, 2.5V
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- **Maximum Memory Configuration:** 8MB External Memory
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### Bus Specifications

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- **CRT:** Triple 8-bit palette DAC, 230MHz
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- Win 98/ME/NT/2000/XP, Linux (Please see your technical contact for alternate OS support)

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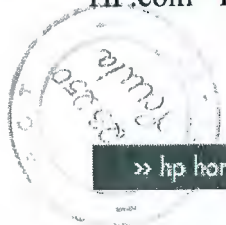
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## ProLiant DL760 G2

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The industry's first server with Hot Plug RAID Memory, the ProLiant DL760 G2 provides the highest levels of intelligent fault resilience, dynamic scalability and powerful, 8-way SMP performance to support your mission-critical enterprise solutions.

### key benefits

- >> Innovative Hot Plug RAID
- >> Groundbreaking ProLiant F8 chipset
- >> Leading performance and availability
- >> ProLiant Essentials management software and rack-optimized form factor
- >> Modular-upgrade strategy

### Innovative Hot Plug RAID

**Innovative Hot Plug RAID Memory feature (as the signature technology in HP's Advanced Memory Protection technology suite) combined with multiple redundant components predict, diagnose, and respond immediately to potential fault conditions for the highest levels of server availability**

- Advanced Memory Protection provides higher levels of memory protection than ECC memory and protects up to 64GB of memory from unplanned downtime
- Hot-Add support with Windows Server 2003, Linux, UnixWare and OpenUnix8
- Industry's first Hot Plug RAID Memory, using industry standard 133MHz SDRAM DIMMs, eliminating downtime caused by multi-bit memory errors and scheduled capacity planning by allowing you to hot-replace failed DIMMs and hot-add memory without taking down your server
- Hot Plug RAID Memory is the only completely redundant memory protection technology available in an industry standard server to do so with only 25% additional memory expense
- Built-in LED's provide simplified, proactive detection and management of memory failures, with an LED for each of the forty DIMM slots, that alert you to potential memory problems





- before they affect your system's availability
- RBSU (ROM-based Setup Utility) offers flexibility to switch between different levels of fault tolerance or to deploy memory in standard system mode or fault tolerant mode
- Outstanding component-level fault resilience through redundant, hot-plug hard drives, RAID controllers, optional Gigabit Ethernet adapters, power supplies, fans and PCI-X slots for the maximum component protection you've come to expect from ProLiant 8 way servers
- Built in hardware-based RAID for, Automatic Server Recovery (ASR), pre-failure warranty on hard drives, processors, and memory help protect you by responding to potential errors before they affect your system

#### Groundbreaking ProLiant F8 chipset

### Groundbreaking ProLiant F8 chipset delivers the industry's highest, 8-way Enterprise-class performance to the data center; leveraging industry standards for lower overall total cost of ownership than Unix/RISC based systems

- F8, HP's exclusively designed Xeon processor MP-based chipset dramatically increases performance designed around an industry-proven, SMP (Symmetrical multi-processing) architecture utilizing all industry standard processors, memory DIMMs and I/O cards
- F8 chipset provides dramatic improvements in balanced system performance increasing throughput up to 4x to the system bus, 5x to memory, and 6x to I/O
- Virtually eliminates I/O system performance bottlenecks with a 400MHz GTL Bus bus, 133MHz SDRAM, PCI-X technology, Gigabit Ethernet, and integrated, dual-channel, Wide-Ultra3 SCSI controllers
- Hot-Plug PCI-X technology offers up to 100MHz peak performance in 10 of 11 available PCI slots for high bandwidth devices such as Gigabit Ethernet, Fibre Channel, Ultra3 SCSI and SAN controllers
- Supports the latest 8P Intel 2.8GHz Xeon MP Foster processors and hyper-threading technology to enhance IA-32 CPU performance on multi-threading applications
- Ideal performance for your most demanding, mission-critical applications including ERP, Exchange, data bases, Lotus, data warehousing and online transaction processing
- Increased application throughput for SAP, PeopleSoft, Oracle Applications and JD Edwards as a result of performance increases in I/O, memory and the system bus.

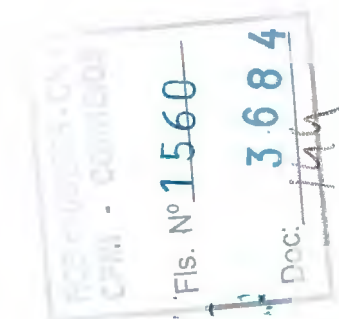
#### Leading performance and availability

### Leading performance and availability extends the reach of standards-based computing, making it the ideal choice for scale-up or server consolidation solutions

- Maximum internal expansion capabilities in a rack-optimized 7U form factor to scale up to 8 processors, 587.2 GB (4x146.8GB) internal storage capacity, 64GB of addressable memory (80GB total), 11 available PCI/PCI-X expansion slots, and SAN capability







- Scale out with high performance, clustered solutions that distribute resources across multiple systems for the highest levels of availability
- Extensive partner support for scale up hot add memory functionality from O/S partners Microsoft Windows Server 2003, and Linux; application partners include Oracle, Lotus and others.
- Consolidate multiple servers and applications to simplify the management of complex environments and to maximize floor space and compute power
  - ProLiant Essentials Workload Management Value Pack is an ideal tool for server consolidation that improves overall server utilization and reduces system management costs by running multiple applications on a single, Windows 2000/Windows Server 2003 server without the need for continuous monitoring and load balancing
  - Ability to re-allocate memory to a specific application in times of unanticipated need - without re-booting or bringing down the system
- Size and configure your specific database, messaging, ERP or CRM solutions using HP's web-based tools. Active Answers

ProLiant Essentials management software and rack-optimized form factor

**ProLiant Essentials management software and rack-optimized form factor provide simplified management, service and deployment versatility for every stage of the server life cycle**

- ProLiant Essentials Foundation Pack provides software every customers needs to install, configure and manage ProLiant Servers. HP SmartStart gives customers reliable and consistent server deployment, while HP Insight Manager provides simple and powerful web-based server management
- ProLiant Essentials Workload Management Pack's Resource Partitioning Manager increases server utilization by giving administrators control over the size and physical location of system resources available to individual applications, services, and other processes, maximizing return-on-investment
- Ability to combine Exchange 2000 with virus checking, spam filtering and backup on a single server
- Supports Remote Insight Lights-Out Edition II (RILOE II) enabling powerful, hardware-based remote administration and control to maximize availability, control and security over your mission-critical ProLiant DL760 for mission-critical database and business applications
- RBSU (ROM-based Setup Utility): Tool-less design, snap on rail kits, and advanced cable management capabilities in a 7U form factor allow for simplified rack deployment and maintenance of hot-plug components
- Modular upgrade components can be added and removed with a simple, tool-less design; including processor drawer, memory and I/O modules
- Built-in LED indicators simplify servicing and accurately diagnose failed components for warranty replacement

Modular-upgrade strategy

**Most complete investment protection solution in the industry maximizes customer value by providing a migration path of current server components through a modular-upgrade strategy**

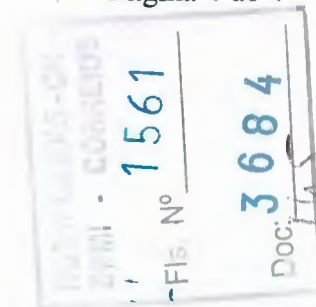
- Upgrade the modular chassis design of the ProLiant 8500/DL760 from its original 550/700/900MHz base models to full Xeon processor MP-based technology for the latest performance and high availability features
- Investment protection includes leveraging existing chassis, media module, and power supplies with the additional capability to migrate any legacy 100MHz SDRAM DIMMs and PCI cards to the new server
- In-chassis upgrades of the I/O, media and processor modular drawers provide all of the new features and functionality in a new ProLiant DL760 G2 with the F8 Chipset, Hot Plug RAID Memory, PCI-X, Smart Array 5i, and many other new features.
- The ProLiant DL760 G2 server upgrade kit is an option and carries a warranty that covers replacement of defective parts, labor costs, and next-business-day onsite repair charges for the first year of ownership or the remainder of the warranty on the server it is upgrading, whichever is longer.

**Buy online or call HP at 1-800-282-6672**

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