Cisco Visual Networking Index (VNI) and VNI Service Adoption
Presentation at Brazilian Senate – CCT
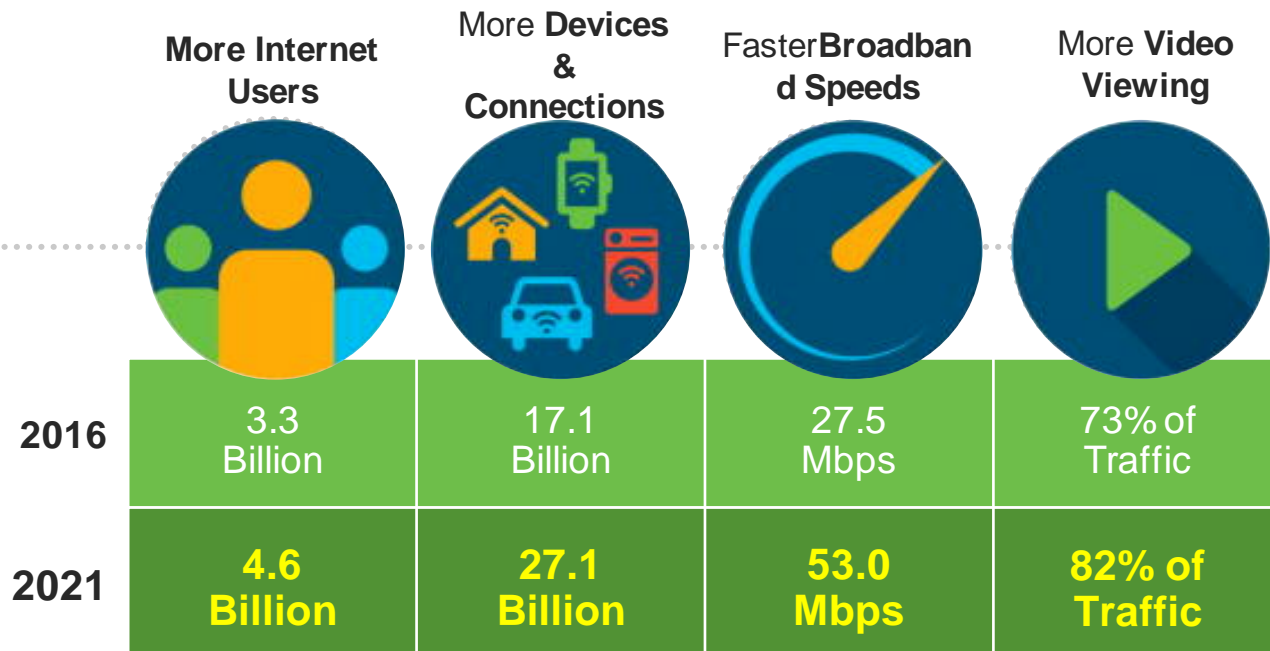
Giuseppe Marrara | Director, Public Policy

June, 27th, 2017

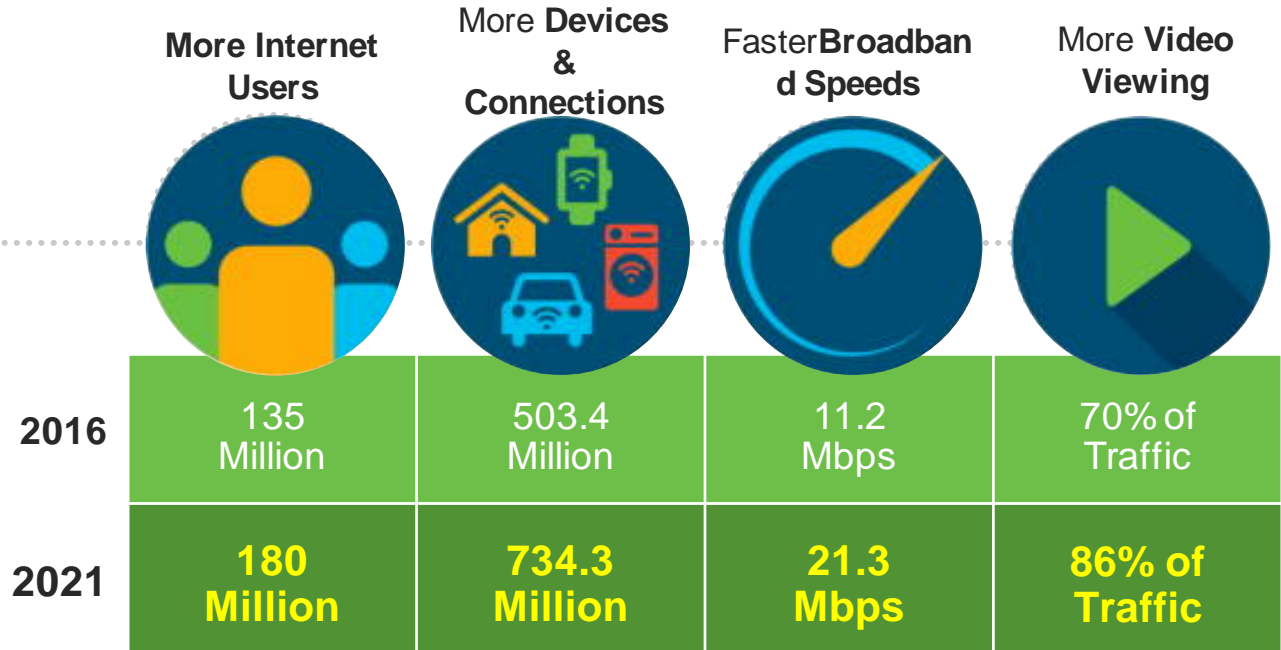# Global Internet Growth and Trends

Key Digital Transformers

By 2021

	More Internet Users	More **Devices & Connections**	Faster **Broadband Speeds**	More **Video Viewing**
2016	3.3 Billion	17.1 Billion	27.5 Mbps	73% of Traffic
2021	**4.6 Billion**	**27.1 Billion**	**53.0 Mbps**	**82% of Traffic**

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Brazil Internet Growth and Trends

Key Digital Transformers

By 2021

	More Internet Users	More **Devices & Connections**	Faster **Broadband Speeds**	More **Video Viewing**
2016	135 Million	503.4 Million	11.2 Mbps	70% of Traffic
2021	**180 Million**	**734.3 Million**	**21.3 Mbps**	**86% of Traffic**

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Establishing the Zettabyte Era

By 2021, global IP traffic will reach an annual run rate of 3.3 zettabytes per year
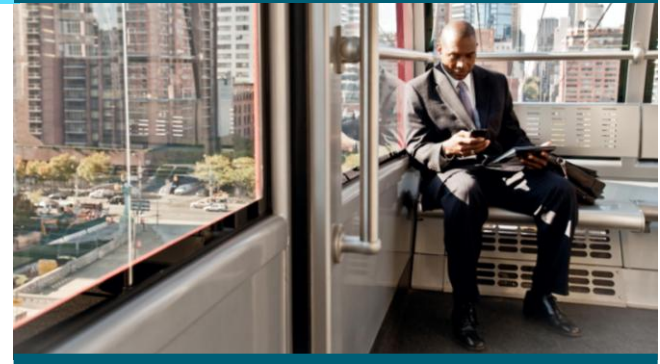
3.3 zettabytes is equal to:

- 14X more than all IP traffic generated in 2010 (232 exabytes)
- All movies ever made crossing global IP networks every minute

What is a zettabyte?

- One trillion gigabytes
- Approximately 10^{21} (1,000,000,000,000,000,000,000 bytes)

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

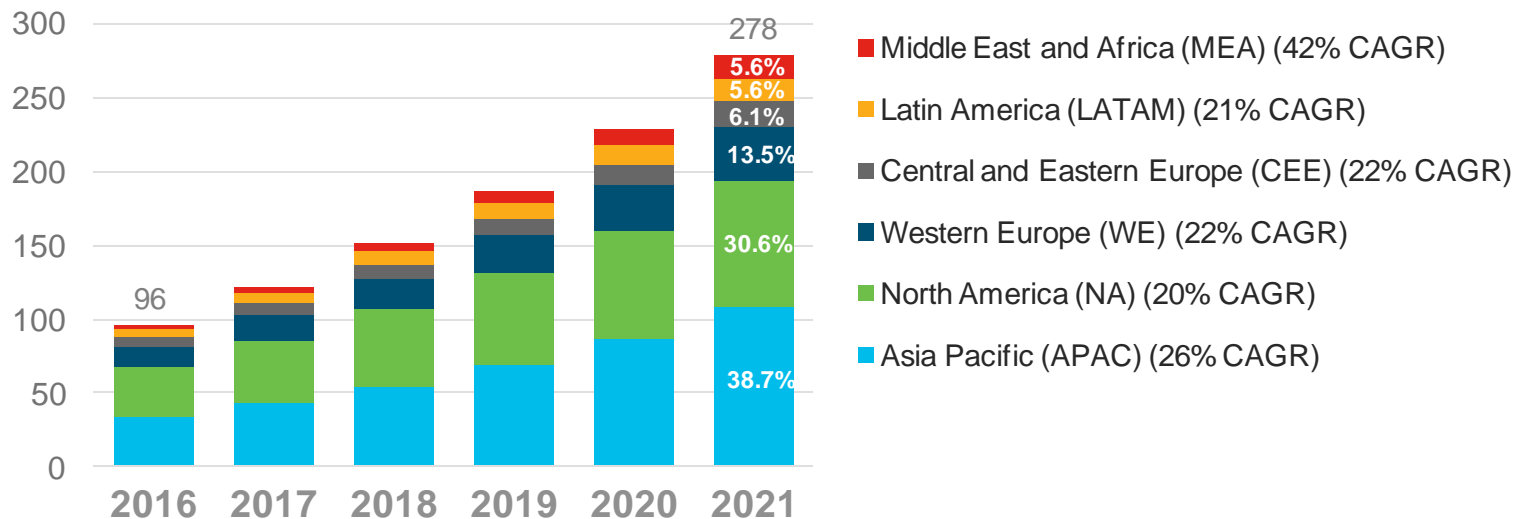# Global IP Traffic Growth by Region

MEA has the highest growth rate (42%) from 2016 to 2021
APAC will generate 39% of all IP traffic by 2021

24% CAGR
2016–2021

Exabytes per Month

Chart data — Exabytes per Month by year:

Year	APAC	NA	WE	CEE	LATAM	MEA	Total
2016							96
2017							
2018							
2019							
2020							
2021	38.7%	30.6%	13.5%	6.1%	5.6%	5.6%	278

Legend:
- ■ Middle East and Africa (MEA) (42% CAGR)
- ■ Latin America (LATAM) (21% CAGR)
- ■ Central and Eastern Europe (CEE) (22% CAGR)
- ■ Western Europe (WE) (22% CAGR)
- ■ North America (NA) (20% CAGR)
- ■ Asia Pacific (APAC) (26% CAGR)

In Brazil, IP traffic will reach 5.5 Exabytes per month in 2021 (2.4 Exabytes per month in 2016).
The gigabyte equivalent of all movies ever made will cross Brazil's IP networks every 1 hour.

Top Trends

Top Trends

Devices & Connections

❶ Devices/Connections Mix

❷ IoT/M2M by Verticals

❸ IPv6 Adoption

Traffic Trends

❹ Traffic Growth by App

❺ "Cord-Cutting"

❻ Traffic Pattern Analysis
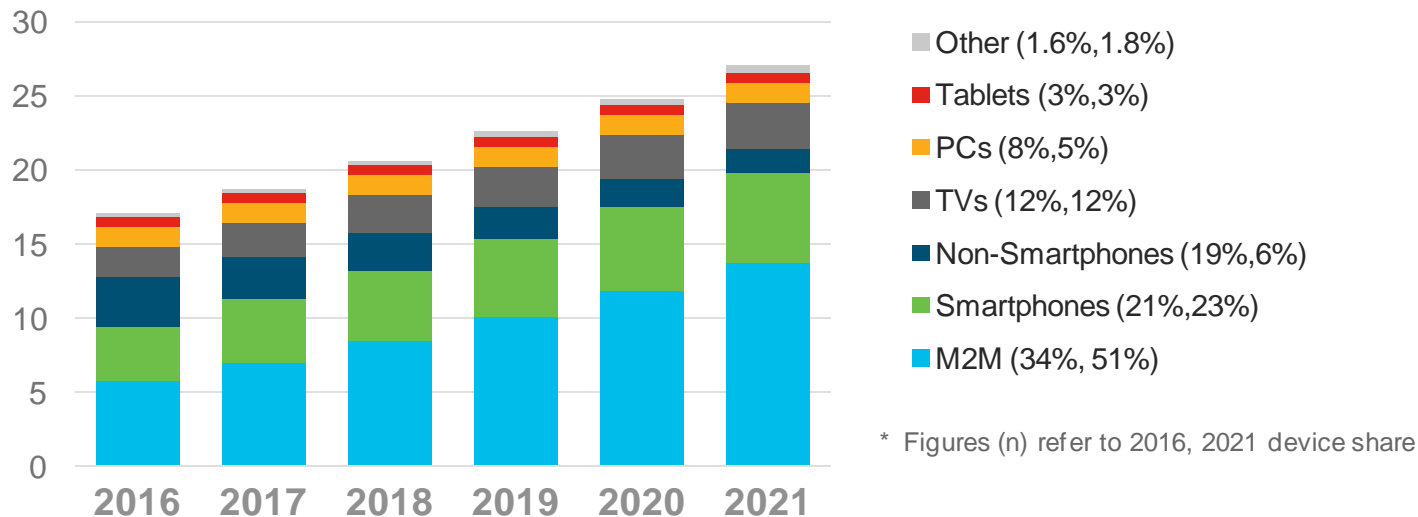
Network Performance and User Experience

❼ Wi-Fi Momentum

❽ Accelerating Speeds

❾ Security Analysis

Global Device/Connection Growth by Type
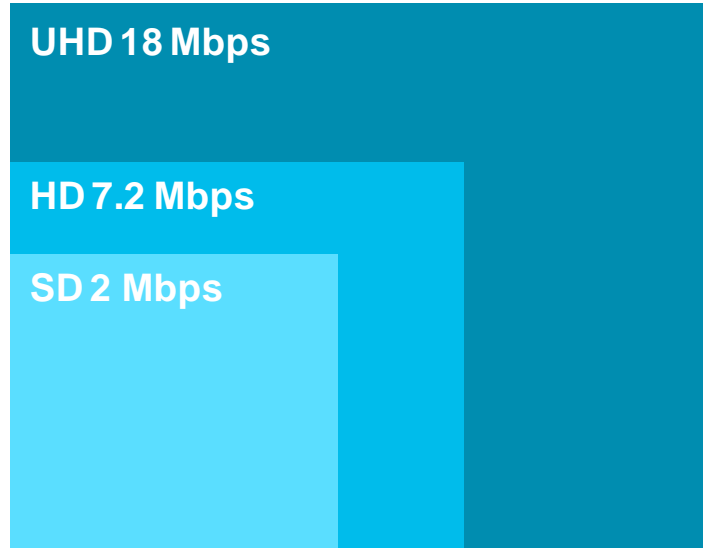## By 2021, M2M connections will be more than half of total connections

10% CAGR
2016–2021

Billions of Devices

Legend:
- Other (1.6%,1.8%)
- Tablets (3%,3%)
- PCs (8%,5%)
- TVs (12%,12%)
- Non-Smartphones (19%,6%)
- Smartphones (21%,23%)
- M2M (34%, 51%)

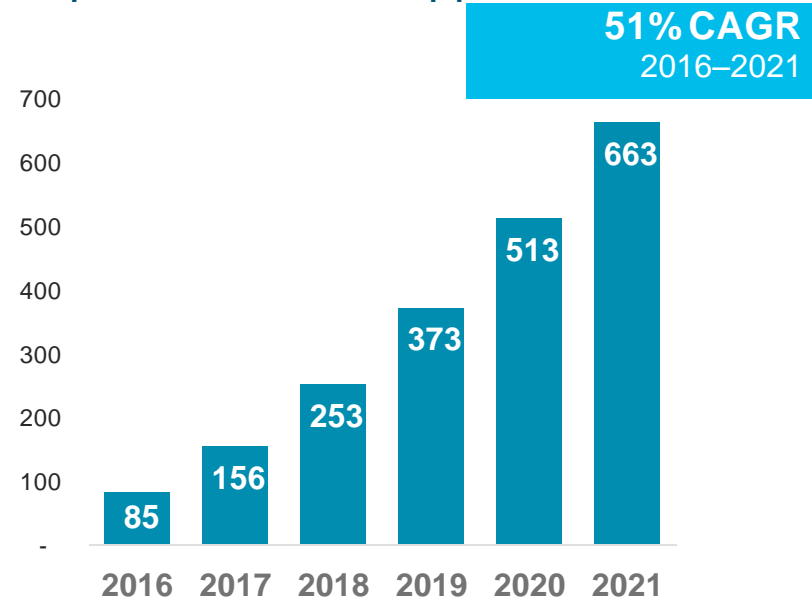* Figures (n) refer to 2016, 2021 device share

In Brazil, by 2021 M2M modules will account for 44% of total devices / connections (from 28% in 2016), Smartphones 27% (from 26%) and Connected TV 14% (from 10%).

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Increasing Video Definition
By 2021, more than half (56%) of connected flat panel TVs will support 4K

UHD 18 Mbps

HD 7.2 Mbps

SD 2 Mbps

51% CAGR
2016–2021

Connected
4K TV Sets
(M)

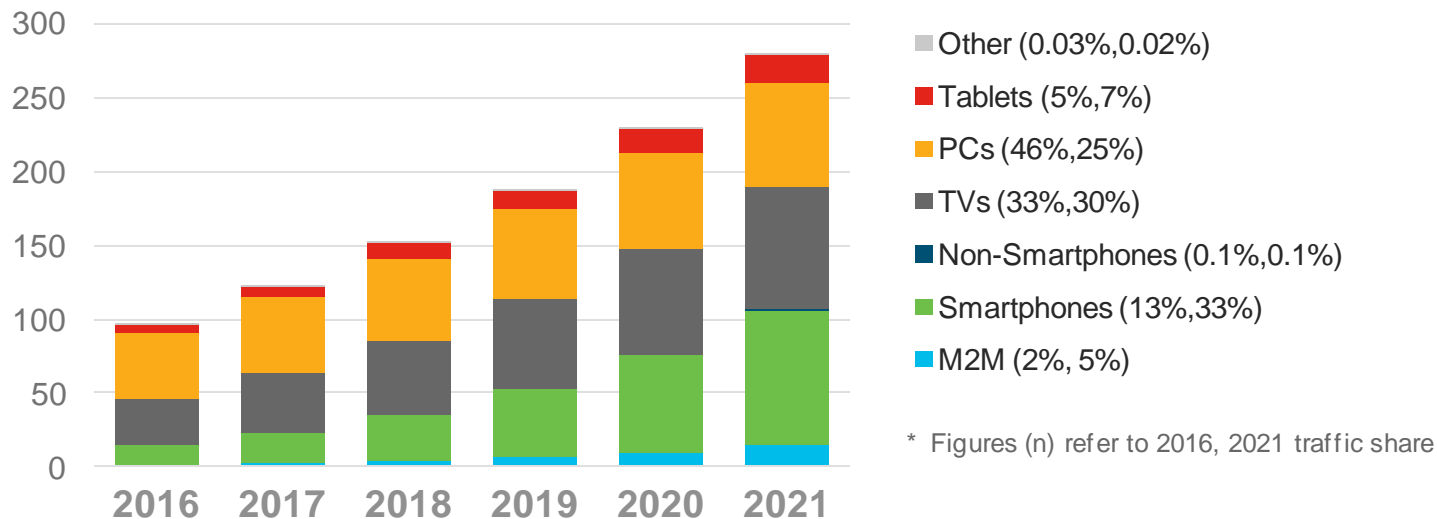| Year	Value
2016	85
2017	156
2018	253
2019	373
2020	513
2021	663

In Brazil, 4K TVs will account for 35% (17.2 million) of all flat panel TVs in 2021, compared to 6.1% (1.1 million) in 2016, (72.5% CAGR).

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Global IP Traffic by Device Type
By 2021, non-PC devices will drive 75% of global IP traffic

24% CAGR
2016–2021

Exabytes per Month

300
250
200
150
100
50
0

2016 2017 2018 2019 2020 2021

- Other (0.03%,0.02%)
- Tablets (5%,7%)
- PCs (46%,25%)
- TVs (33%,30%)
- Non-Smartphones (0.1%,0.1%)
- Smartphones (13%,33%)
- M2M (2%, 5%)

* Figures (n) refer to 2016, 2021 traffic share

In Brazil, PCs accounted for 66% of IP traffic in 2016, reducing to 28% in 2021.
While Smartphones will grow from 14% to 39% and Connected TV from 14% to 24%.

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Global M2M Connections / IoT Growth by Vertical
By 2021, connected home largest, connected health fastest growth

19% CAGR
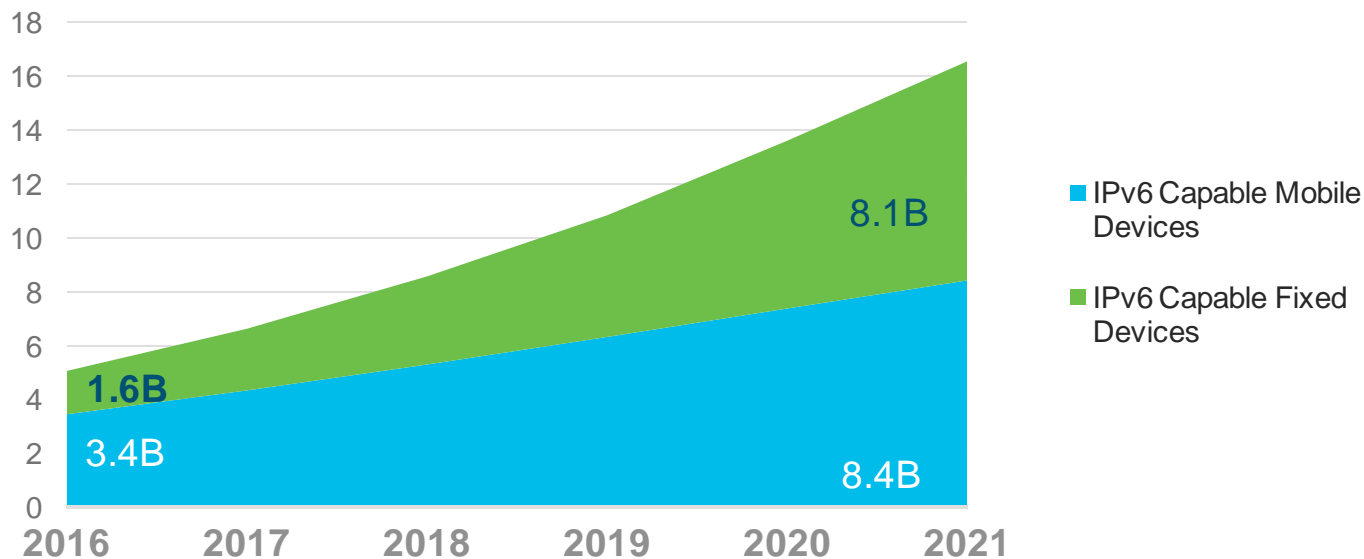2016–2021

Billions of M2M Connections

Legend:
- Other (1% CAGR)
- Energy (25% CAGR)
- Mfg & Supply Chain (9% CAGR)
- Retail (15% CAGR)
- Connected Car (29% CAGR)
- Connected Cities (29% CAGR)
- Connected Health (30% CAGR)
- Connected Work (15% CAGR)
- Connected Home (18% CAGR)

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021
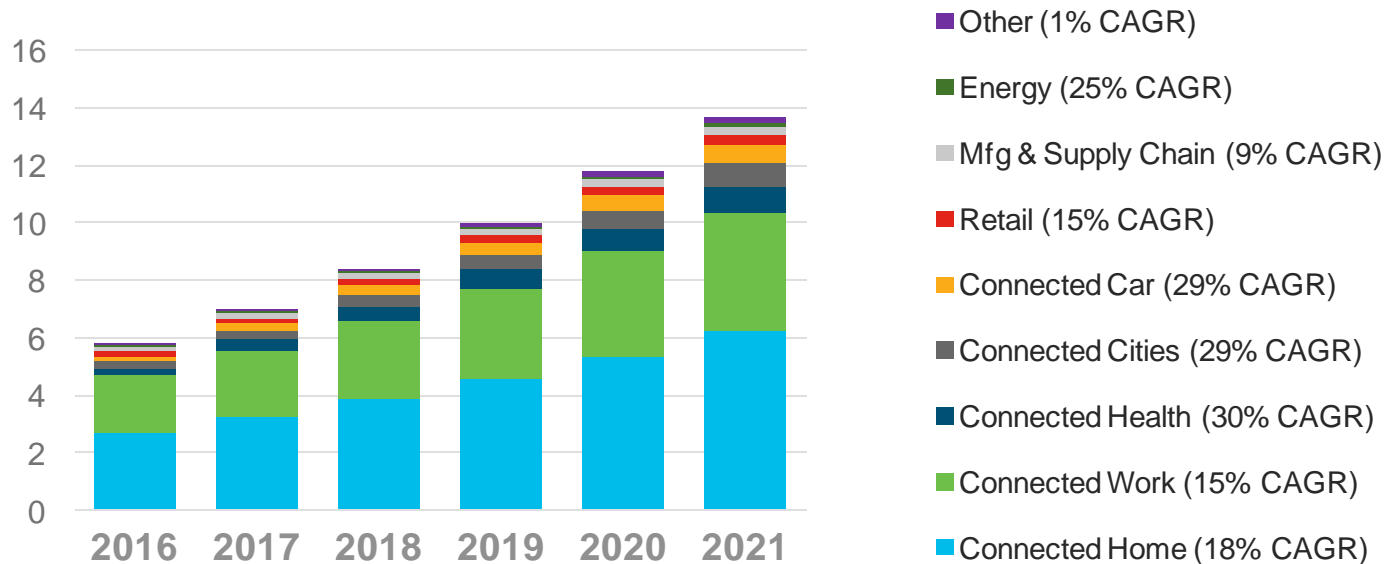
Global IPv6-Capable Devices/Connections
By 2021, 61% of devices/connections will be IPv6-capable

27% CAGR
2016–2021

Number of Devices (Billions)

- ■ IPv6 Capable Mobile Devices
- ■ IPv6 Capable Fixed Devices

1.6B

3.4B

8.1B

8.4B

2016 2017 2018 2019 2020 2021

In Brazil, 62.3% of all fixed and mobile networked devices will be IPv6-capable in 2021, up from 35.3% in 2016.

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Top Trends

Devices & Connections

❶ Devices/Connections Mix
❷ IoT/M2M by Verticals
❸ IPv6 Adoption

Traffic Trends

❹ Traffic Growth by App
❺ "Cord-Cutting"
❻ Traffic Pattern Analysis

Network Performance and User Experience

❼ Wi-Fi Momentum
❽ Accelerating Speeds
❾ Security Analysis

Global IP Traffic by Application Type
By 2021, video will account for 82% of global IP traffic
Gaming starts showing significant growth

24% CAGR
2016–2021

Exabytes
per Month

- Gaming (1%,4%)
- File Sharing (8%,3%)
- Web/Data (18%,11%)
- IP VOD (22%,14.5%)
- Internet Video (51%, 67.4%)
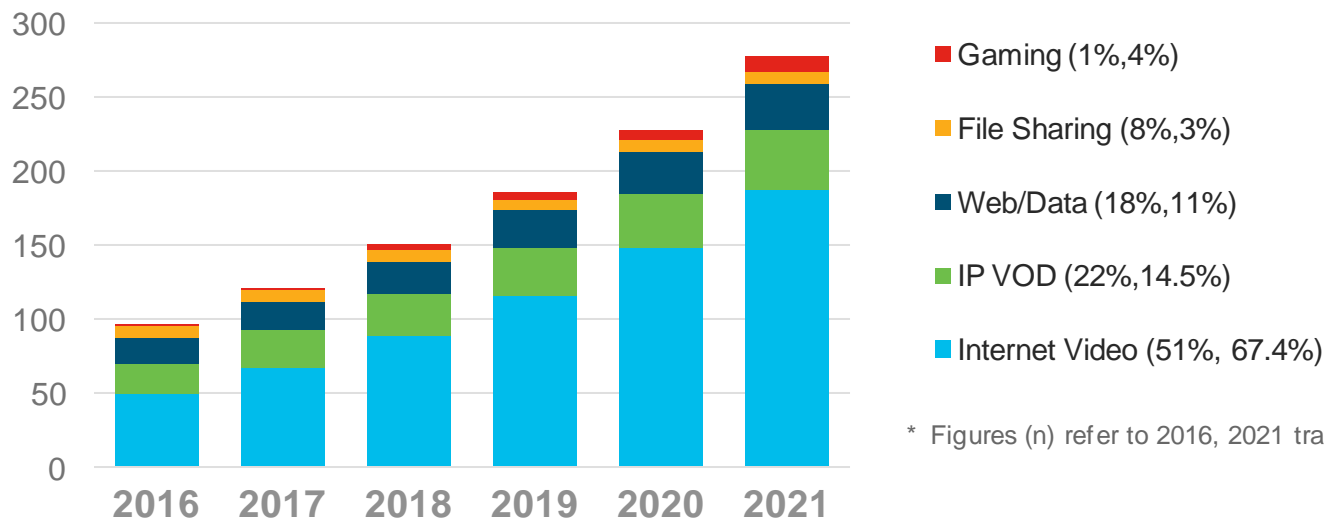
* Figures (n) refer to 2016, 2021 traffic share

In Brazil, IP video will be 86% of all IP traffic in 2021, up from 70% in 2016.

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Virtual and Augmented Reality Traffic
By 2021, VR/AR traffic will increase 20-fold, 1% of Entertainment Traffic

82% CAGR
2016–2021

Exabytes
per
Month

Year	Value
2016	0,09
2017	0,24
2018	0,49
2019	0,85
2020	1,25
2021	1,72
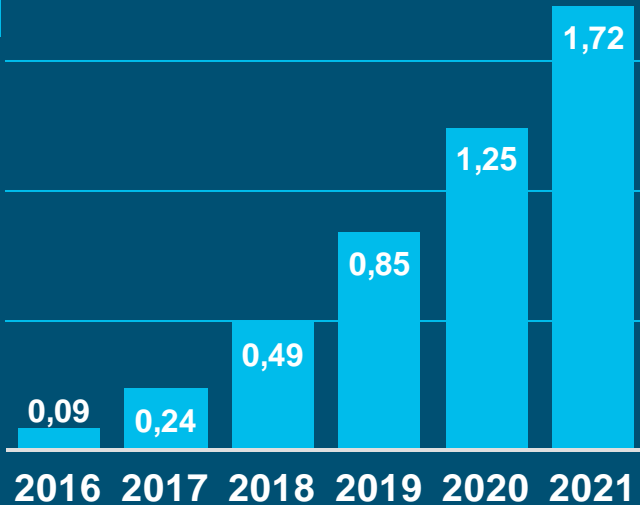
Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Average Global Internet Bandwidth Usage

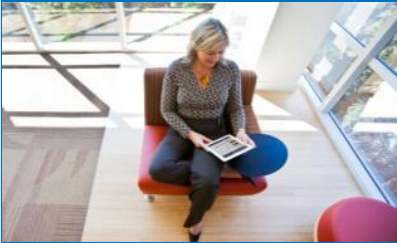|	2016	2021	Future
Average Traffic per User 🇧🇷	**24 GB** per month **24 GB** per month	**57 GB** per month **44 GB** per month	**200 GB** per month
Average Traffic per Household 🇧🇷	**63 GB** per month **62 GB** per month	**155 GB** per month **119 GB** per month	**500 GB** per month

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

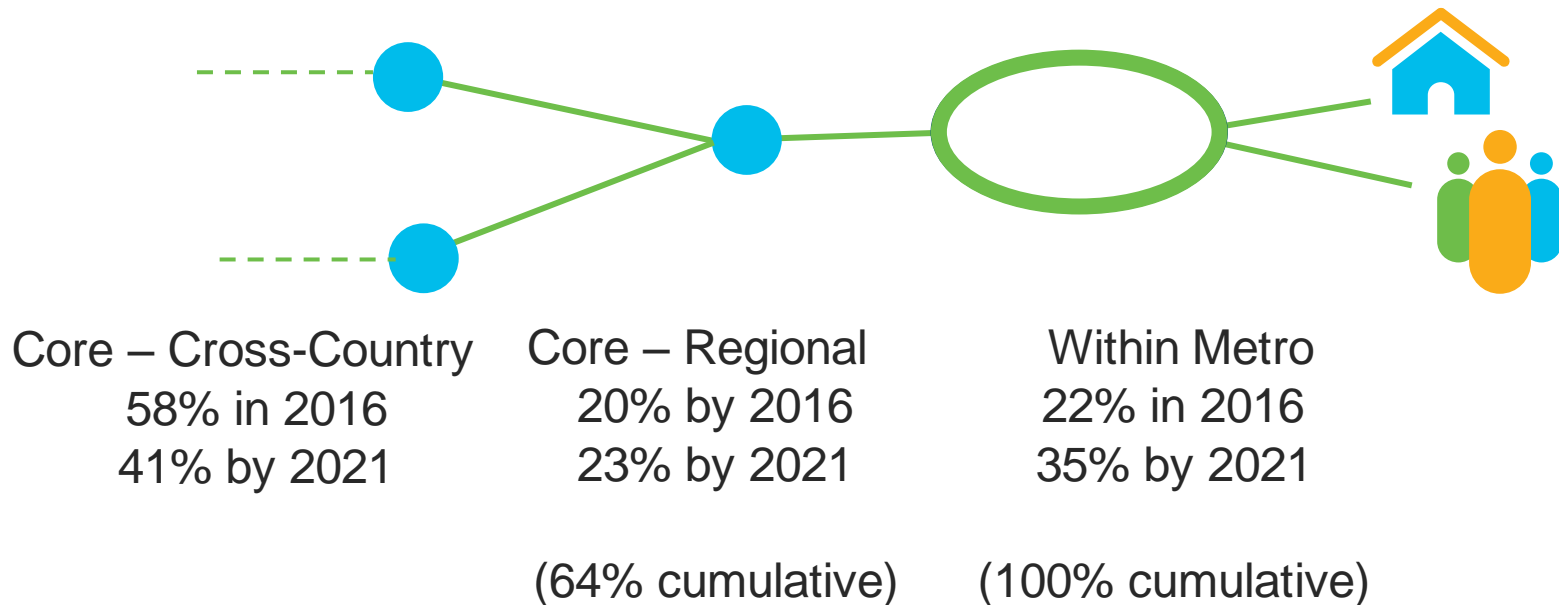# End-User Internet Traffic Moving Closer to the Edge
Over one-third of traffic will bypass core completely by 2021

Core – Cross-Country
58% in 2016
41% by 2021

Core – Regional
20% by 2016
23% by 2021

(64% cumulative)

Within Metro
22% in 2016
35% by 2021

(100% cumulative)

Top Trends

Devices & Connections

❶ Devices/Connections Mix
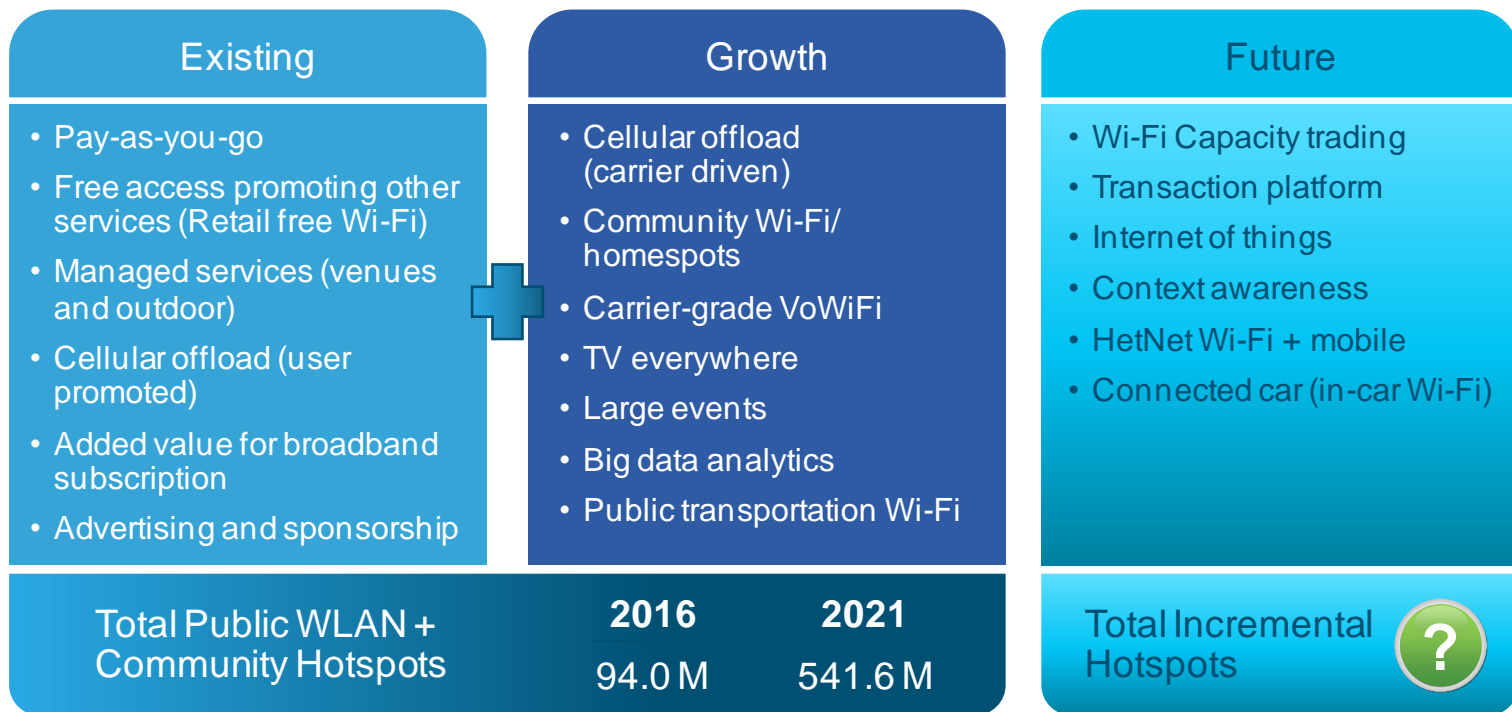❷ IoT/M2M by Verticals
❸ IPv6 Adoption

Traffic Trends

❹ Traffic Growth by App
❺ "Cord-Cutting"
❻ Traffic Pattern Analysis

Network Performance and User Experience

❼ Wi-Fi Momentum
❽ Accelerating Speeds
❾ Security Analysis

Global Wi-Fi Hotspot Coverage and Availability

Existing

- Pay-as-you-go
- Free access promoting other services (Retail free Wi-Fi)
- Managed services (venues and outdoor)
- Cellular offload (user promoted)
- Added value for broadband subscription
- Advertising and sponsorship

Growth

- Cellular offload (carrier driven)
- Community Wi-Fi/ homespots
- Carrier-grade VoWiFi
- TV everywhere
- Large events
- Big data analytics
- Public transportation Wi-Fi

Future

- Wi-Fi Capacity trading
- Transaction platform
- Internet of things
- Context awareness
- HetNet Wi-Fi + mobile
- Connected car (in-car Wi-Fi)

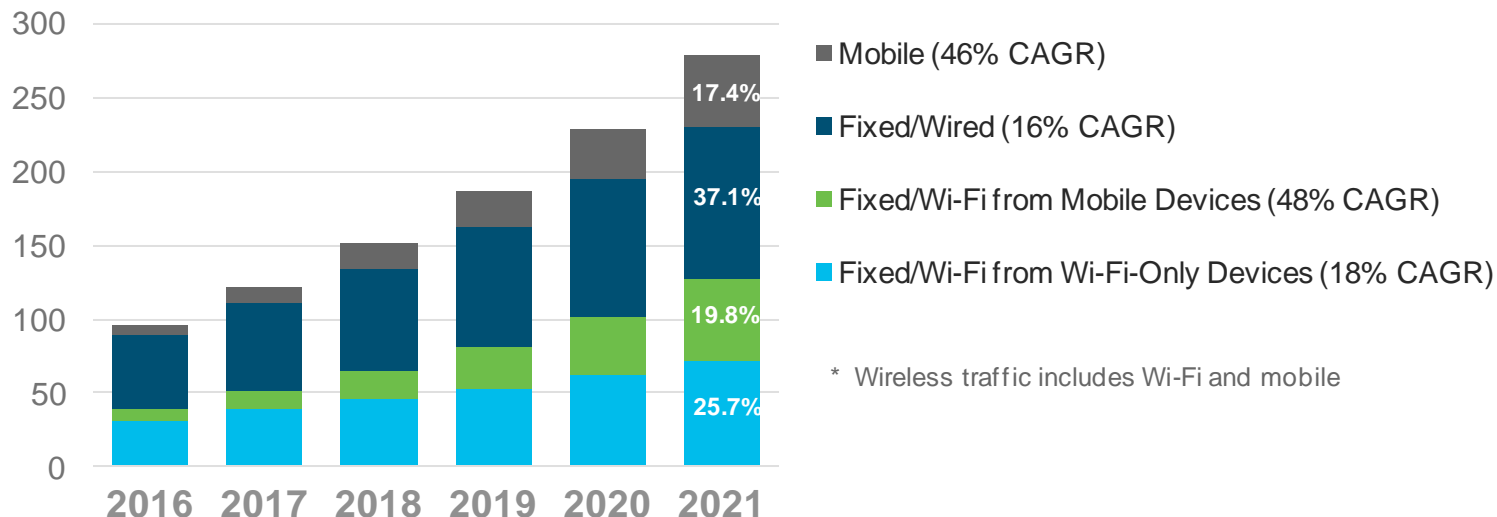| Total Public WLAN + Community Hotspots	2016	2021
	94.0 M	541.6 M

Total Incremental Hotspots ?

Source: Maravedis, Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global IP Traffic by Local Access Technology
By 2021, 63% of total IP traffic will be wireless*

24% CAGR
2016–2021

Exabytes
per Month

Mobile (46% CAGR)

Fixed/Wired (16% CAGR)

Fixed/Wi-Fi from Mobile Devices (48% CAGR)

Fixed/Wi-Fi from Wi-Fi-Only Devices (18% CAGR)

* Wireless traffic includes Wi-Fi and mobile

2021 percentages: 17.4% · 37.1% · 19.8% · 25.7%

Brazil's Mobile was 7% of total IP traffic in 2016, and will be 16% of total IP traffic in 2021.
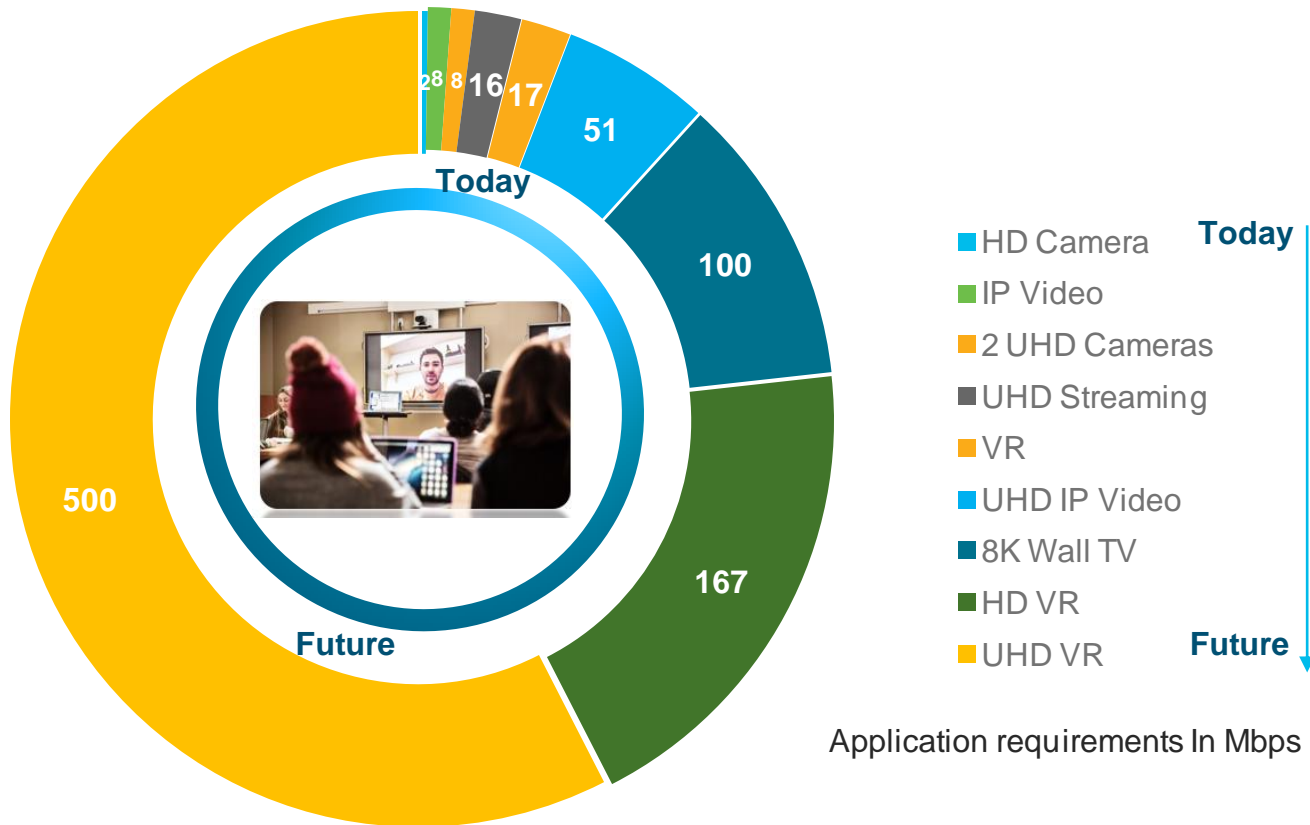Fixed/Wired will represent 31% and Fixed/Wi-Fi from Mobile 53%.

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Global Average Fixed Broadband Speeds
Doubling in speeds from 2016–2021

In Mbps	2016	2021
GLOBAL		
Global	27.5	**53.0**
BY REGION		
Asia Pacific	33.9	**63.7**
Latin America	9.3	**20.5**
North America	32.9	**74.2**
Western Europe	30.2	**53.6**
Central and Eastern Europe	29.2	**45.5**
Middle East & Africa	7.8	**17.1**
Brazil	11.2	**21.3**

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021

Video in the Home of Today and the Future
Significant demand for video in the home of the future

Today

- HD Camera
- IP Video
- 2 UHD Cameras
- UHD Streaming
- VR
- UHD IP Video
- 8K Wall TV
- HD VR
- UHD VR

Today

Future

Application requirements In Mbps

Today: 2, 8, 8, 16, 17, 51, 100
Future: 167, 500

DDoS Attack Size and Traffic Increasing

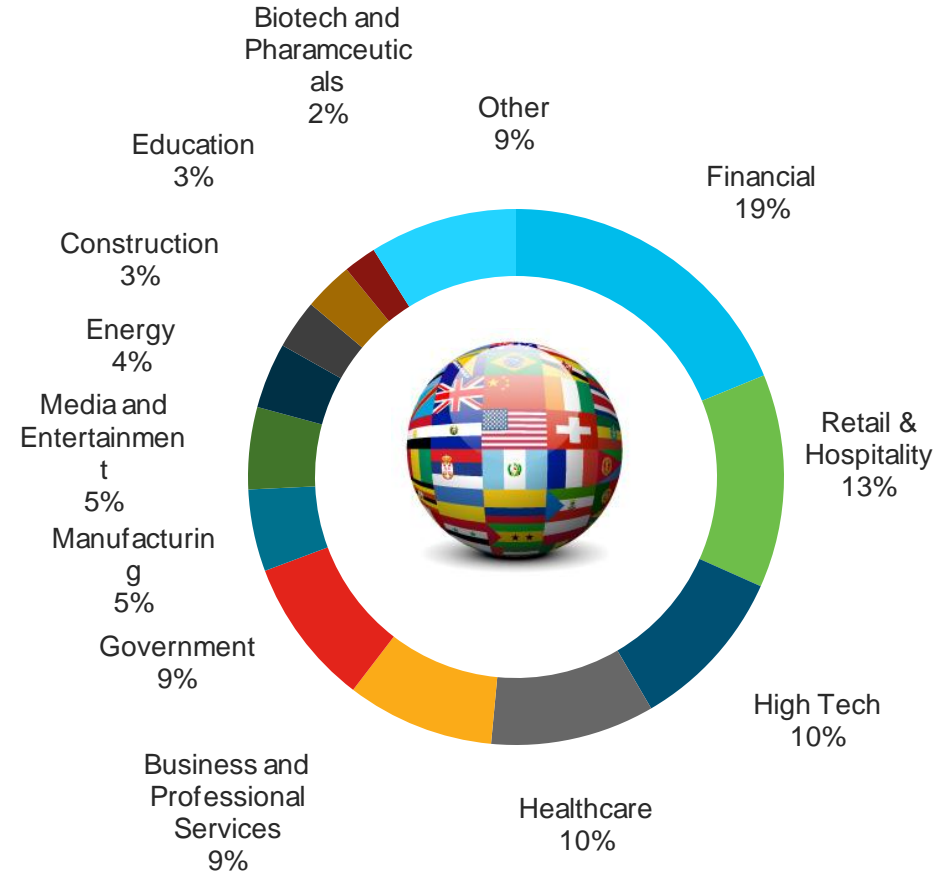Peak attack size increased 60% Y/Y.

DDoS attacks can represent up to 18% of a country's total Internet traffic while they are occurring.

Average DDoS attack size increases at 22% which is relatively the same rate as Internet traffic at 29% Y/Y.

Source: Arbor Networks, Cisco VNI Global IP Traffic Forecast, 2016–2021

Financial, Retail and Hospitality are the leading targets

Biotech and Pharamceuticals 2%
Other 9%
Education 3%
Financial 19%
Construction 3%
Energy 4%
Media and Entertainment 5%
Retail & Hospitality 13%
Manufacturing 5%
Government 9%
High Tech 10%
Business and Professional Services 9%
Healthcare 10%

Source: M-Trends 2017

Call to Action
Cisco VNI Web Site

Complete VNI Forecast: http://www.cisco.com/go/vni

- Press Release

- White Papers / FAQ

- Cisco VNI Web-based Tools

Cisco VNI Forecast inquiries: traffic-inquiries@cisco.com