



# Cisco VNI Forecast update

Mark Nowell

Cisco

6/24/19

*The forecasted global IP traffic in 2022 will exceed all the internet traffic up to 2016*

# Cisco VNI

- Started in 2006
- Broad distillation of numerous information sources to provide an aggregate view of traffic trends.
- Numerous subset analysis (eg region specific, mobile specific) available

Cisco's public VNI site:

<https://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html>

Includes a forecast tool to perform your own analysis.



# Cisco Visual Networking Index (VNI) Complete Forecast Update, 2017–2022

## 2018 Global Presentation

**Thomas Barnett, Jr.** | Director, SP Thought Leadership

**Shruti Jain** | Senior Analyst

**Usha Andra** | Senior Analyst

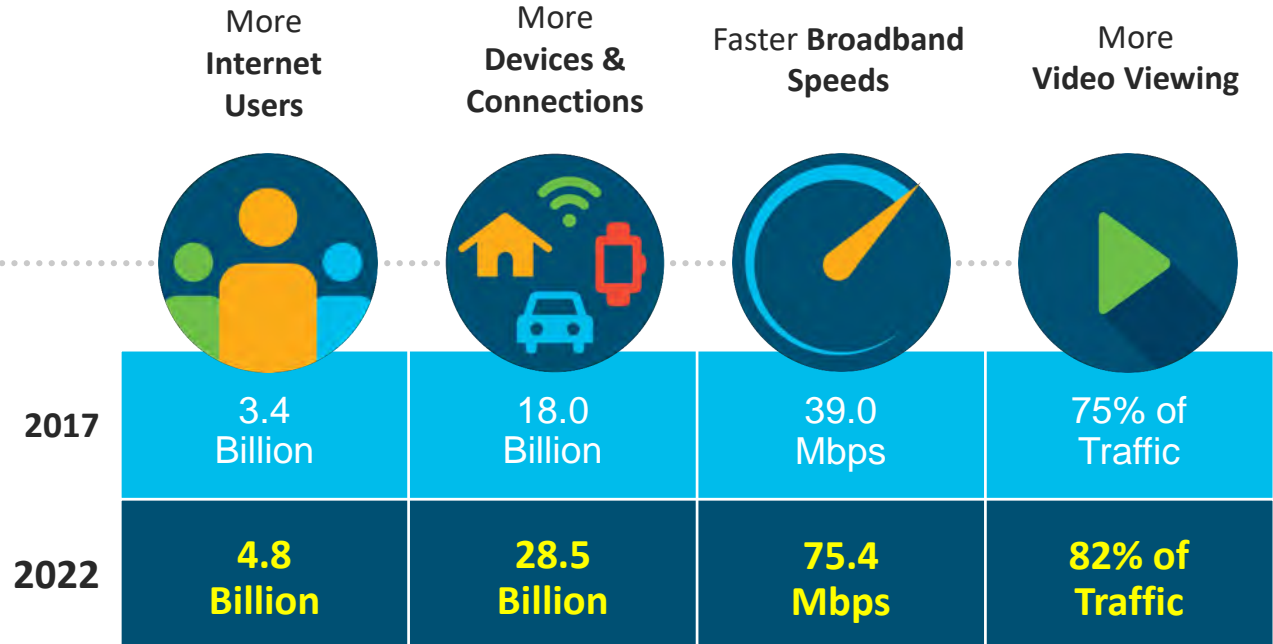
**Taru Khurana** | Senior Analyst

November 2018

# Global Internet Growth and Trends

## Key Digital Transformers

By 2022



Source: Cisco VNI Global IP Traffic Forecast, 2017–2022

# Overview

# Establishing the Zettabyte Era

**By 2022, global IP traffic will reach an annual run rate of 4.8 zettabytes per year**

4.8 zettabytes is equal to:

- Nearly 11X more than all IP traffic generated in 2012 (437 exabytes)
- All movies ever made crossing global IP networks in less than a minute (53 seconds)

What is a zettabyte?

One trillion gigabytes

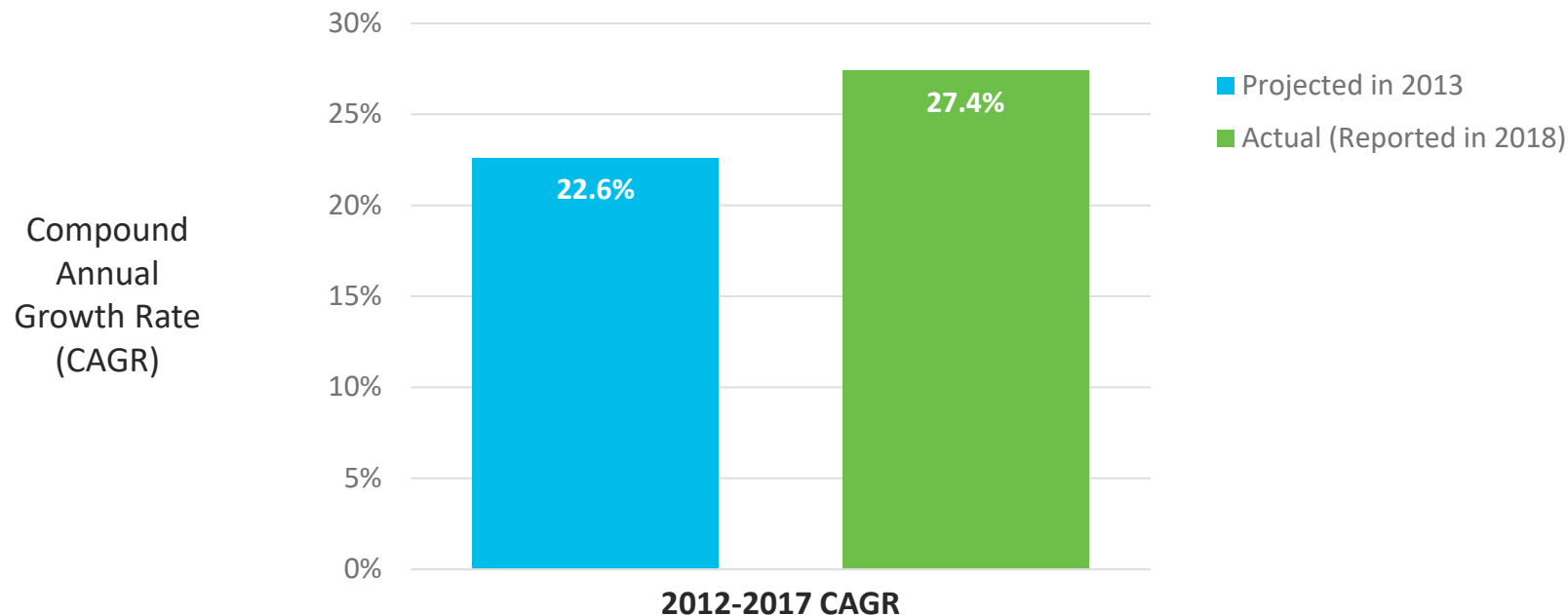
Approximately  $10^{21}$

(1,000,000,000,000,000,000 bytes)



# VNI Projections and Actuals (Global)

Actual growth has been within  $\pm 10\%$  of projected growth



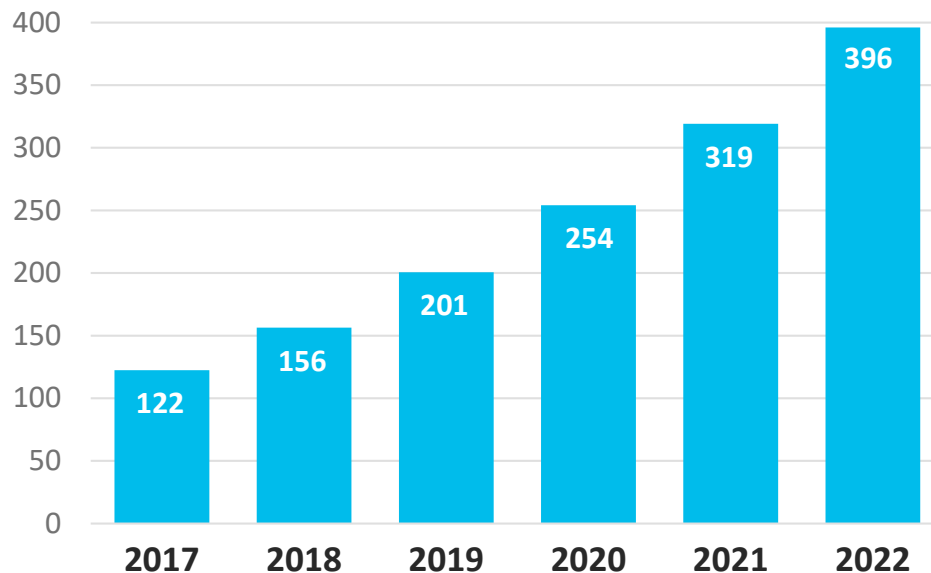


# Global IP Traffic Growth

Global IP traffic will increase 3-fold from 2017 to 2022

26% CAGR  
2017–2022

Exabytes per  
Month

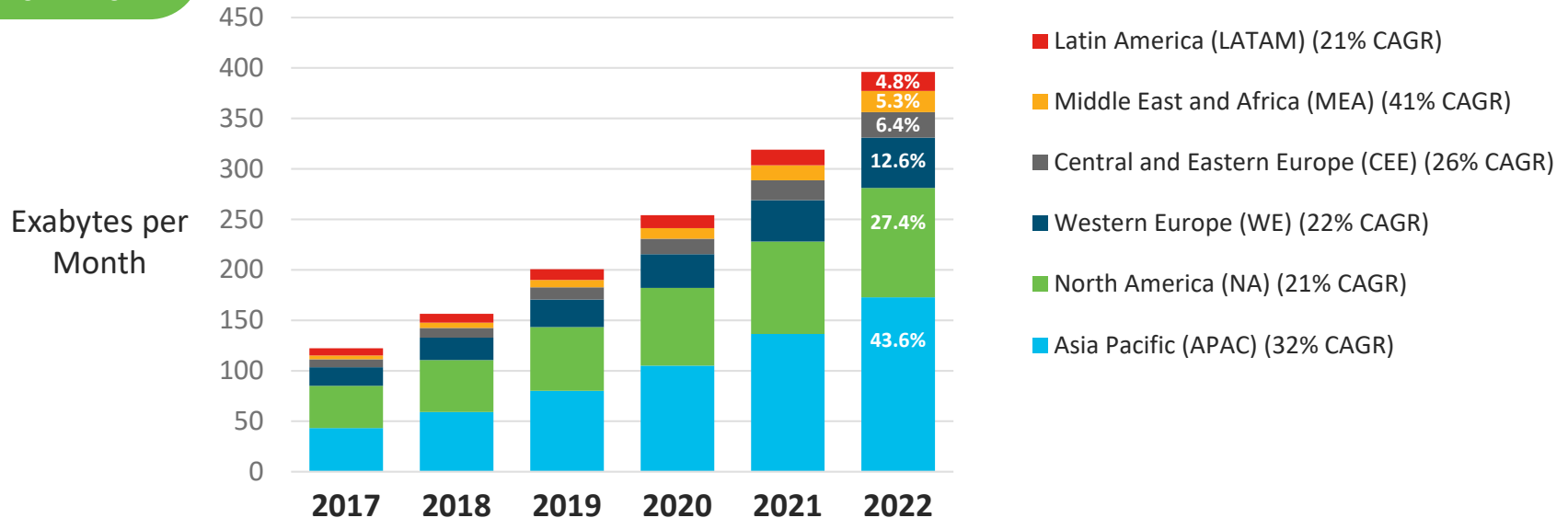


# Global IP Traffic Growth by Region

MEA has the highest growth rate (41%) from 2017 to 2022

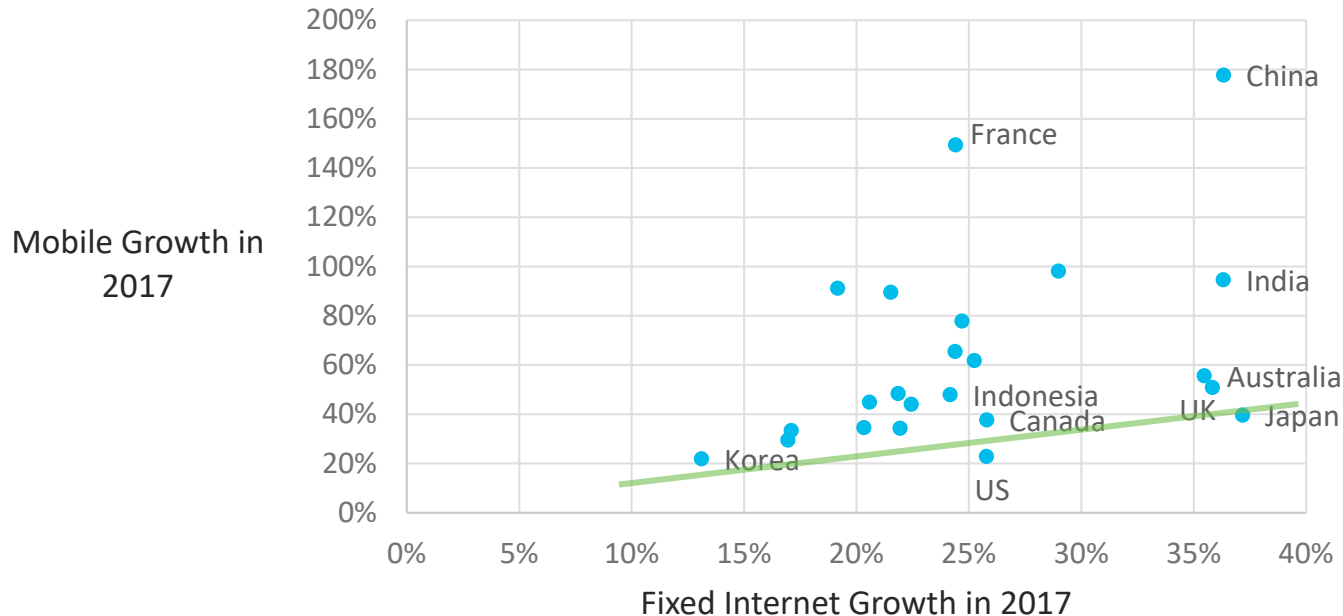
APAC will generate 44% of all IP traffic by 2022

26% CAGR  
2017–2022



# Fixed and Mobile Growth in 2017

Most countries have higher mobile than fixed growth  
But there are a growing number of exceptions



# Top Trends

# Top Trends

## Devices & Connections



- ① Devices/Connections Mix
- ② IoT/M2M by Verticals
- ③ IPv6 Adoption

## Traffic Trends



- ④ Traffic Growth by App
- ⑤ Traffic Pattern Analysis
- ⑥ “Cord-Cutting”

## Network Performance and User Experience



- ⑦ Wi-Fi Momentum
- ⑧ Accelerating Speeds
- ⑨ Security Analysis

# Top Trends

## Devices & Connections



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

## Traffic Trends



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

## Network Performance and User Experience



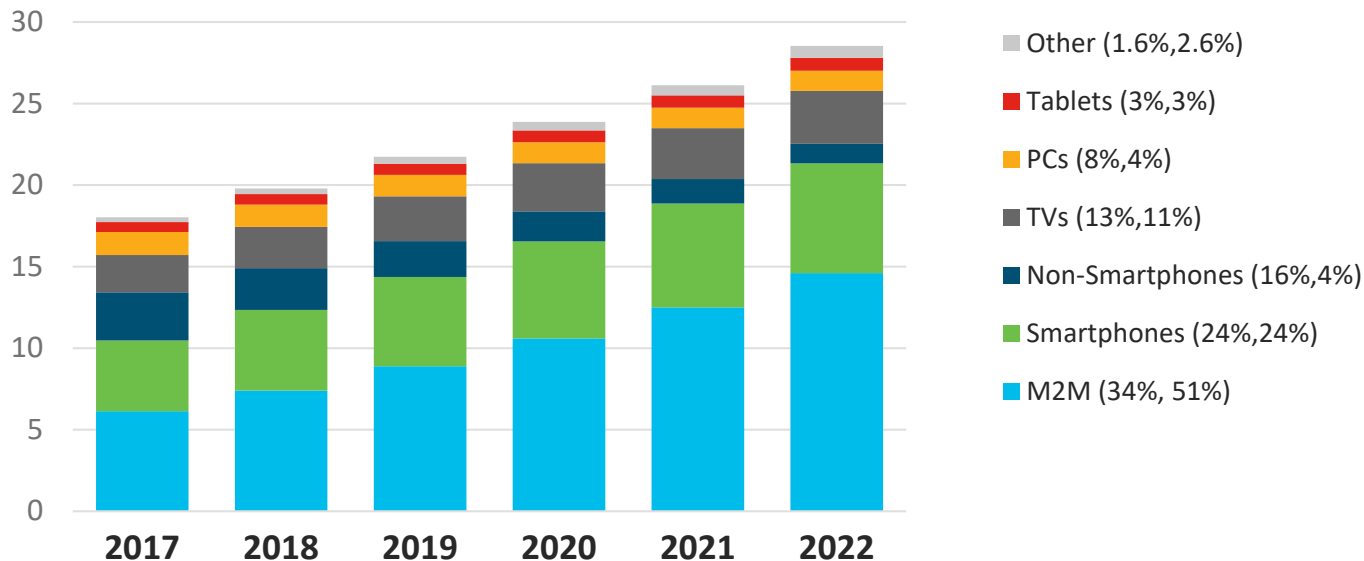
- ❼ Wi-Fi Momentum
- ❽ Accelerating Speeds
- ❾ Security Analysis

# Global Device/Connection Growth by Type

By 2022, M2M connections will be more than half of total connections

10% CAGR  
2017–2022

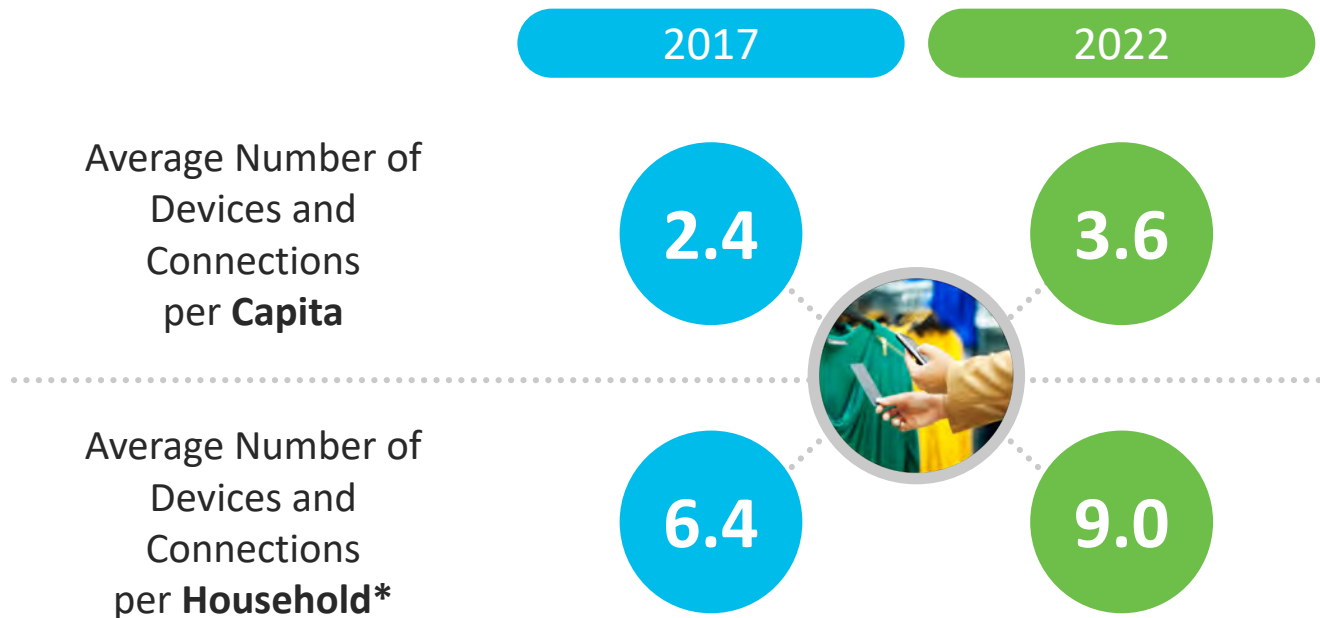
Billions of  
Devices



\* Figures (n) refer to 2017, 2022 device share

# Global Devices and Connections

Average per capita and per household



\* Household average includes only Consumer devices and connections

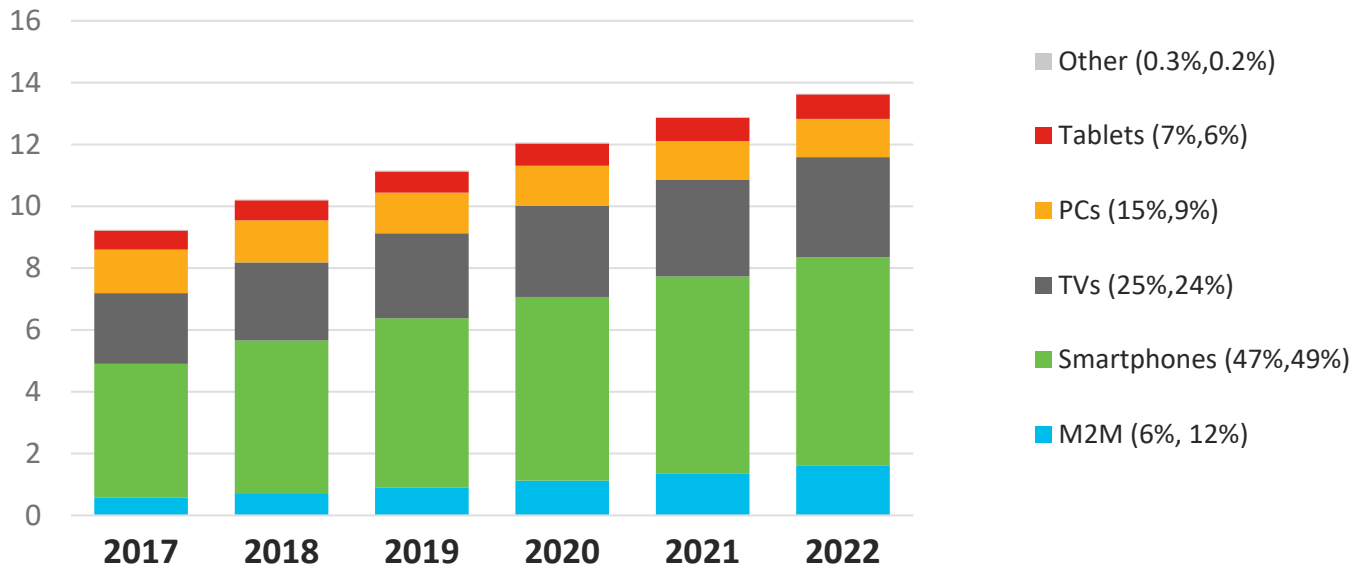


# Global Video Capable Device Growth by Type

By 2022, nearly half (48%) of total devices and connections will be video capable

8% CAGR  
2017–2022

Billions of  
Devices

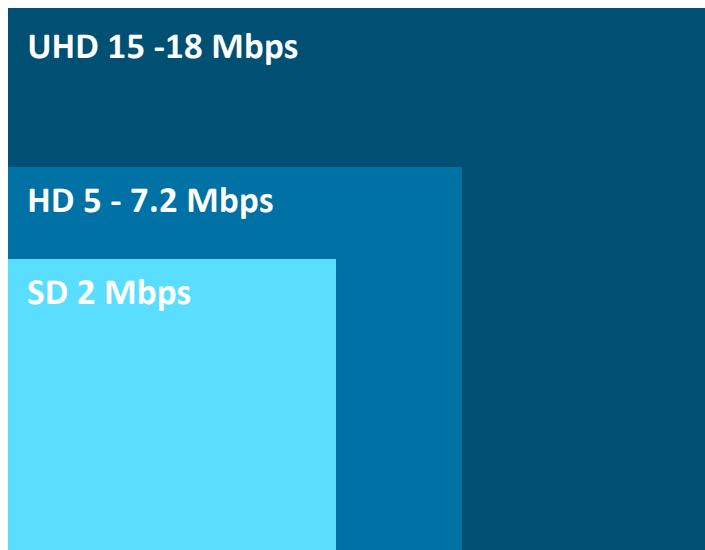


\* Figures (n) refer to 2017, 2022 device share

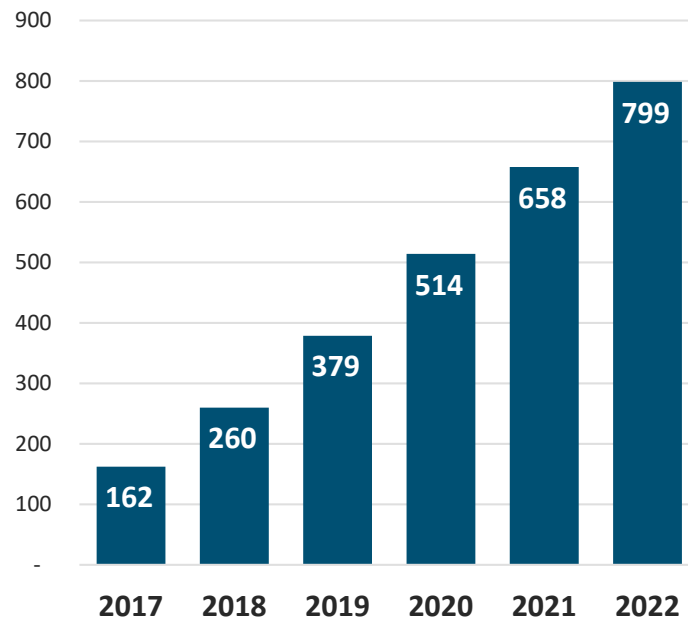
# Increasing Video Definition

By 2022, nearly two-thirds (62%) of connected flat panel TVs will support 4K

38% CAGR  
2017–2022



Connected  
4K TV Sets  
(M)

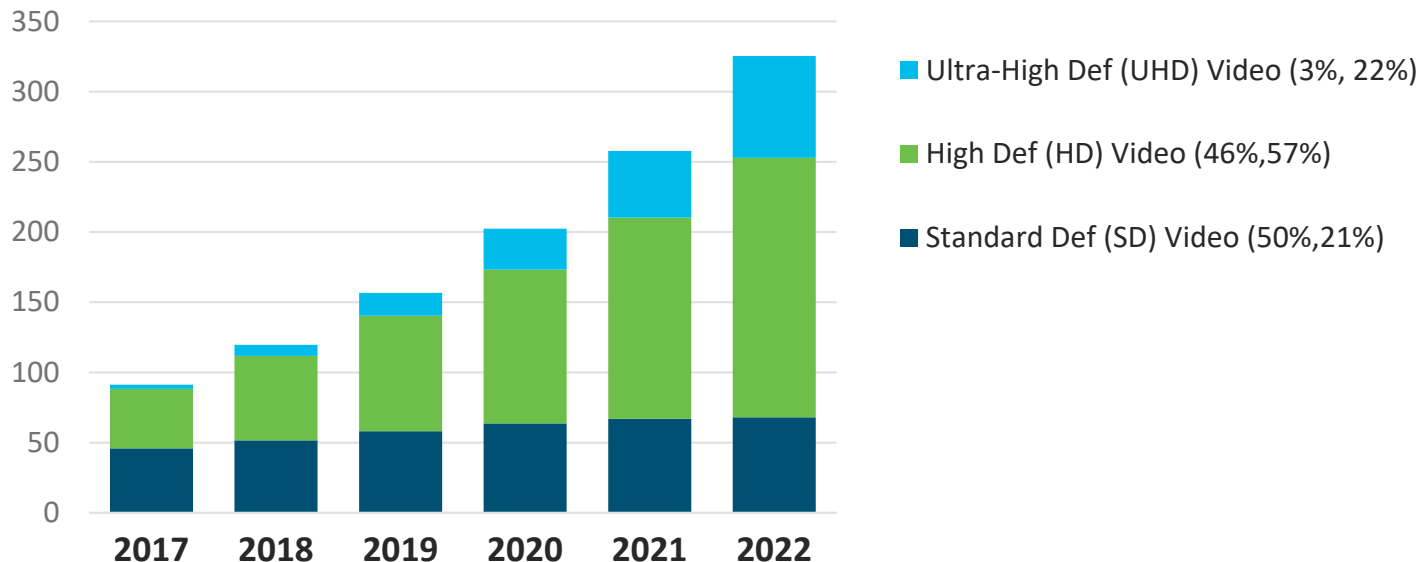


# High Definition Content Impacts IP Video Growth

UHD IP video will account for 22% of global IP video traffic by 2022

29% CAGR  
2017–2022

Exabytes per  
Month



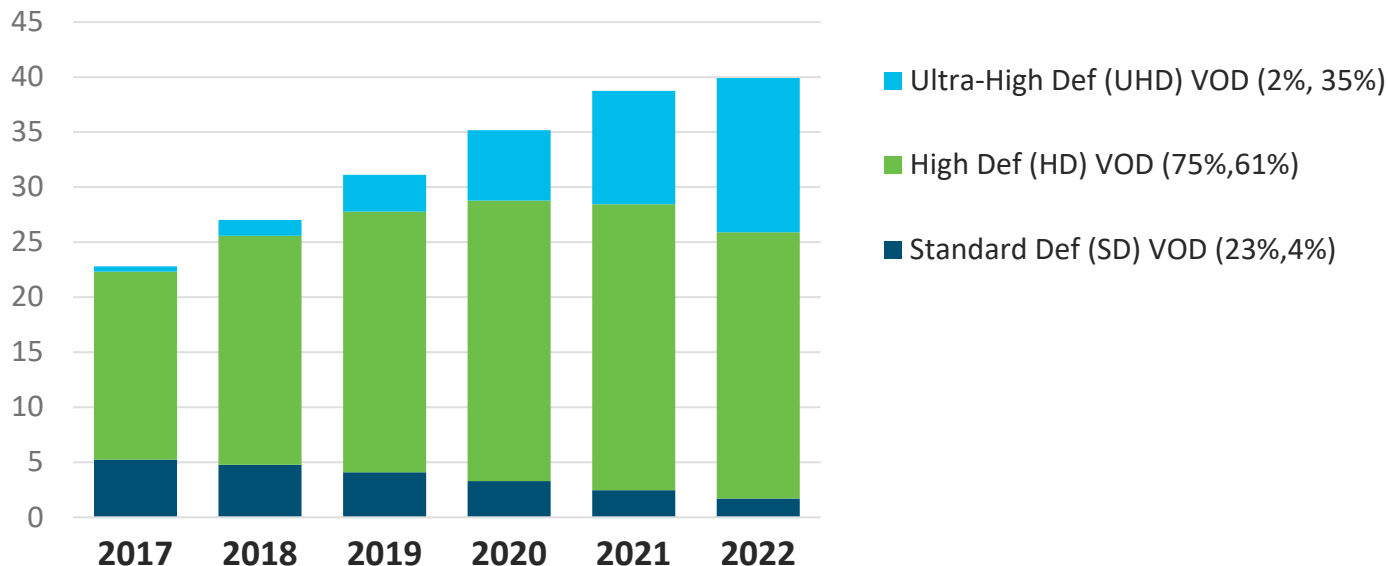
\* Figures (n) refer to 2017, 2022 traffic share

# High Definition Content Impacts IP VoD Growth

UHD VoD will account for 35% of global IP VoD traffic by 2022






12% CAGR  
2017–2022

Exabytes per  
Month



\* Figures (n) refer to 2017, 2022 traffic share

# Global Average IP Traffic Per Device

		2017	2022
		MBs per Month	MBs per Month
	M2M Module	610	1,730
	Smartphone	5,110	26,100
	Tablet	10,380	31,140
	Laptop / PC	35,950	59,250
	Ultra High Definition TV*	7,520	35,840

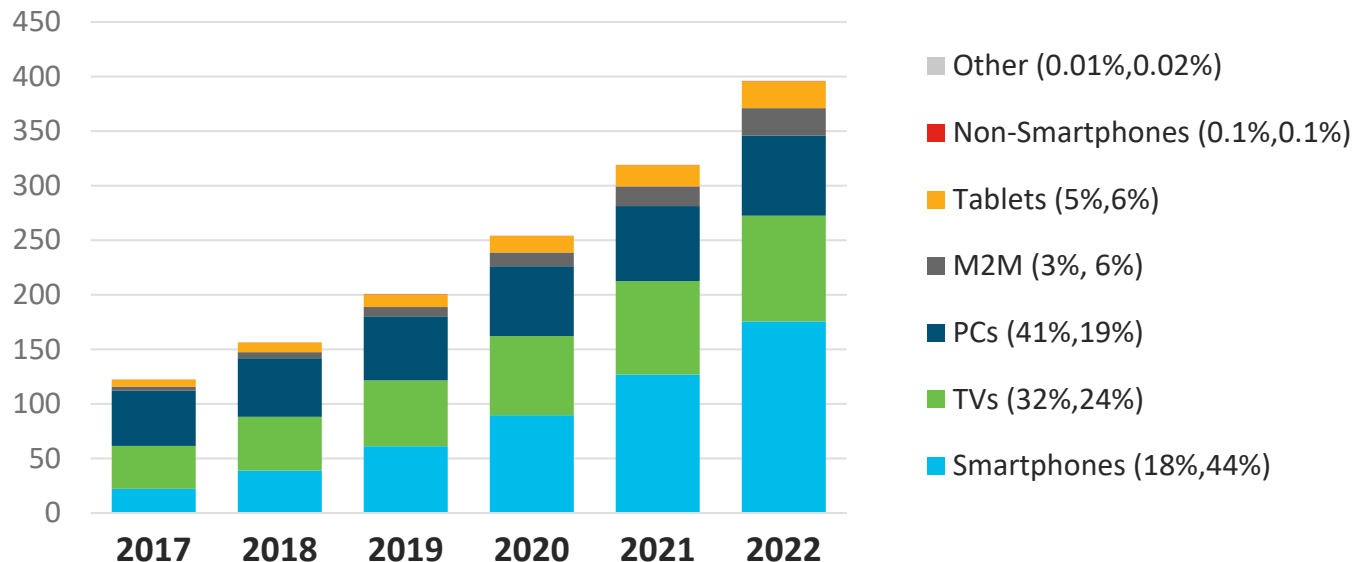
\* Includes IP VoD traffic

# Global IP Traffic by Device Type

By 2022, non-PC devices will drive 81% of global IP traffic

26% CAGR  
2017–2022

Exabytes per  
Month



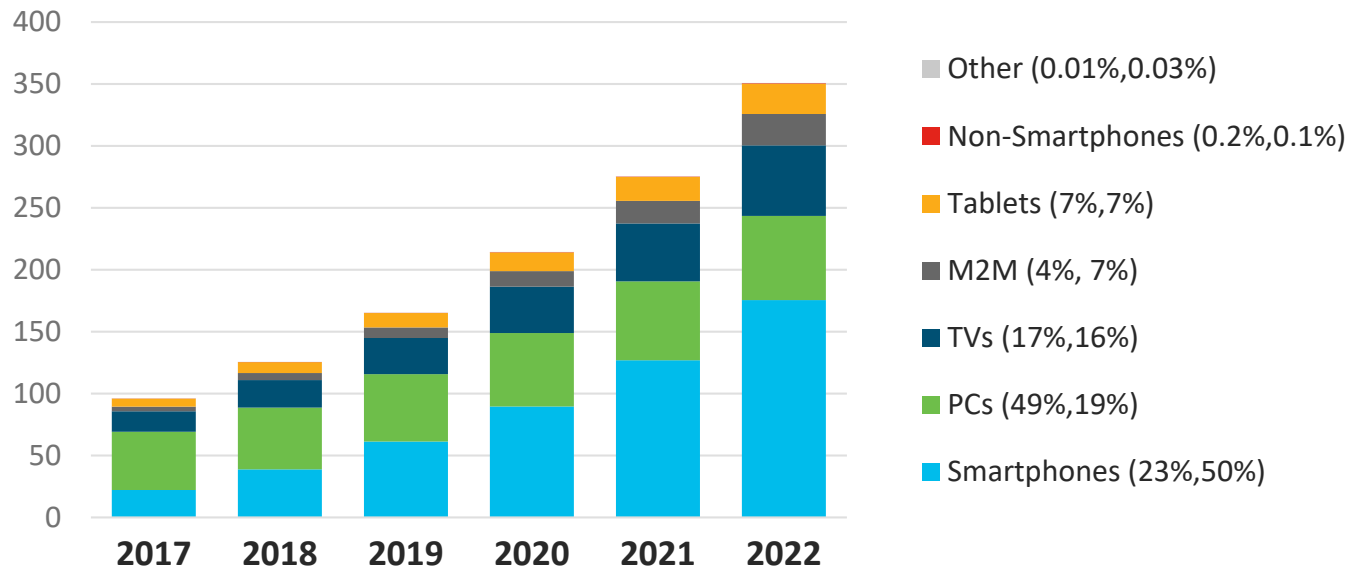
\* Figures (n) refer to 2017, 2022 traffic share

# Global Internet Traffic by Device Type

By 2022, non-PC devices will drive 81% of global Internet traffic

30% CAGR  
2017–2022

Exabytes per  
Month



\* Figures (n) refer to 2017, 2022 traffic share

# Top Trends

## Devices & Connections



- ① Devices/Connections Mix
- ② **IoT/M2M by Verticals**
- ③ IPv6 Adoption

## Traffic Trends



- ④ Traffic Growth by App
- ⑤ Traffic Pattern Analysis
- ⑥ “Cord-Cutting”

## Network Performance and User Experience



- ⑦ Wi-Fi Momentum
- ⑧ Accelerating Speeds
- ⑨ Security Analysis

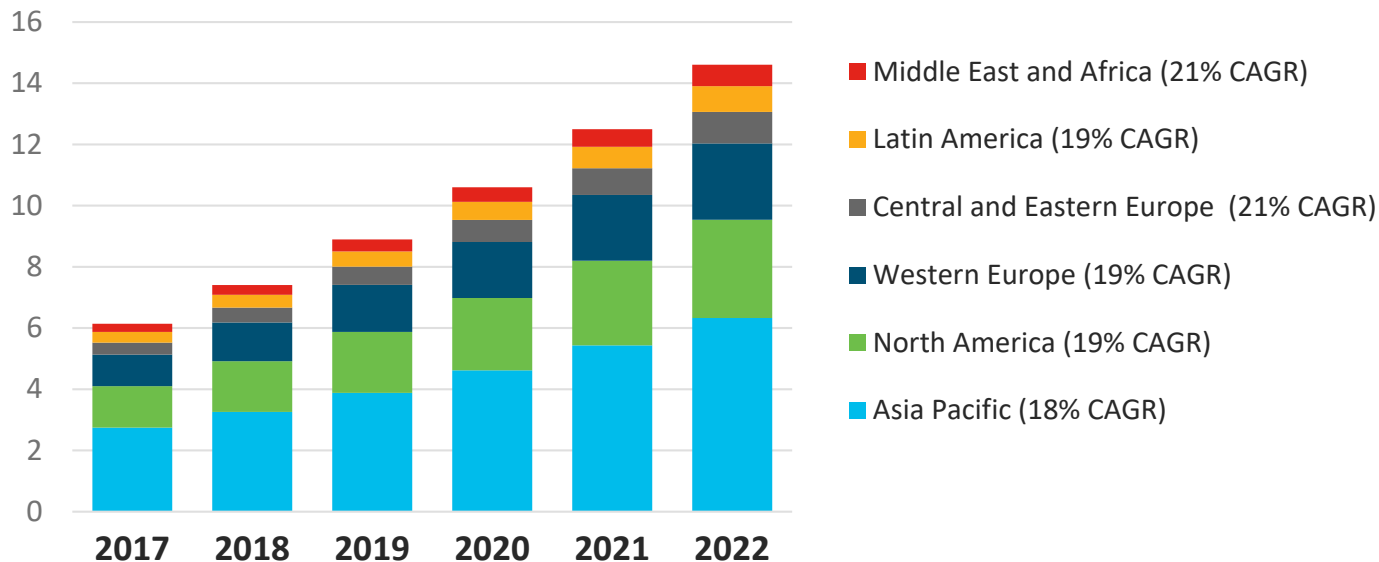


# Global M2M Connections / IoT Growth

By 2022, 1.8 M2M connections per capita globally

19% CAGR  
2017–2022

Billions of  
M2M  
Connections

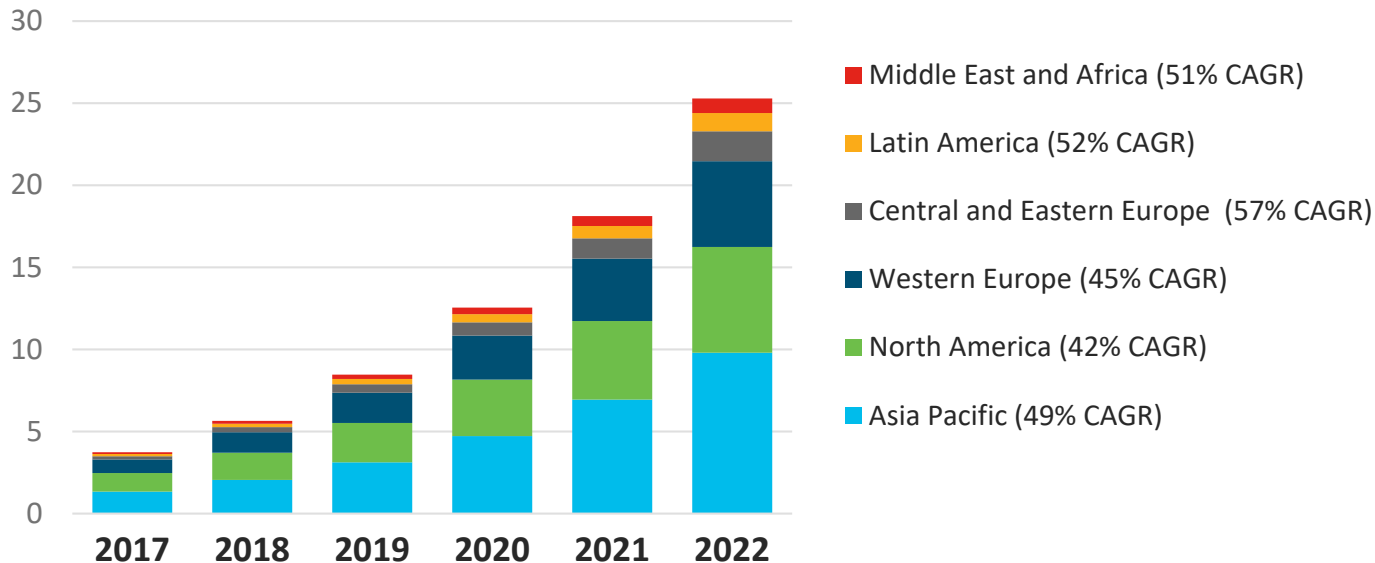


# Global M2M Traffic Growth

M2M traffic will grow more than 7-fold from 2017 to 2022

47% CAGR  
2017–2022

Exabytes  
per Month



By 2022, M2M modules will be **51%** (14.6 billion) of total global devices and connections and will account for **6%** (25.3 EBs/month) of total global IP traffic.

Source: Cisco VNI Global IP Traffic Forecast, 2017–2022

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## Connected Home



- Home automation
- Building security
- Network equipment – printers +
- Network infrastructure – routers +
- White goods
- Tracking applications
- Household information devices

## Connected Work



- Office building automation
- Building security
- Office equipment – printers +
- Routers +
- Commercial appliances

## Connected Car



- Fleet management
- In-vehicle entertainment systems, emergency calling, Internet
- Vehicle diagnostics, navigation
- Stolen vehicle recovery
- Lease, rental, insurance management

## Connected Health



- Health monitors
- Assisted living – medicine dispensers +
- Clinical trials
- First responder connectivity
- Telemedicine

## Connected Cities



- Environment and public safety – closed-circuit TV, street lighting, waste removal, information +
- Public space advertising
- Public transport
- Road traffic management

## Retail



- Retail goods monitoring and payment
- Retail venue access and control
- Slot machines, vending machines

## Manufacturing & Supply Chain



- Mining and extraction
- Manufacturing and processing
- Supply chain
- Warehousing and storage

## Energy



- New energy sources – monitoring and power generation support apps
- Smart grid and distribution
- Micro-generation – generation of power, by residential, commercial and community users on their own property

## Other



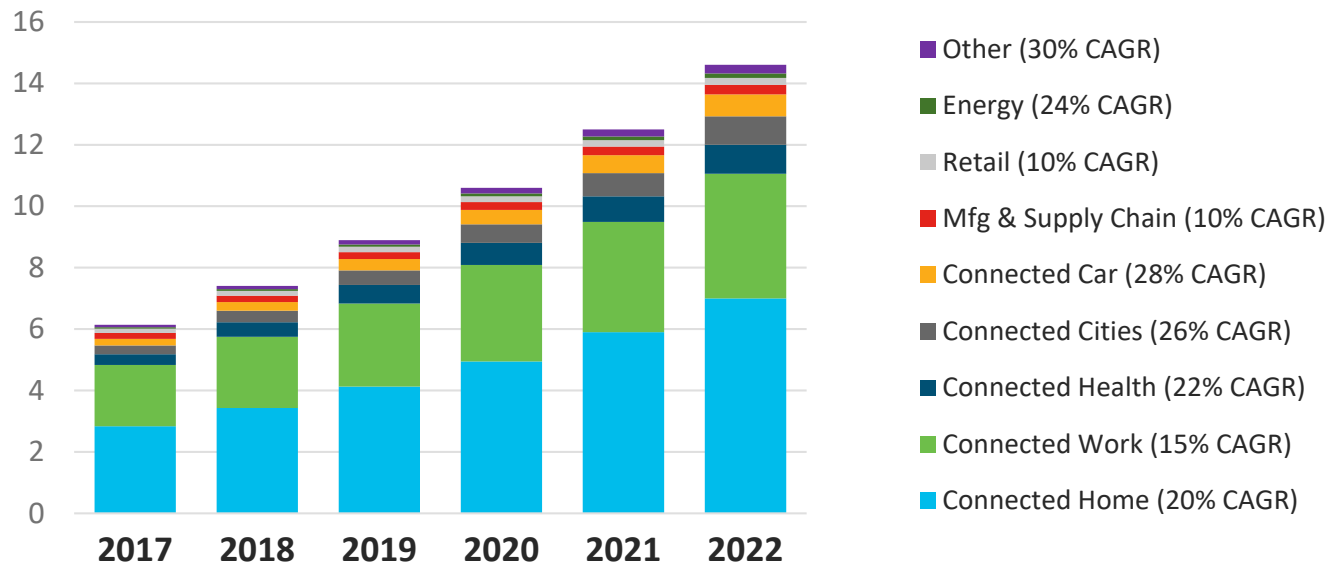
- Agriculture – livestock, soil monitoring, water and resource conservation, temperature control for milk tanks +
- Construction: Site and equipment monitoring
- Emergency services and national security

# Global M2M Connections / IoT Growth by Vertical

By 2022, connected home largest, connected car fastest growth

19% CAGR  
2017–2022

Billions of  
M2M  
Connections



# Top Trends

## Devices & Connections



- ① Devices/Connections Mix
- ② IoT/M2M by Verticals
- ③ **IPv6 Adoption**

## Traffic Trends



- ④ Traffic Growth by App
- ⑤ Traffic Pattern Analysis
- ⑥ “Cord-Cutting”

## Network Performance and User Experience



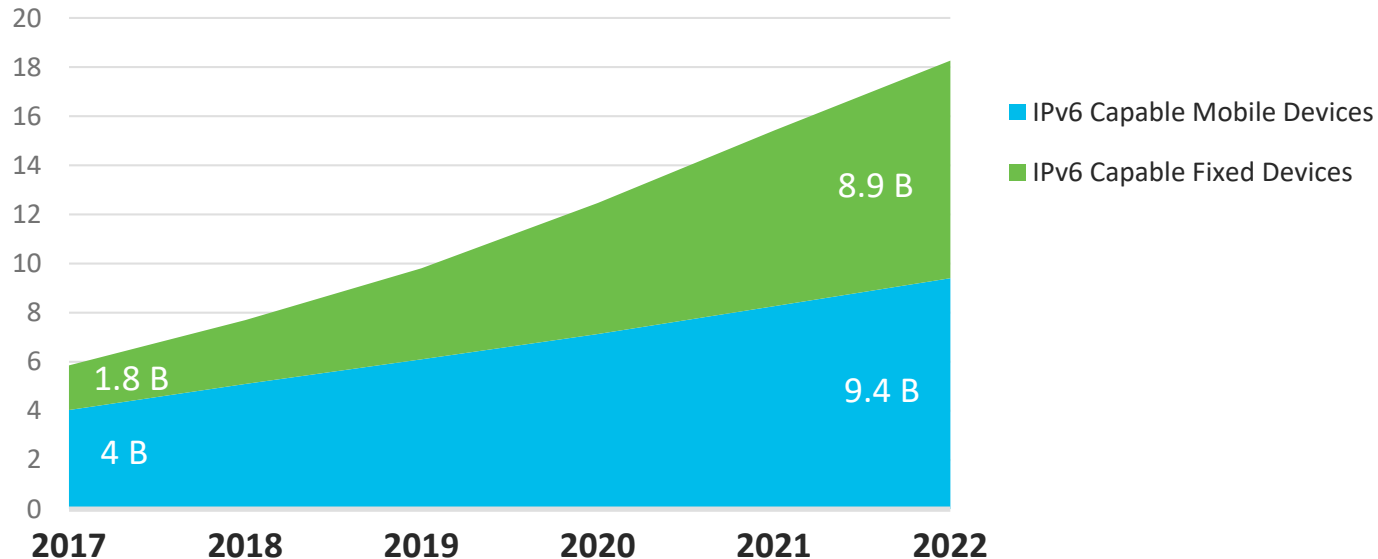
- ⑦ Wi-Fi Momentum
- ⑧ Accelerating Speeds
- ⑨ Security Analysis

# Global IPv6-Capable Devices/Connections

By 2022, 64% of devices/connections will be IPv6-capable

26% CAGR  
2017–2022

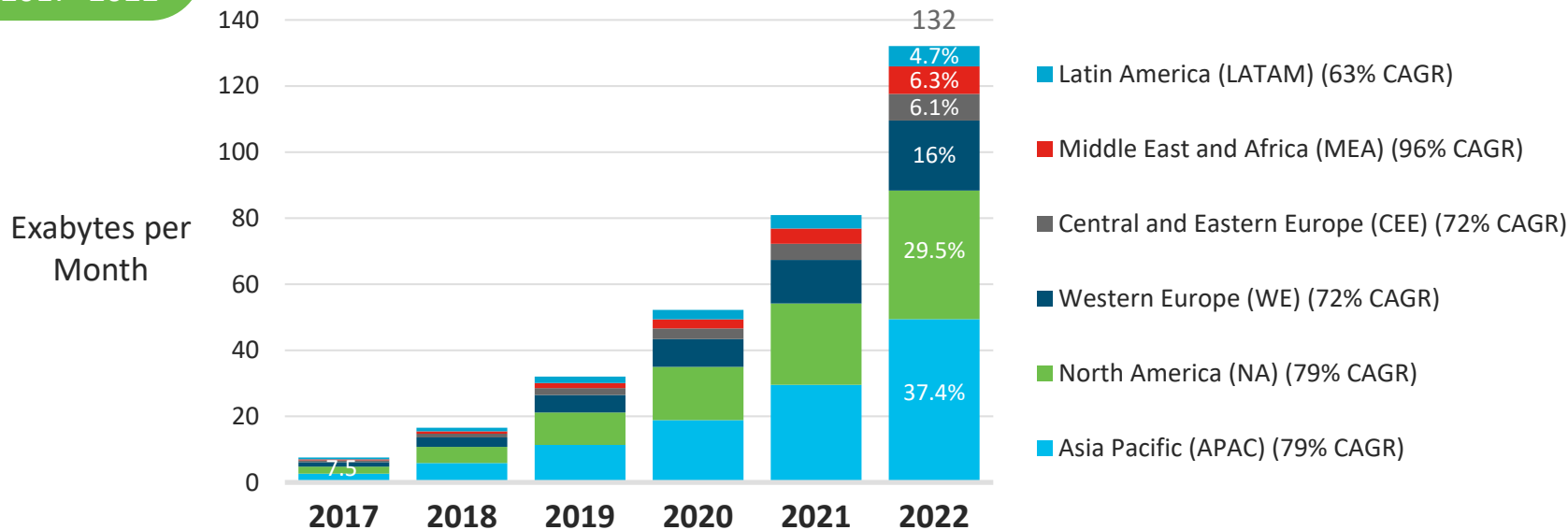
Number of  
Devices  
(Billions)



# Global IPv6 Traffic Growth / Regions

By 2022, IPv6 will represent 38% of total Internet traffic

77% CAGR  
2017–2022





# Top Trends

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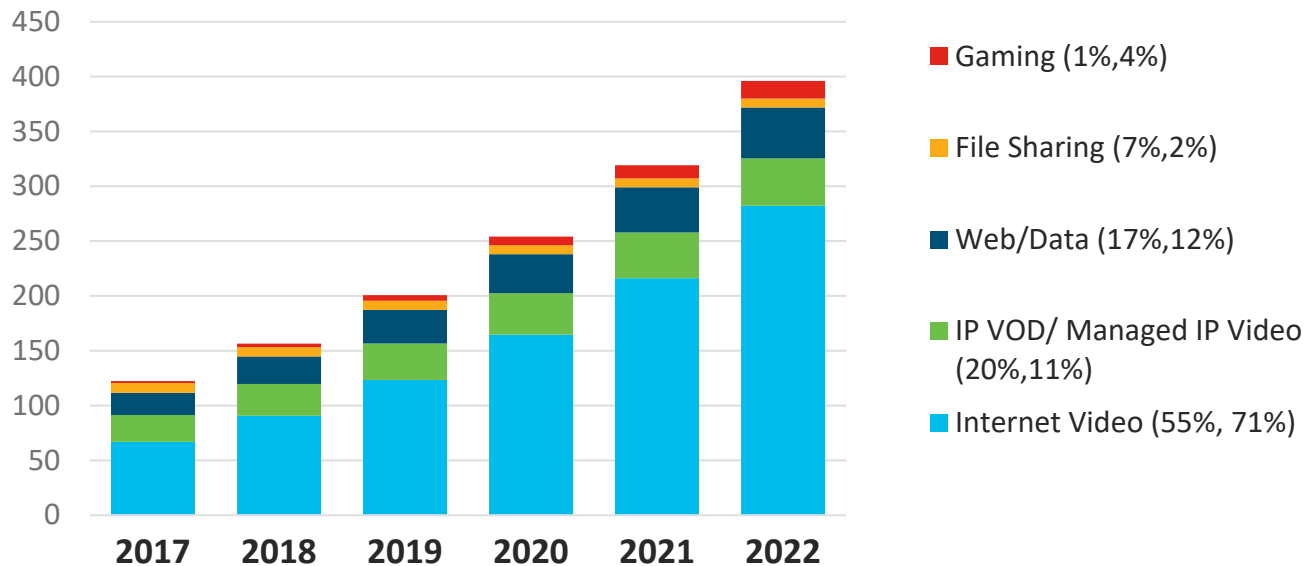
- ⑦ Wi-Fi Momentum
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# Global IP Traffic by Application Type

By 2022, video will account for 82% of global IP traffic

26% CAGR  
2017–2022

Exabytes per  
Month



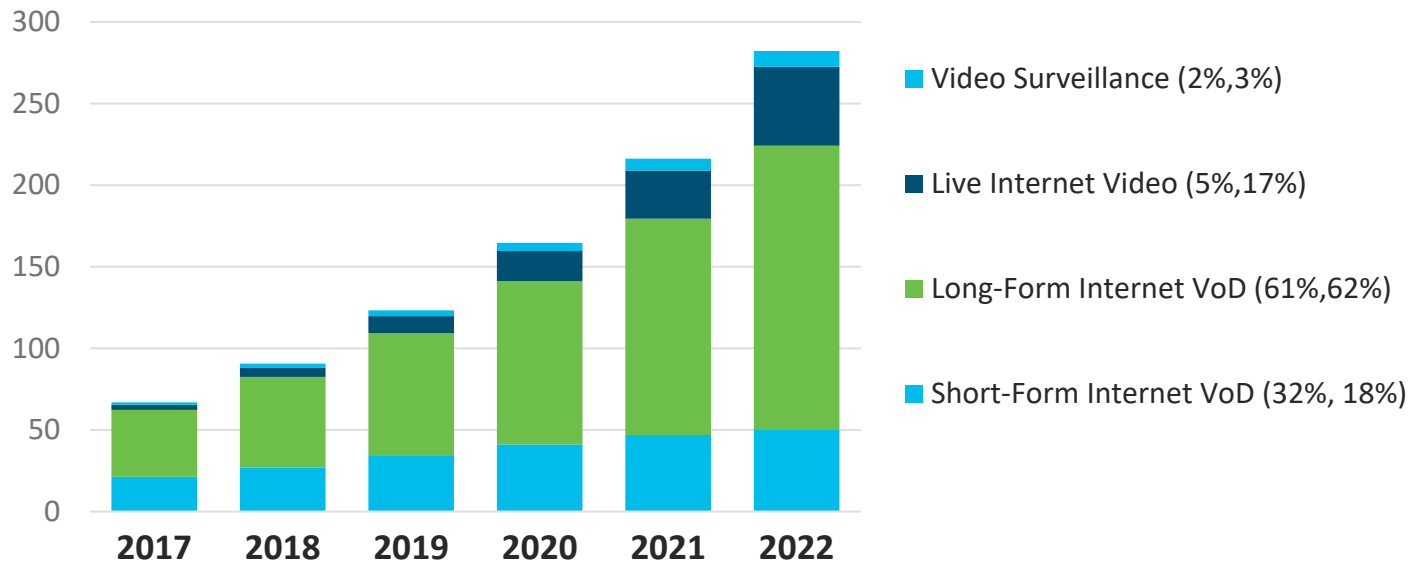
\* Figures (n) refer to 2017, 2022 traffic share

# Global Internet Video Traffic by Type

By 2022, live video will increase 15-fold and reach 17% of Internet video traffic

33% CAGR  
2017–2022

Exabytes per  
Month

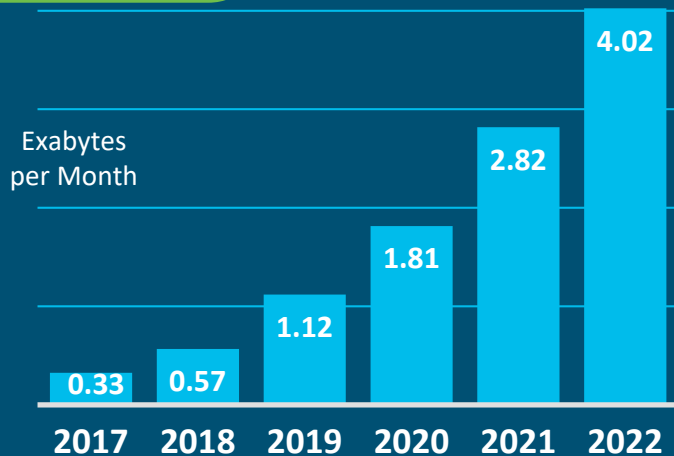


\* Figures (n) refer to 2017, 2022 traffic share

# Virtual and Augmented Reality Traffic

By 2022, VR/AR traffic will increase 12-fold

65% CAGR  
2017–2022



Source: Cisco VNI Global IP Traffic Forecast, 2017–2022

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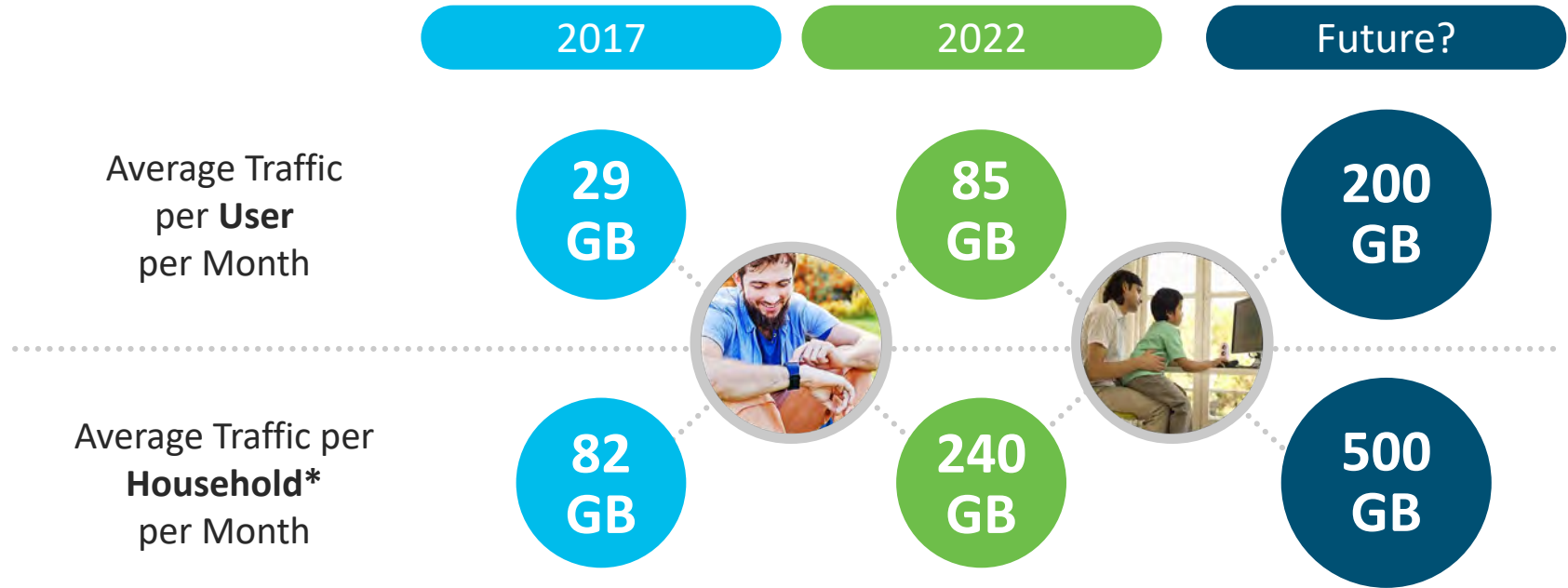
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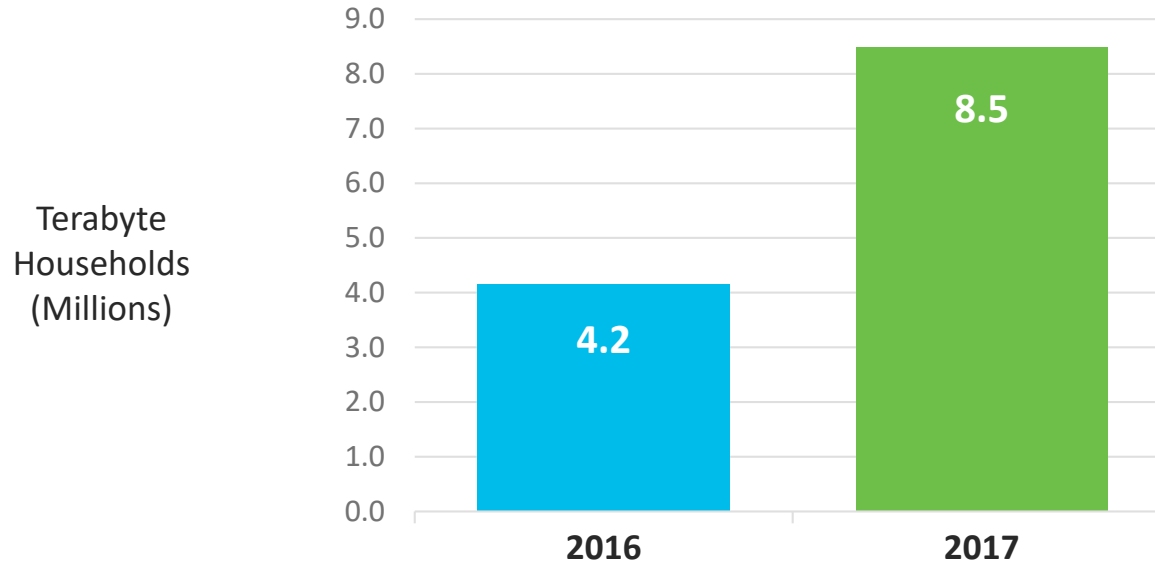
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# Average Global Internet Bandwidth Usage



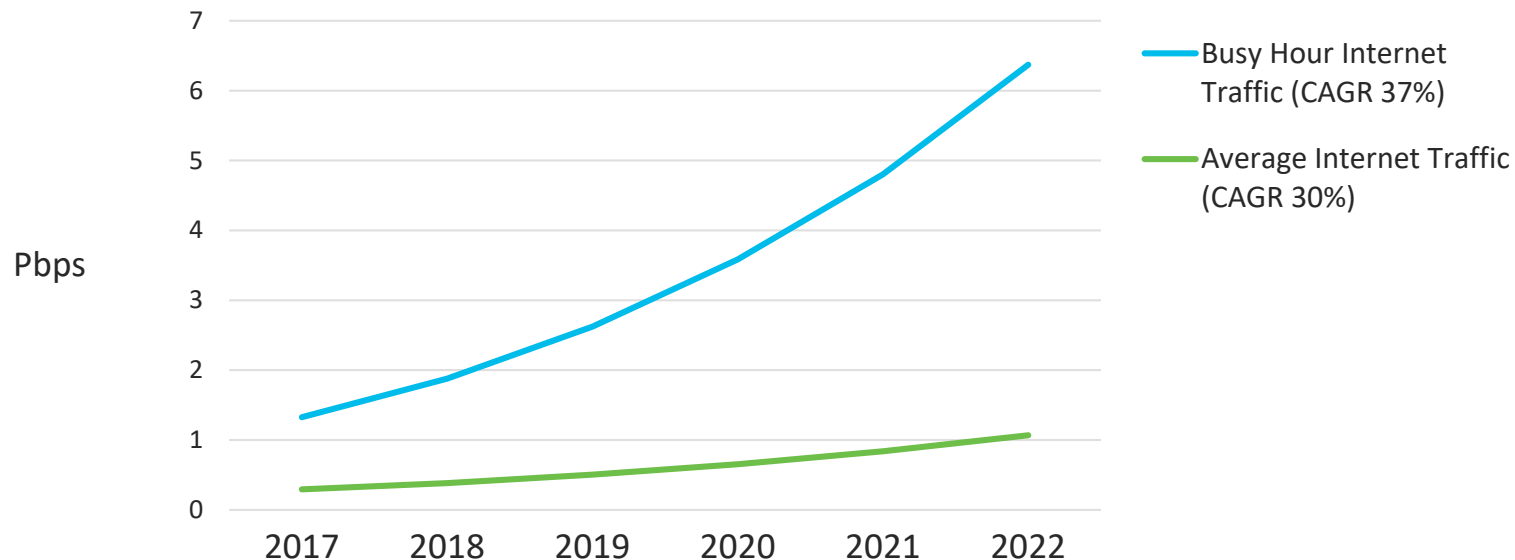
# Internet Households Reshape Usage Limits

Internet households exceeding 1 TB more than doubled in 2017



# Global Busy-Hour vs. Average Hour Internet Traffic

By 2022, busy Internet traffic will be nearly 6X greater than average traffic



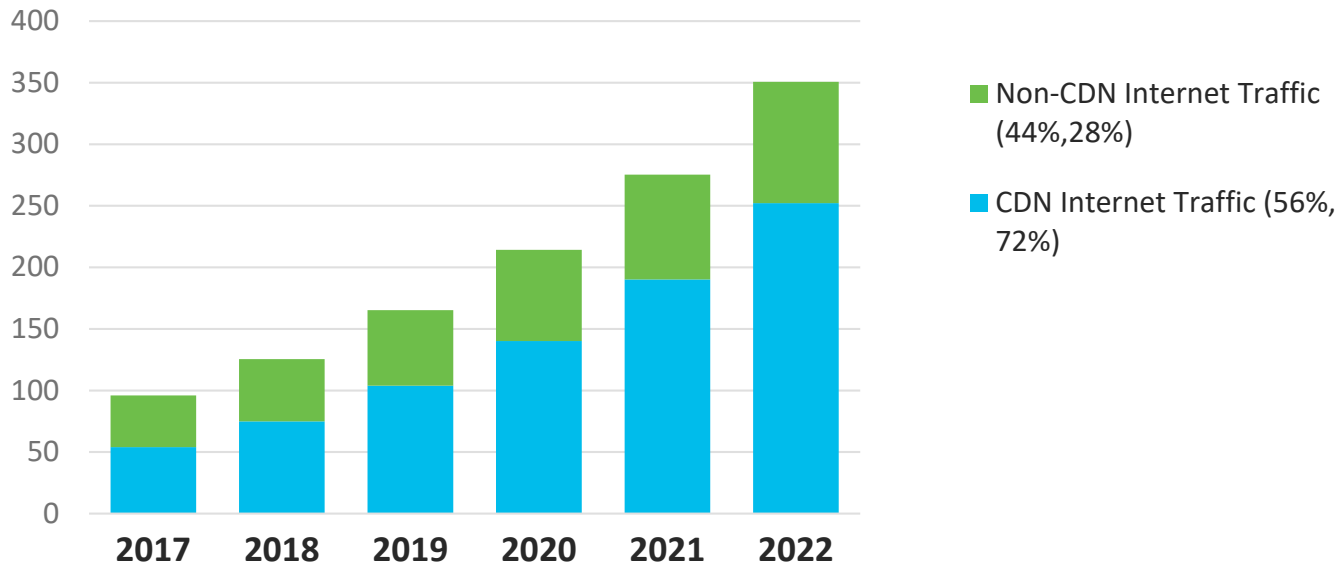


# Global Content Delivery Network (CDN) Traffic

CDNs will deliver 72 percent of Internet traffic by 2022

30% CAGR  
2017–2022

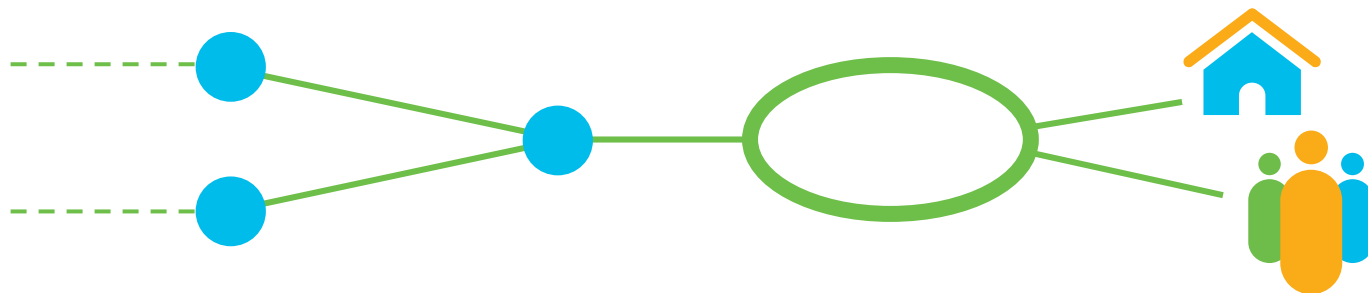
Exabytes per  
Month



\* Figures (n) refer to 2017, 2022 traffic share

# SP Network Capacity Moving Closer to the Edge

Over one-third of capacity will bypass core completely by 2022



Core – Cross-Country  
48% in 2017  
43% by 2022

Core – Regional  
25% by 2017  
24% by 2022

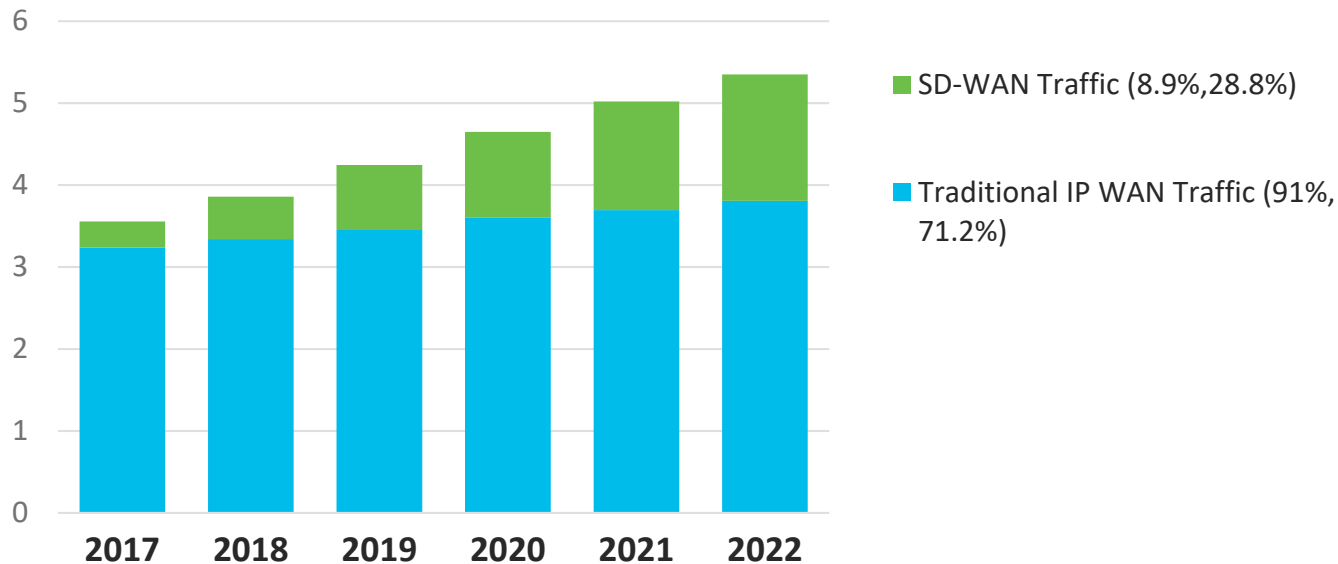
Within Metro  
27% in 2017  
33% by 2022

# Global Enterprise SD-WAN Traffic

SD-WAN traffic will grow at a CAGR of 37% compared to 3% for traditional WAN SD-WAN will increase 5x and will be 29% of WAN traffic by 2022

9% CAGR  
2017–2022

Exabytes per  
Month



\* Figures (n) refer to 2017, 2022 traffic share

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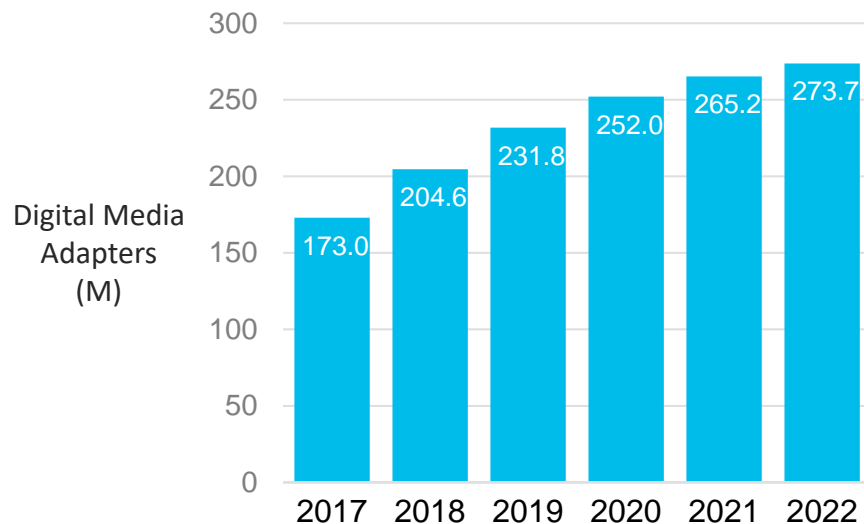
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# Global Digital Media Adapters\* Growth

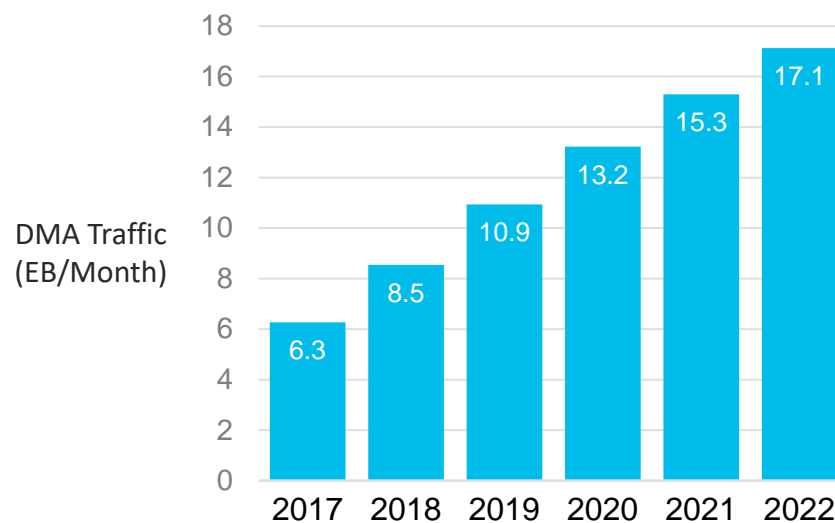
By 2022, DMAs will represent 9% of global Internet connected TV

by 2022, DMAs will represent 18% of global Internet connected TV traffic

10% CAGR  
2017–2022



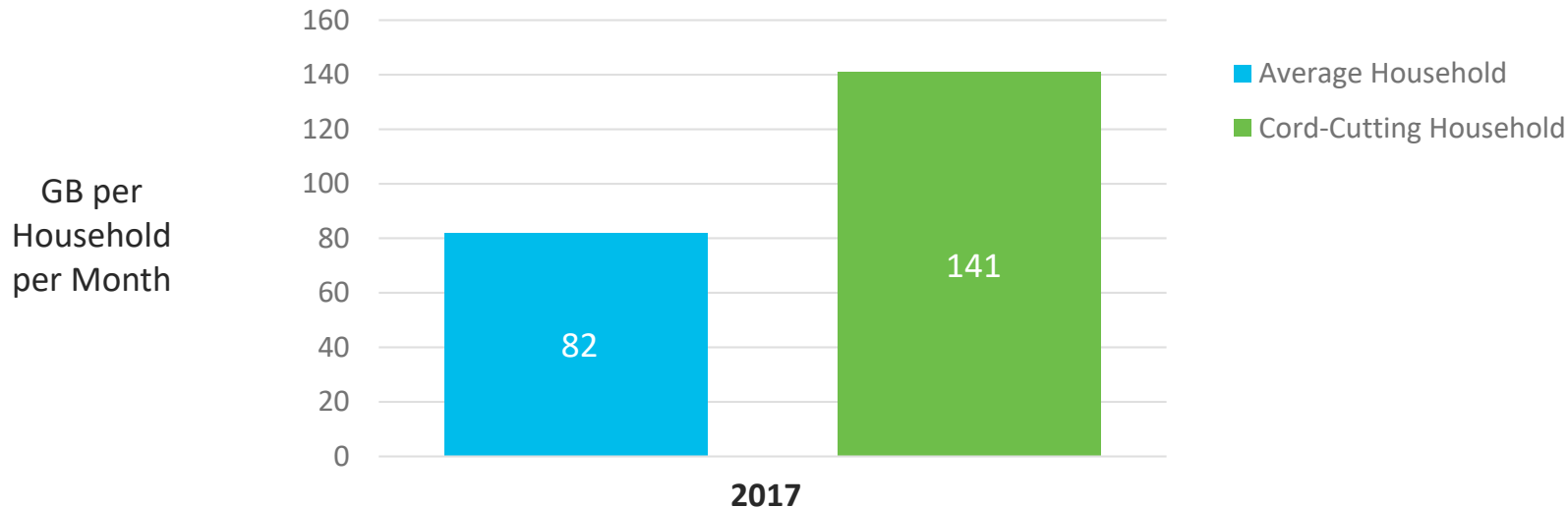
22% CAGR  
2017–2022



\* DMAs include devices such as Roku, Apple TV, Chromecast

# Cord-Cutting Household Traffic Is 72% Higher

A global cord-cutting household generates 141 GB per month in 2017, compared to 82 GB per month for an average household



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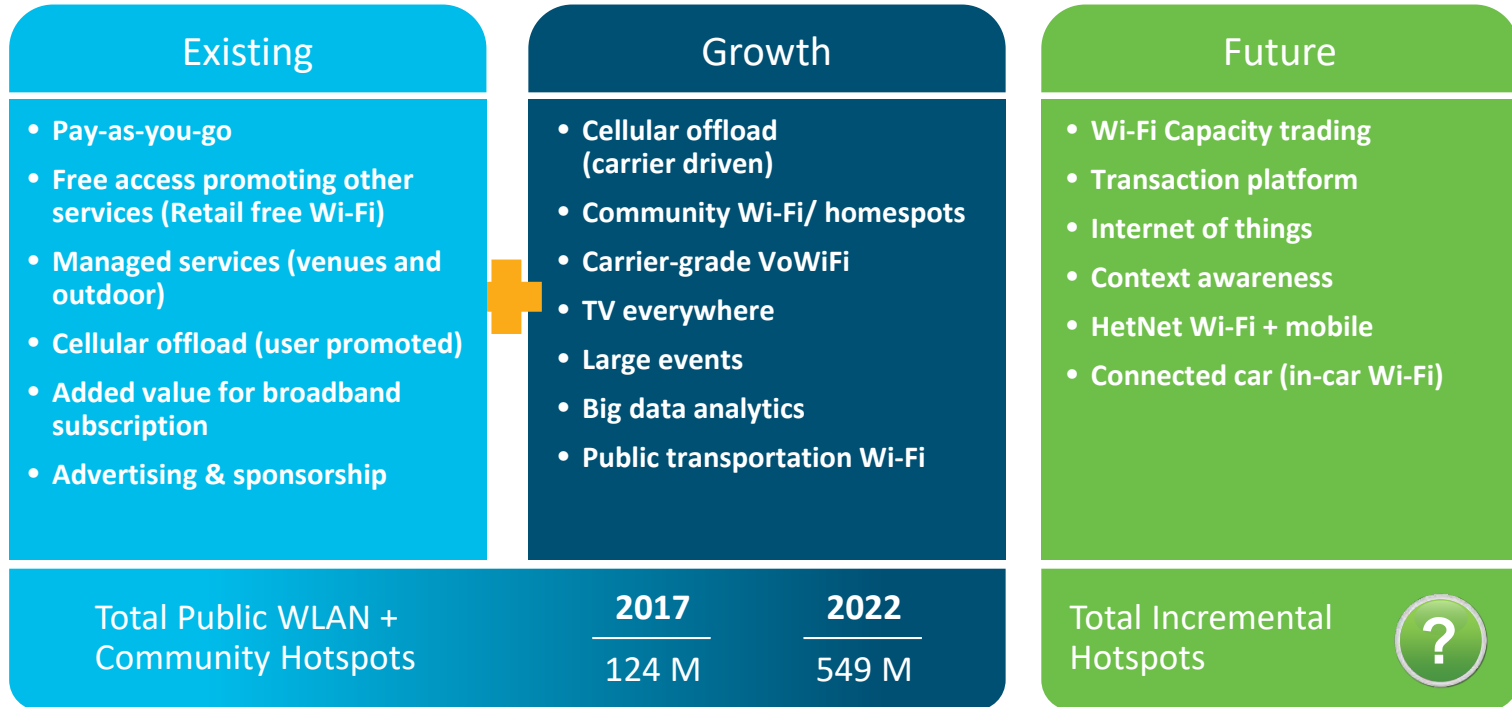
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# Global Wi-Fi Hotspot Coverage and Availability



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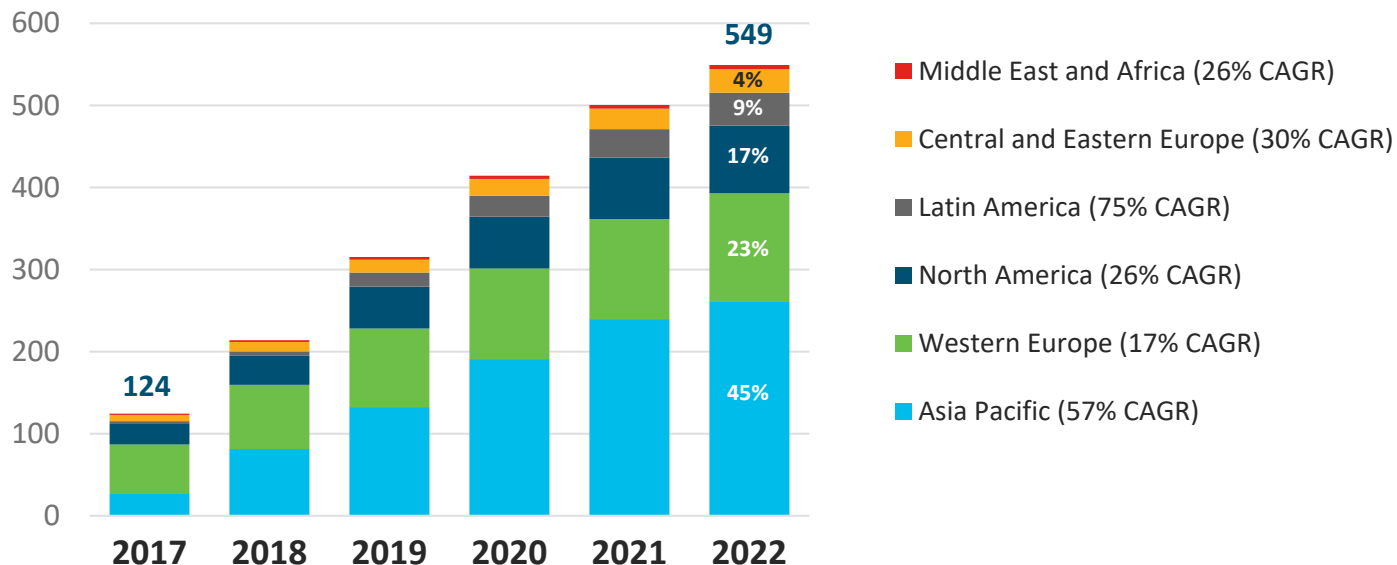


# Global Public Wi-Fi Hotspots

Asia Pacific leads with 261 Million (47%) Hotspots by 2022

35% CAGR  
2017–2022

Millions of  
Hotspots



\* Middle East and Africa represents 1% of global public Wi-Fi hotspots by 2022

By 2022, China will have  
**34%** of global hotspots,  
the most number of  
hotspots (**185 million**)  
in  
the world.

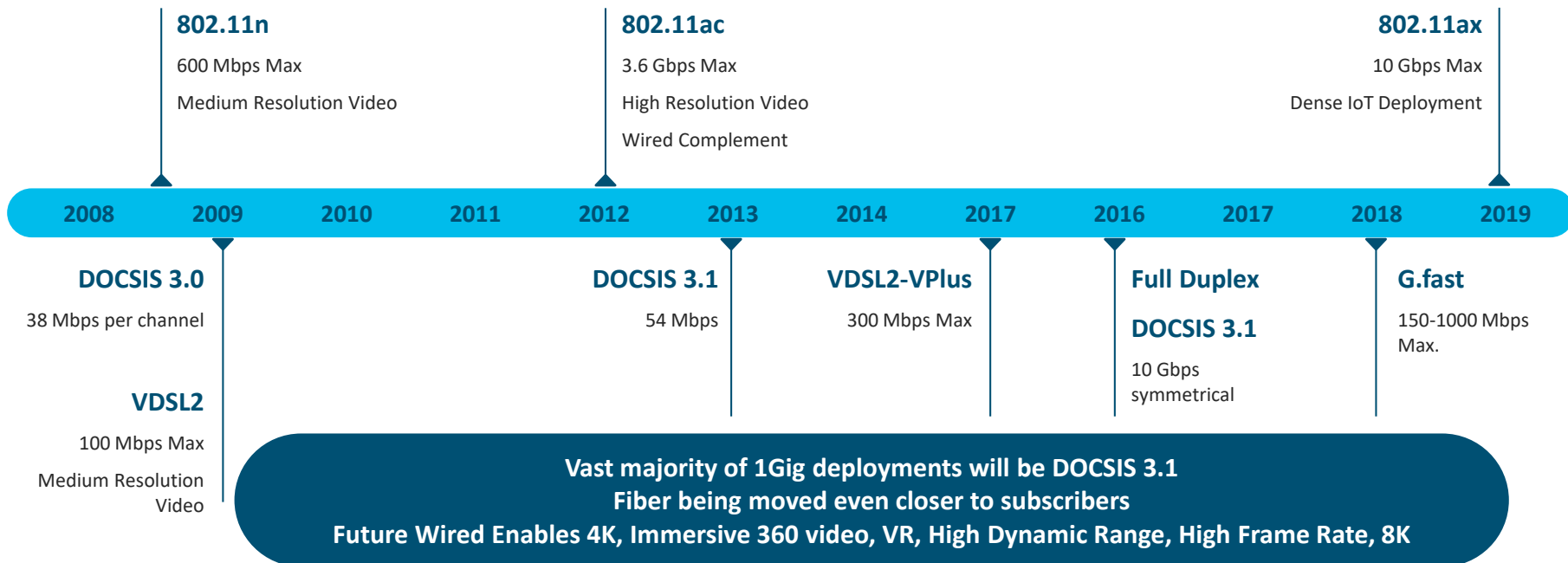
Source: Cisco VNI Global IP Traffic Forecast, 2017–2022

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# Future of Wired and Wireless Technologies

By 2022, 9.5% of total SOHO will be equipped with 802.11ax  
By 2022, 86.9% of total SOHO will be equipped with 802.11ac  
Future Wi-Fi Enables Virtualization, IoT, Speech Processing, Security, Data Analytics

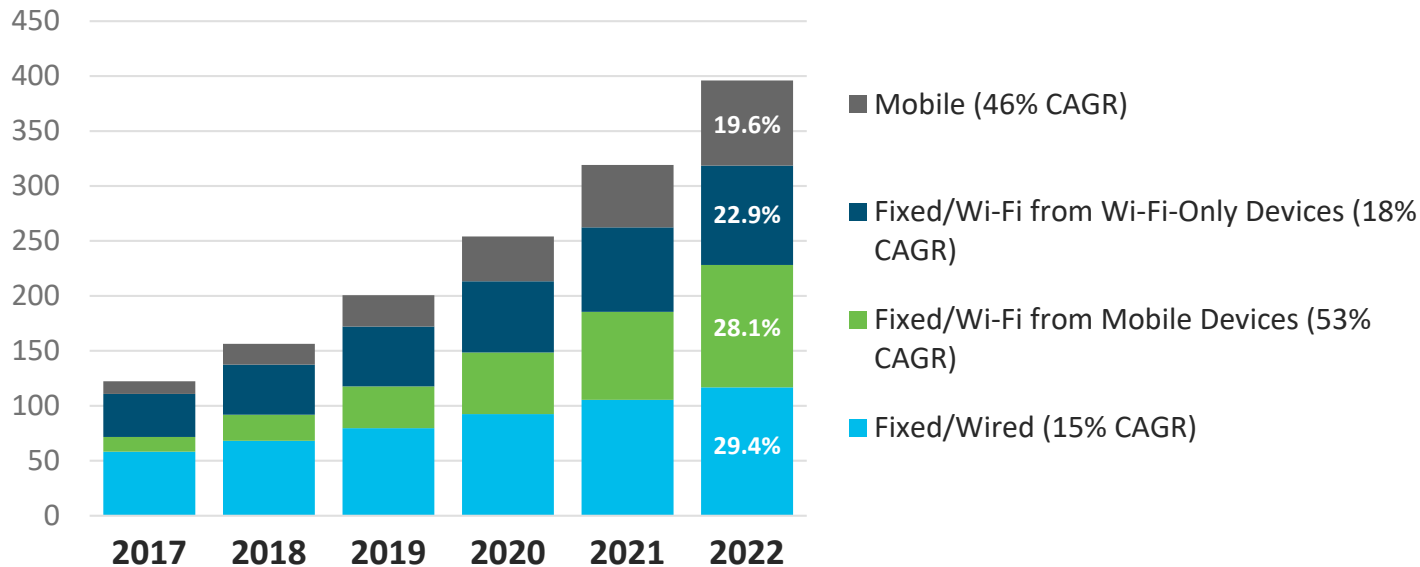


# Global IP Traffic by Local Access Technology

By 2022, 71% of total IP traffic will be wireless\*

26% CAGR  
2017–2022

Exabytes per  
Month



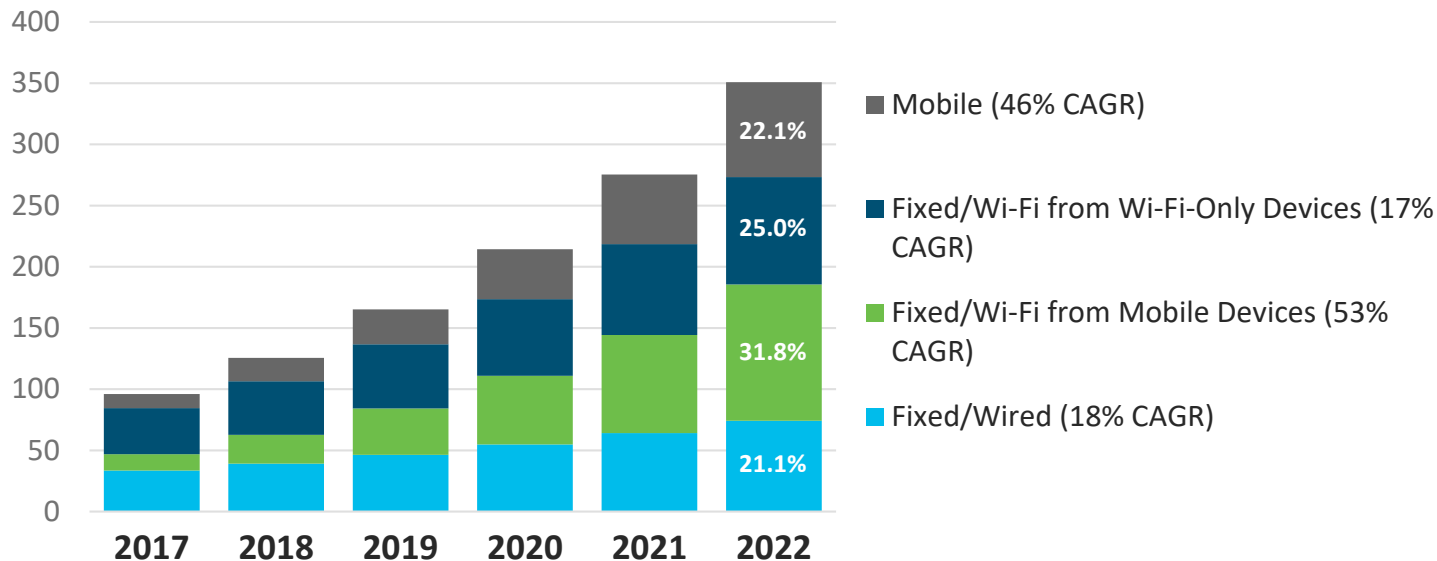
\* Wireless traffic includes Wi-Fi and mobile

# Global Internet Traffic by Local Access Technology

By 2022, 79% of total Internet traffic will be wireless\*

30% CAGR  
2017–2022

Exabytes per  
Month



\* Wireless traffic includes Wi-Fi and mobile

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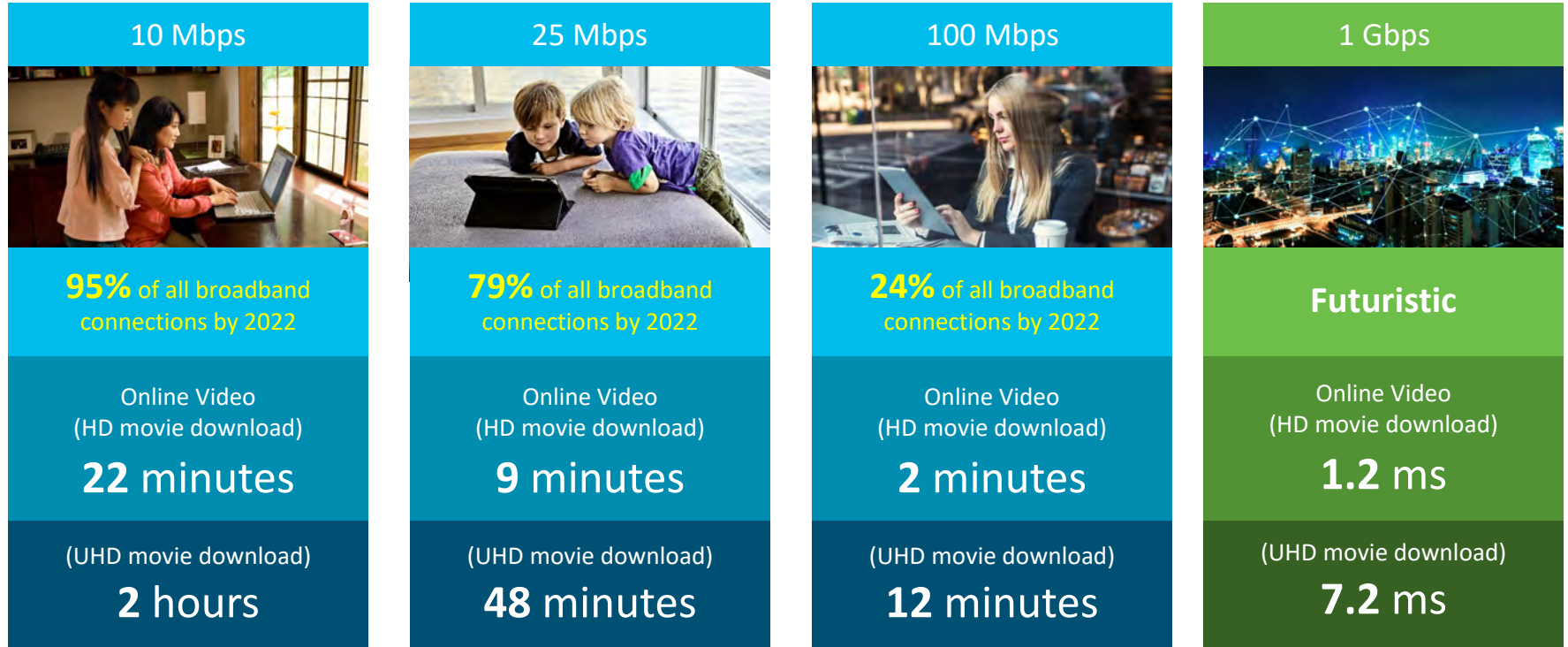
- ⑦ Wi-Fi Momentum
- ⑧ **Accelerating Speeds**
- ⑨ Security Analysis

# Global Average Fixed Broadband Speeds

Doubling in speeds from 2017–2022

	2017	2022
In Mbps		
<b>GLOBAL</b>		
Global	39.0	75.4
<b>BY REGION</b>		
Asia Pacific	46.2	98.8
Latin America	11.7	28.1
North America	43.2	94.2
Western Europe	37.9	76.0
Central and Eastern Europe	32.8	46.7
Middle East & Africa	7.8	20.2

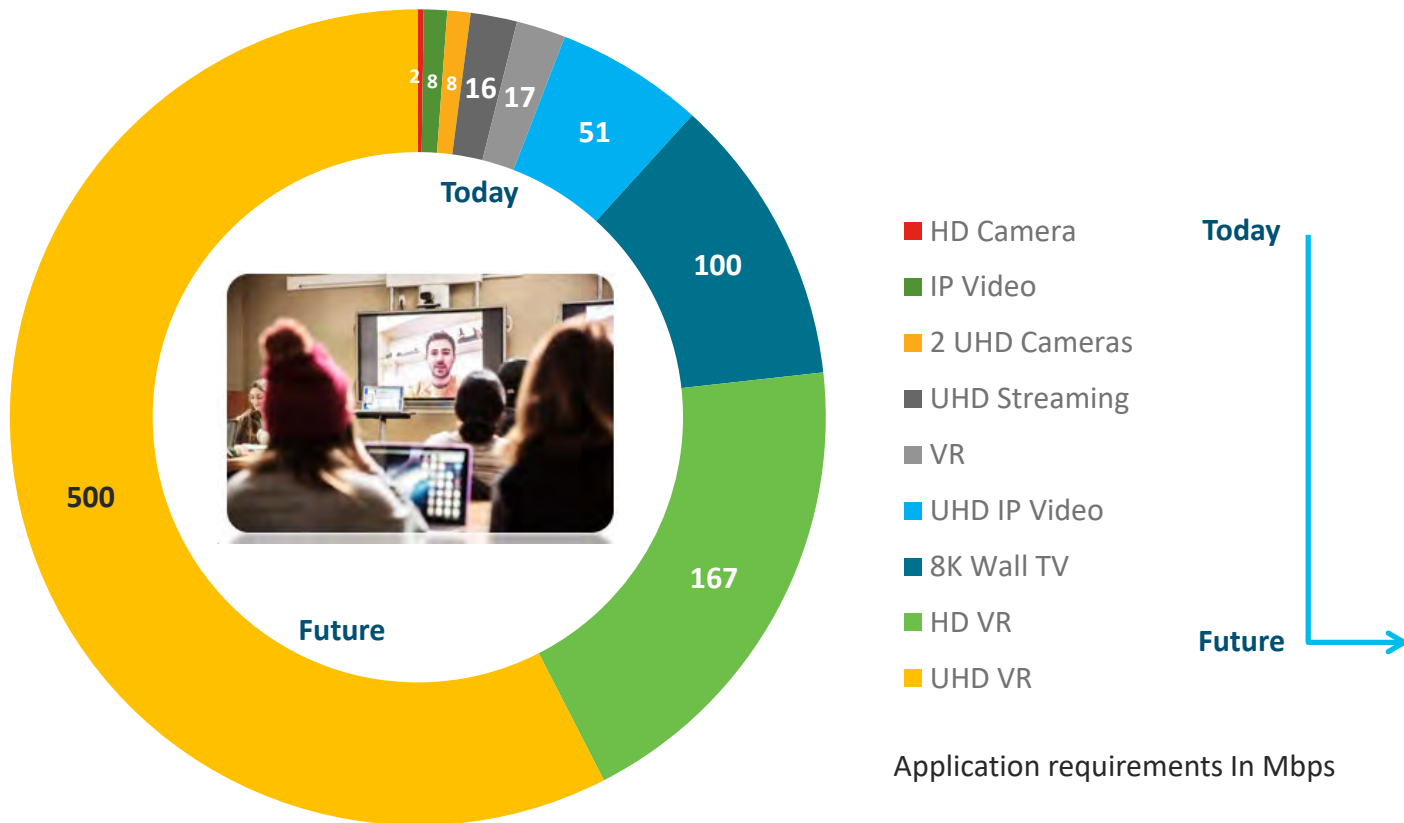
# Global Faster Networks Enable Better Experiences





# Video in the Home of Today and the Future

Significant demand for video in the home of the future



# Global Average Wi-Fi Speeds

Wi-Fi speeds double from 2017–2022

	2017	2022
In Mbps		
<b>GLOBAL</b>		
Global	24.4	54.2
<b>BY REGION</b>		
Asia Pacific	26.7	63.3
Latin America	9.0	16.8
North America	37.1	83.8
Western Europe	25.0	49.5
Central and Eastern Europe	19.5	32.8
Middle East & Africa	6.2	11.2

# Global Average Cellular Speeds

Mobile/Cellular speeds double from 2017–2022

	2017	2022
In Mbps		
<b>GLOBAL</b>		
Global	8.7	28.5
<b>BY REGION</b>		
Asia Pacific	10.6	28.8
Latin America	4.9	17.7
North America	16.3	42.0
Western Europe	16.0	50.5
Central and Eastern Europe	10.1	26.2
Middle East & Africa	4.4	15.3

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- ⑨ **Security Analysis**

# DDoS Attack Size and Traffic Increasing

Peak attack size increased 174% Y/Y.\*

DDoS attacks can represent up to 25% of a country's total Internet traffic while they are occurring.

Average DDoS attack size between 1-2 Gbps increased 50% Y/Y which is faster than Internet traffic at 33% Y/Y.

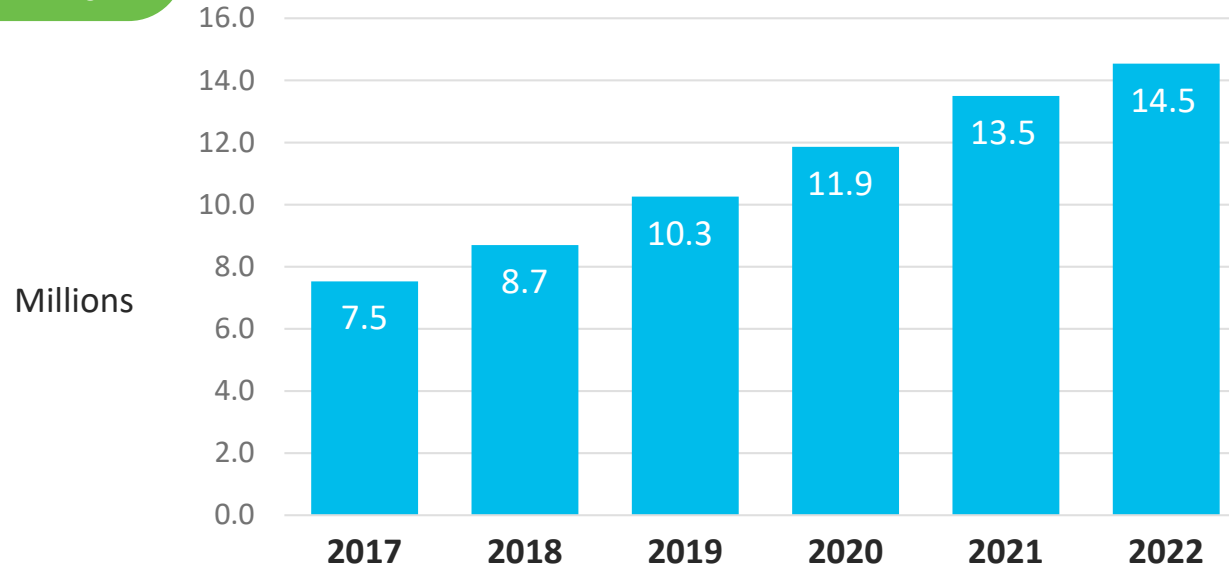
\* 1H2017- 1H2018



# Number of DDoS Attacks

Attacks will double to 14.5 million by 2022 globally

14% CAGR  
2017–2022





# 39,554 Records Exposed per Breach

Total Breaches: 864

Records Exposed: 34.2 Million

Highest in Business: 46.8%

Highest in Business: 63.7%

# Call to Action

## Cisco VNI Web Site

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

- [Press Release](#)
- [White Paper / FAQ](#)
- [Cisco VNI Web-based Tools](#)

Cisco VNI Forecast inquiries: [traffic-inquiries@cisco.com](mailto:traffic-inquiries@cisco.com)