Cisco Visual Networking Index (VNI) Global Mobile Forecast, 2016–2021

Cisco Knowledge Network Session

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Cisco Visual Networking Index (VNI)

Expanding the Scope of Cisco's IP Thought Leadership

Cisco® VNI Forecast research is an ongoing initiative to predict global traffic growth. This study focuses on consumer and business mobile data traffic and its key drivers.

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

Overview

Global Mobile Data Traffic Drivers

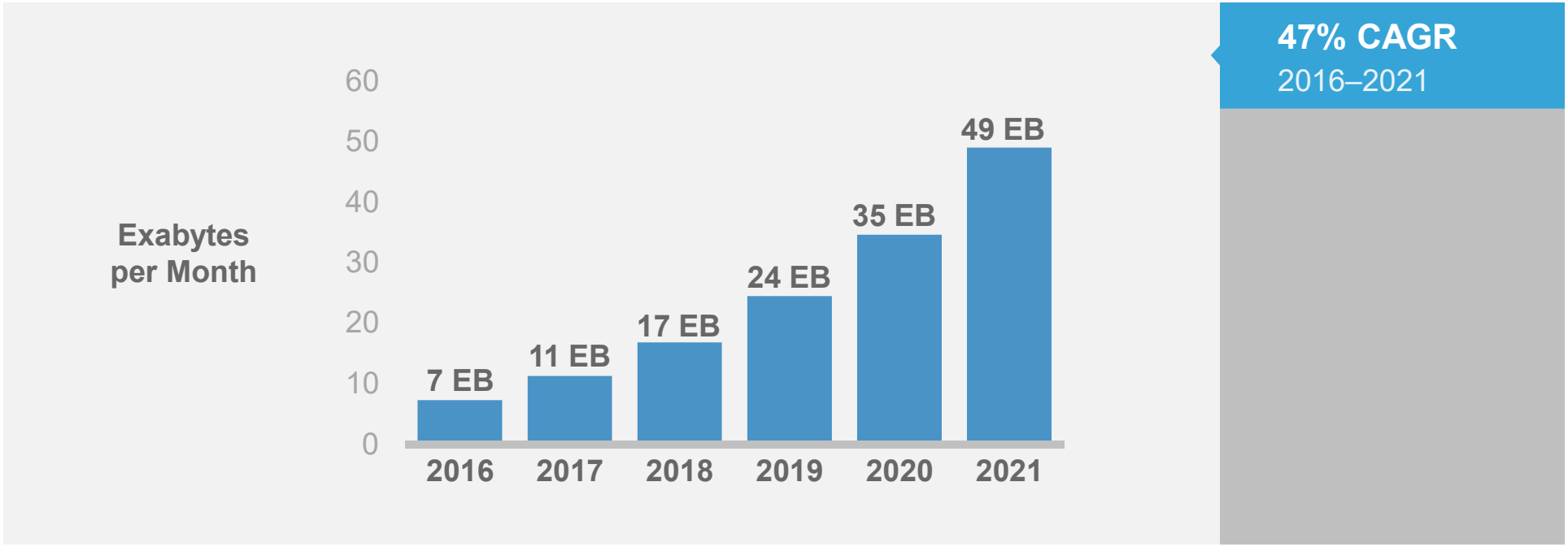
Mobile Momentum Metrics

		2016	2021
More Mobile Users		4.9 Billion	5.5 Billion
More Mobile Connections		8 Billion	12 Billion
Faster Mobile Speeds		6.8 Mbps	20.4 Mbps
More Mobile Video		60% of Traffic	78% of Traffic

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

Global Mobile Data Traffic Growth / Top-Line

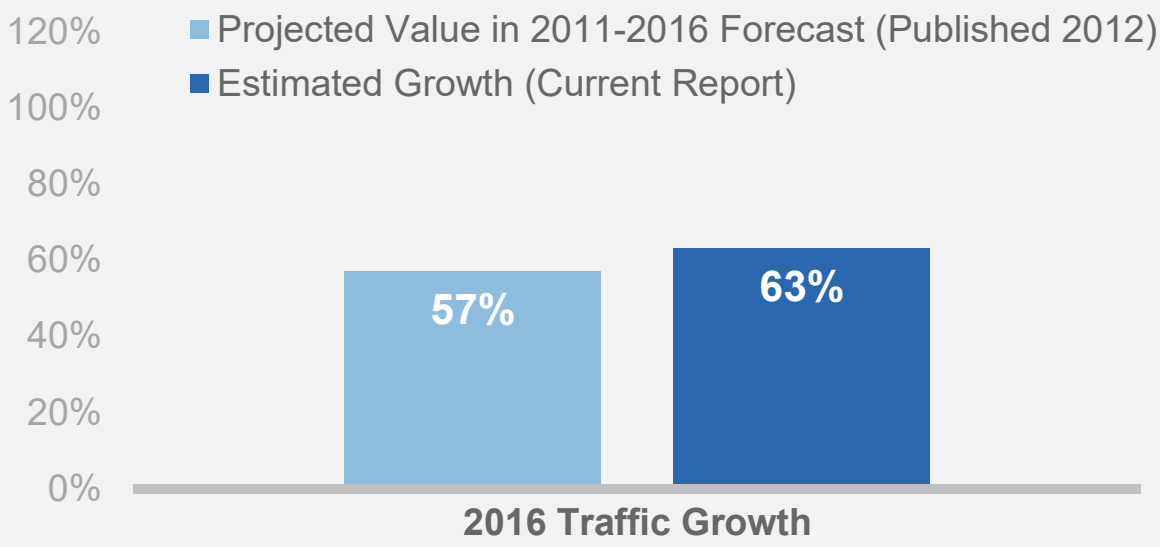
Global Mobile Data Traffic will Increase 7-Fold from 2016–2021



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

Global Mobile Data Traffic Forecast Accuracy

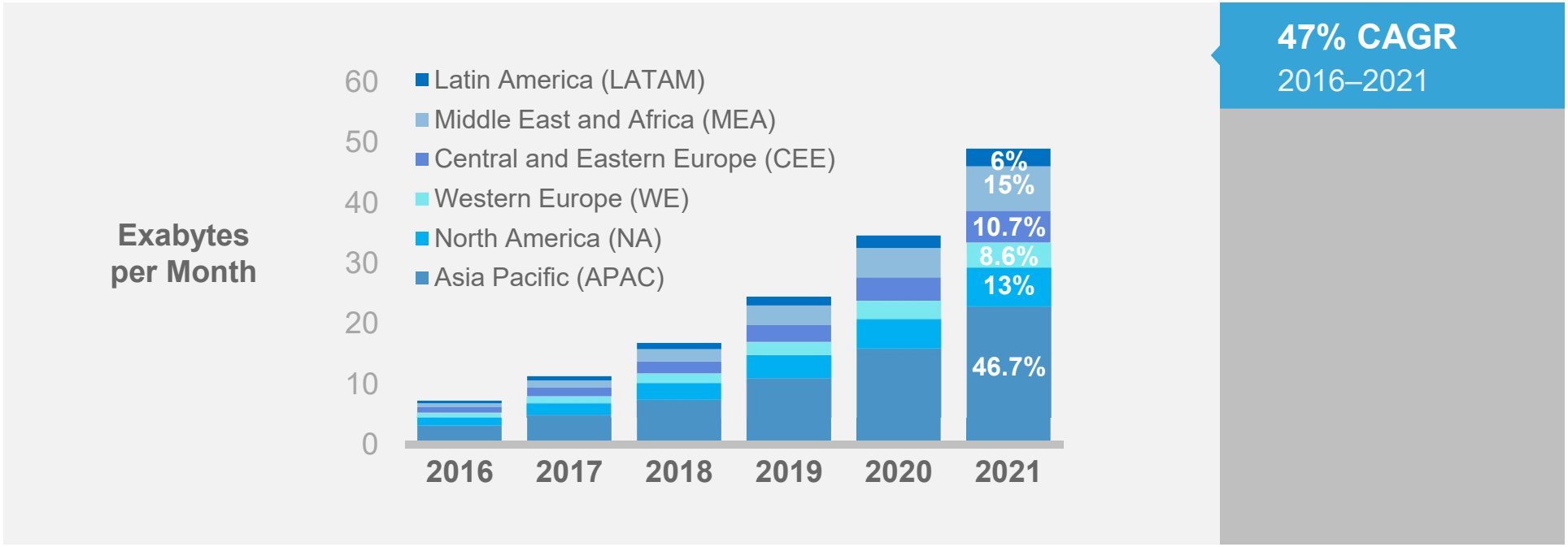
VNI Projections for 2016 within ±10% of Actual Traffic Growth



Source: Cisco VNI Global Mobile Data Traffic Forecasts, 2012, 2013, 2014, 2015, 2016, 2017

Global Mobile Data Traffic Growth / Regions

MEA has the Highest Growth Rate (65%) from 2016–2021
APAC will Generate 47% of all Mobile Data Traffic by 2021



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

Average Mobile User and Connection

Cellular Traffic per Month

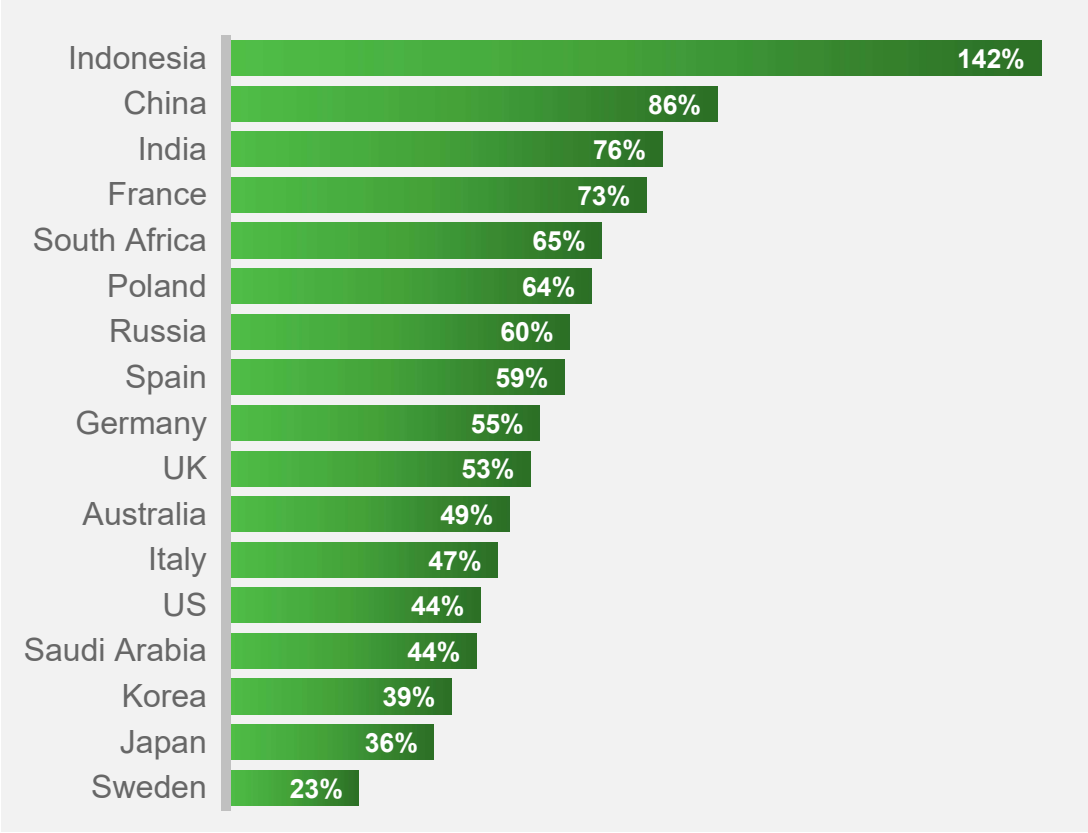
	2016	2021
Average Traffic per **User**	 **1,456 MB** per month	 **8,423 MB** per month
Average Traffic per **Connection**	 **902 B** per month	 **4,226 MB** per month

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

Cisco VNI Mobile Year in Review—2016

Acceleration in Indonesia, France, Korea, Australia. Slowdown in India, Japan, Sweden.

Normal tapering in most others.



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

Top Trends

VNI Mobile Forecast Update, 2016–2021

Top Mobile Networking Trends

1. Evolving Toward Smarter Multimedia Mobile Devices
2. Defining Cell Network Advances—2G, 3G, 4G (Initial 5G Projections)
3. Measuring Mobile IoT Adoption—M2M and Emerging Wearables
4. Analyzing the Expanding Role and Coverage of Wi-Fi
5. Identifying New Mobile Applications and Requirements
6. Comparing Mobile Network Speed Improvements
7. Reviewing Tiered Pricing—Unlimited Data and Shared Plans

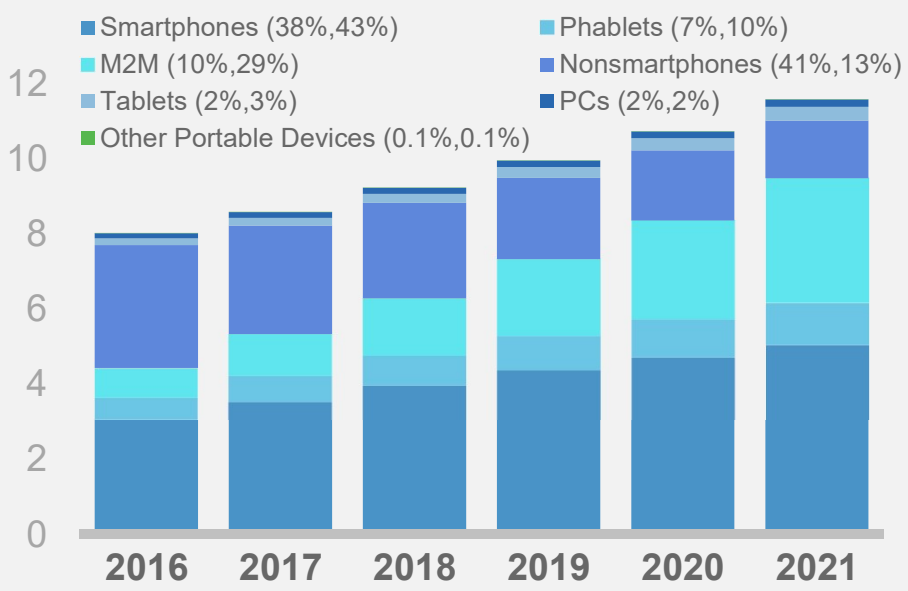
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Trend 1
Adapting to Smarter Mobile Devices

- Total devices and connections growth
- Traffic by device category
- Smarter devices growth
- Smart devices traffic
- IPv6 Analysis

Global Mobile Device Growth by Type

By 2021, Smartphones / Phablets Will Have More Than 50% Share



8% CAGR
2016–2021

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

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

Average Cellular Traffic Per Mobile Device Type

	2016 MBs per Month	2021 MBs per Month
Non-smartphone	33	175
M2M Module	203	670
VR Headset	840	2,790
Smartphone	1,614	6,825
Tablet/PC	3,392	7,951

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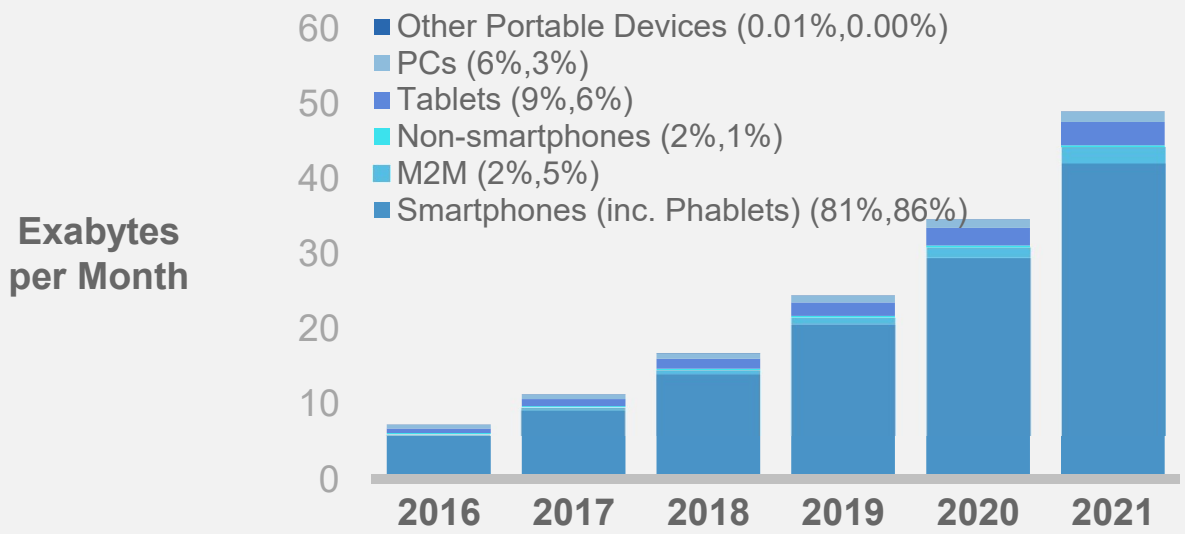
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global Mobile Traffic Growth by Device Type

Globally, Smartphones Will Continue to Dominate Mobile Traffic, but M2M Will Gain Share by 2021



47% CAGR
2016–2021

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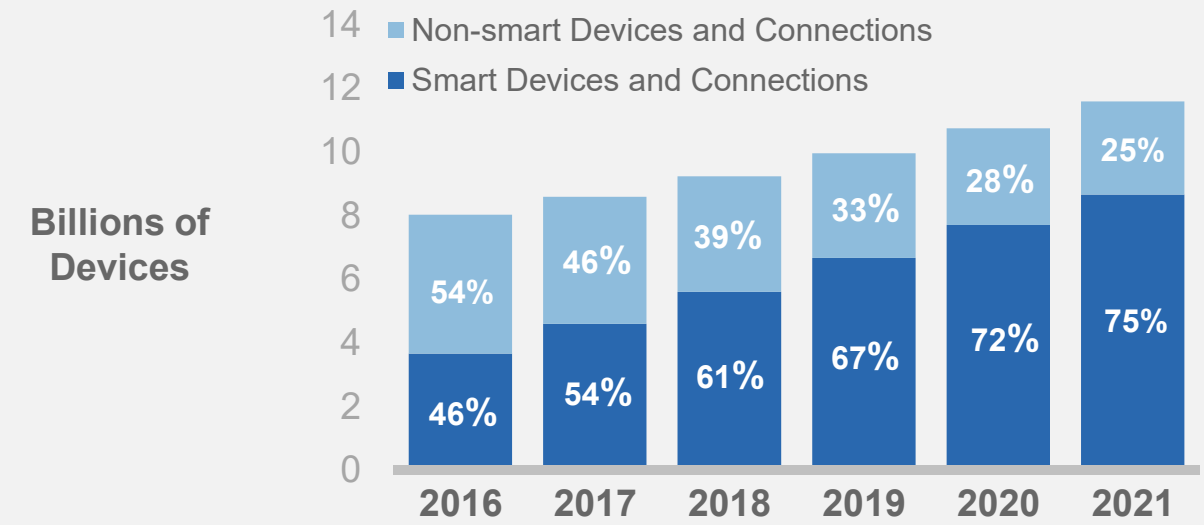
*** Figures (n) refer to 2016, 2021 traffic share**

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

Global Growth of Smart Mobile Devices and Connections

By 2021, Smart Devices Will Have Three-Fourths Share of Total Devices and Connections



8% CAGR
2016–2021

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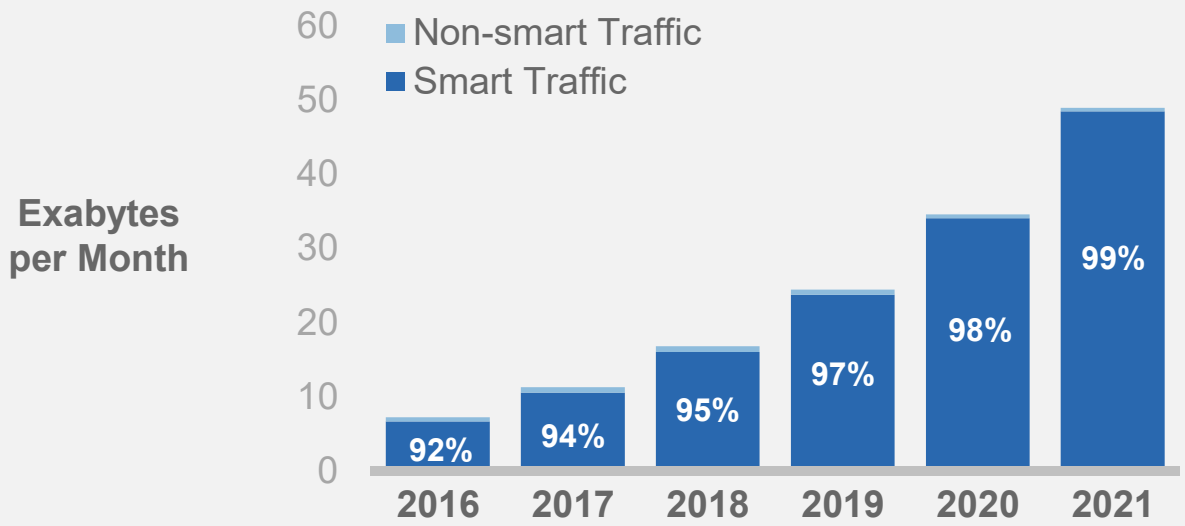
*** Smart devices are those having advanced multimedia/computing capabilities with a minimum of 3G connectivity**

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

Global Impact of Smart Devices and Connections on Mobile Traffic

By 2021, Smart Devices Will Have 99% Share of Traffic



47% CAGR
2016–2021

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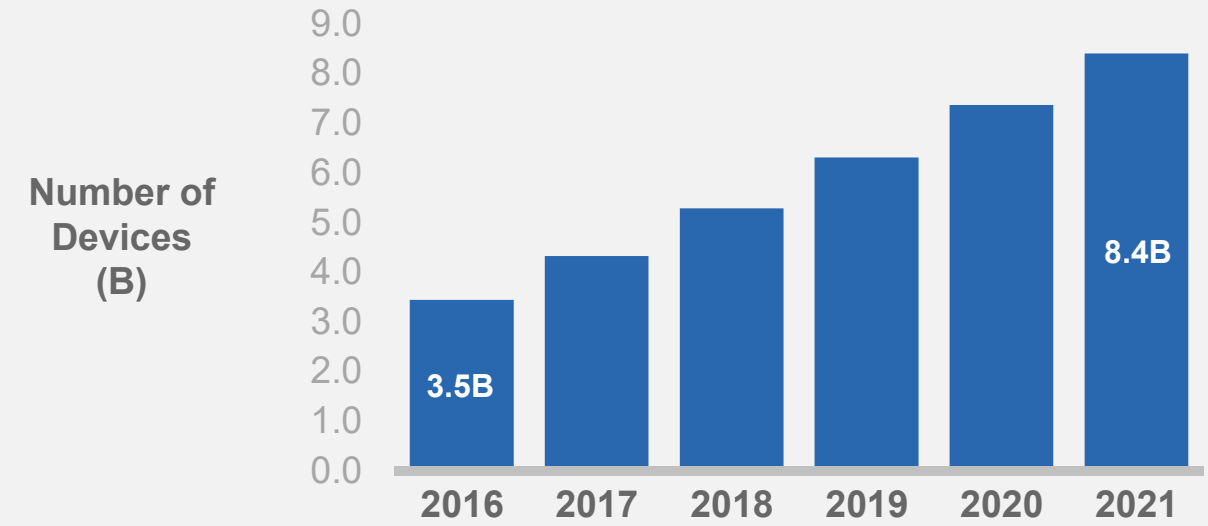
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global IPv6-Capable Mobile Devices/Connections

By 2021, 73% of Mobile Devices/Connections Will Be IPv6-Capable



20% CAGR
2016–2021

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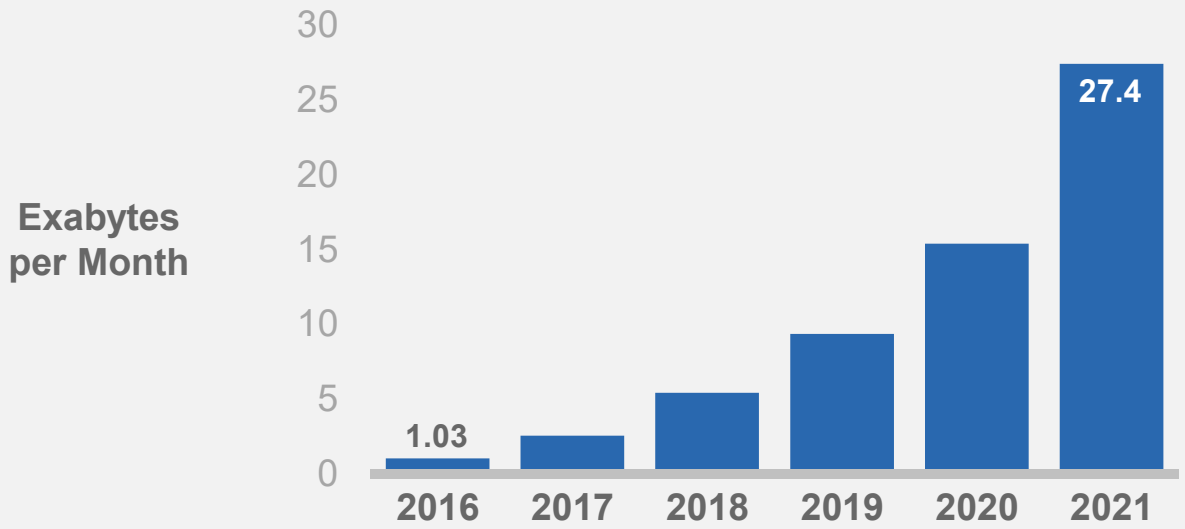
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global IPv6 Mobile Data Traffic Forecast

By 2021, IPv6 Traffic Projected to be 56% of Mobile Data Traffic



92% CAGR
2016–2021

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

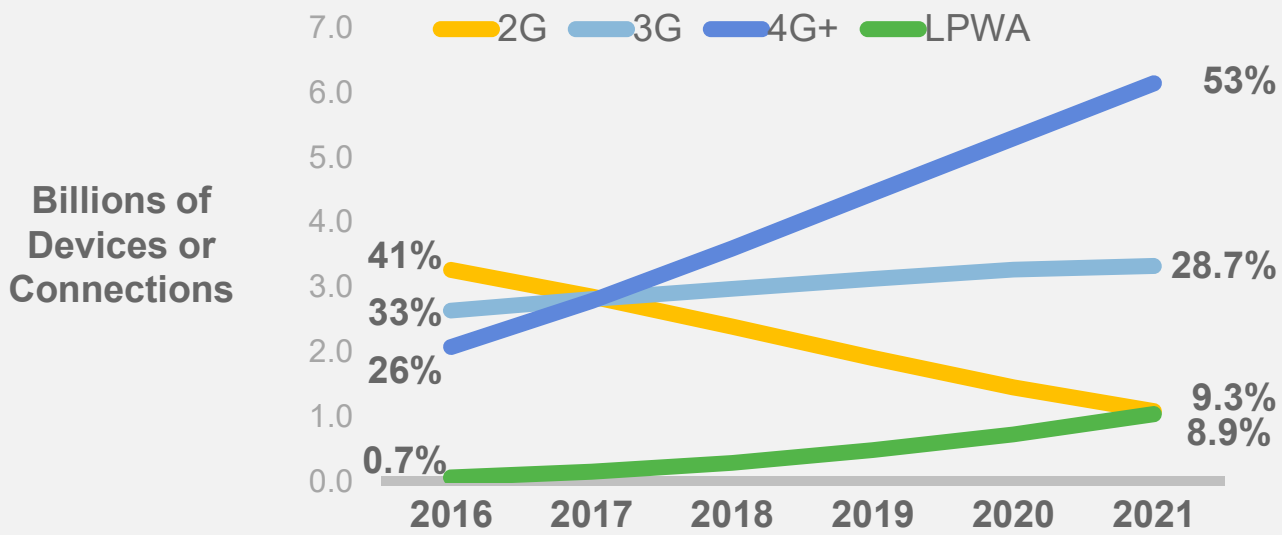
Trend 2

Defining Cell Network Advances—2G, 3G, 4G (5G Perspectives)

- Total Connections by Network Type
- Network Connectivity for M2M
- Traffic by Network Connectivity
- 5G Perspectives

Global Connections by Network Type

4G Surpasses All Other Connection Types



*Includes M2M

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* 5G connections will grow more than a thousand percent from 2.3 million in 2020 (0.02%)to over 25 million in 2021 (0.2%).

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

Connections by Network Type

Regional Share by 2021

	2G	3G	4G	LPWA
Global	9%	29%	53%	9%
BY REGION				
North America	0%	6%	63%	31%
Western Europe	5%	11%	65%	20%
Central & Eastern Europe	4%	23%	65%	9%
Latin America	9%	33%	55%	2%
Asia-Pacific	9%	29%	56%	6%
Middle East & Africa	22%	54%	23%	1%

Includes M2M

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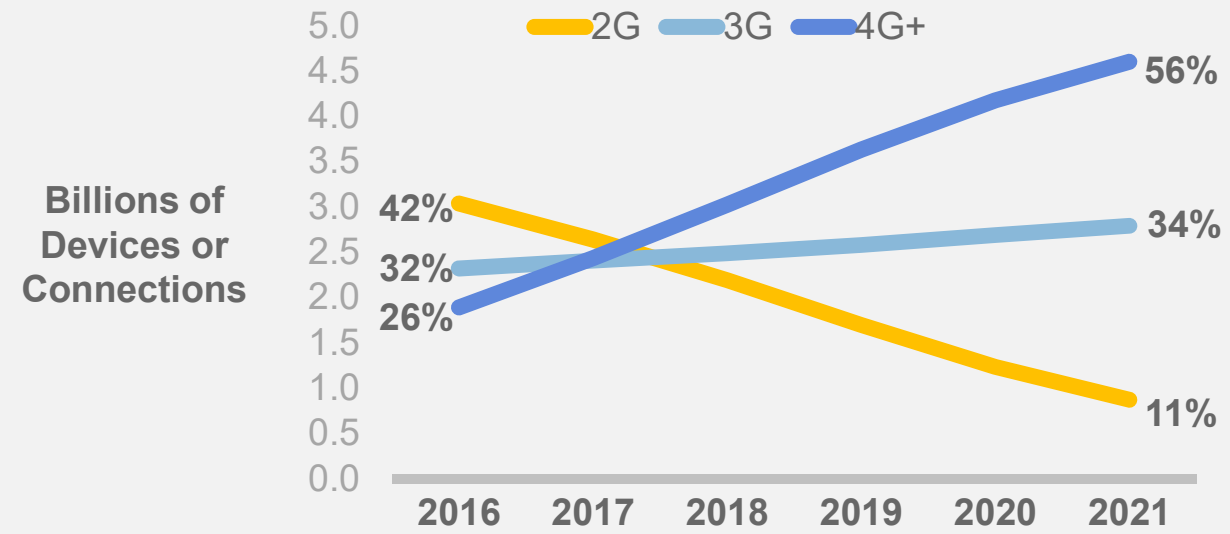
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global Connections by Network Type

By 2018 4G Becomes Dominant Connection Type



*Excludes M2M

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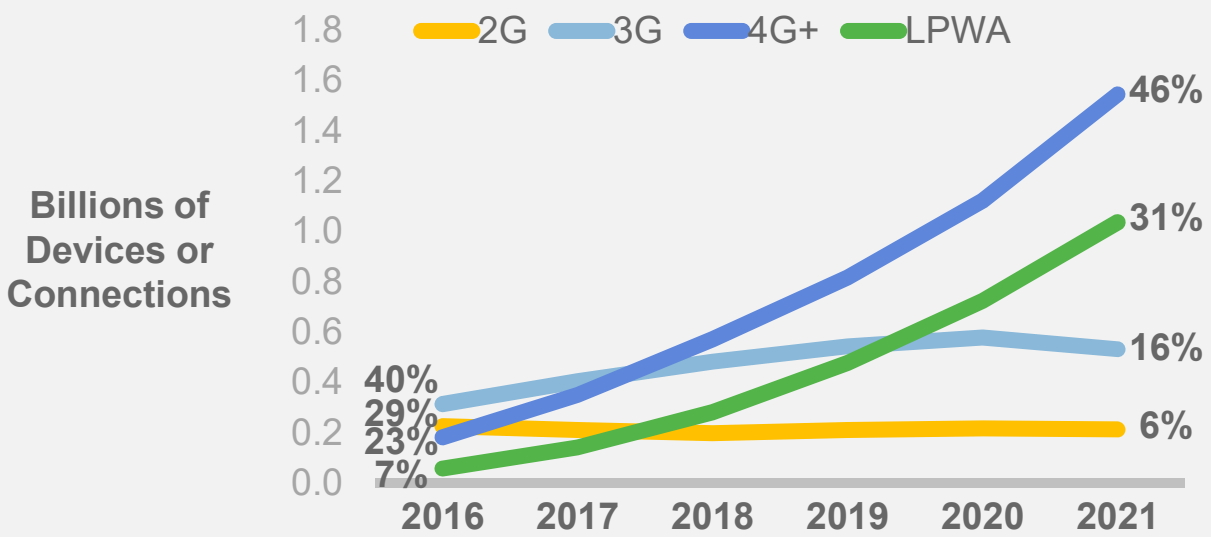
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global M2M Connections by Network Type

By 2021, 4G and LPWA Lead M2M Connections



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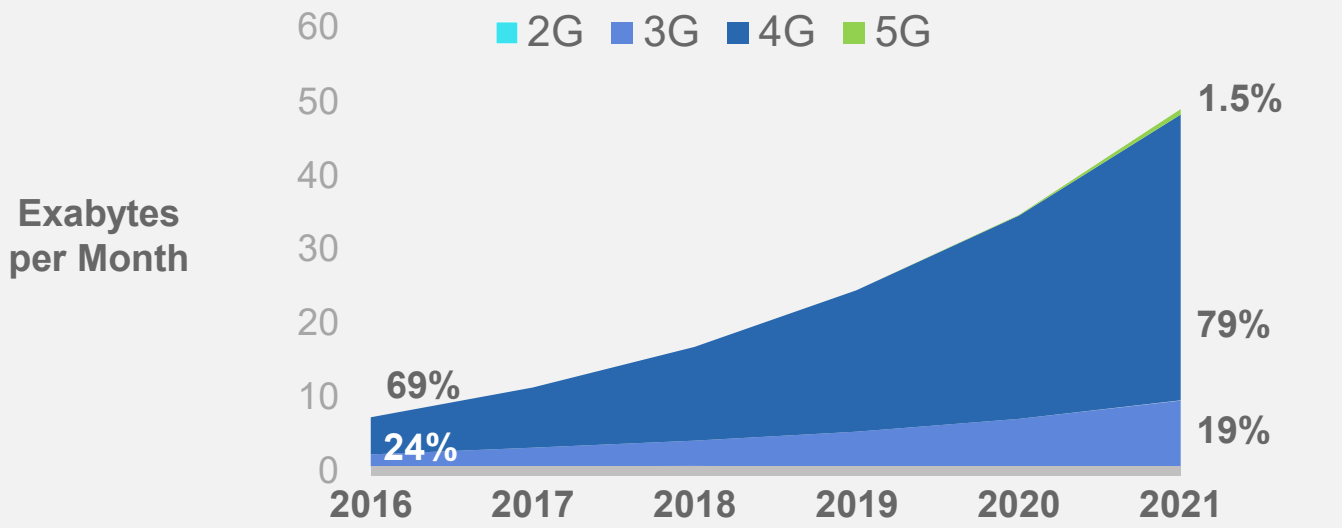
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global Mobile Data Traffic Growth: 4G

Globally, 4G Already Carries Largest Share of Traffic—69%
By 2021, 5G Will Support 1.5% of Mobile Traffic



* By 2021, 5G will account for 1.5% of global mobile traffic and 2G will account for 0.6%.

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

Globally, in 2016, a 4G connection generated 2.4 GB/mo, nearly 4X higher than the 655 MB/mo for 3G connections.

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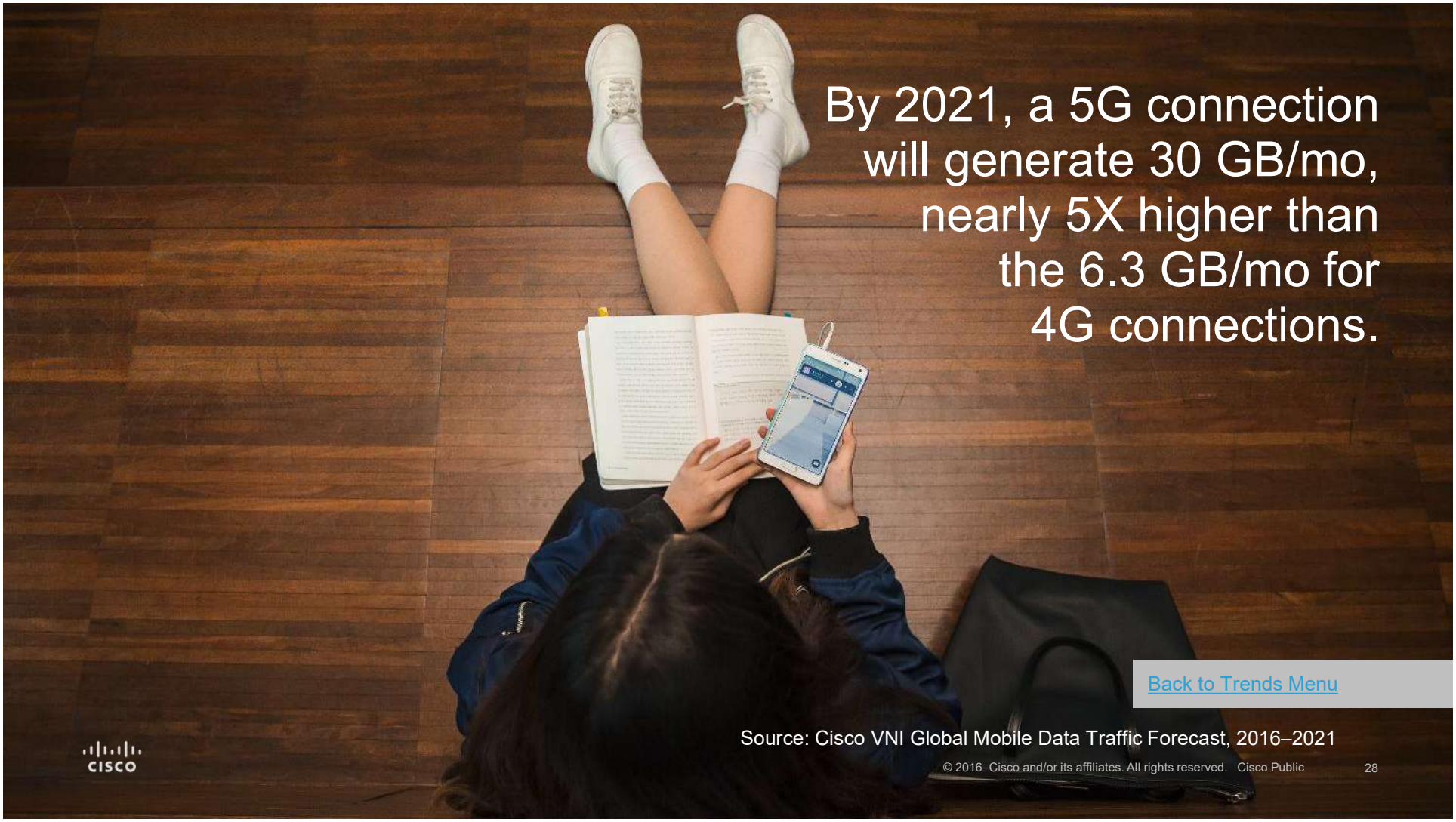
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021



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

Generations of Mobile Technology— A Snapshot

Generation	1G	2G	3G	4G	5G
Deployment	1970–84	1980–99	1990–2002	2000–10	2020+
Bandwidth	2 Kbps	14–64 Kbps	2 Mbps	200 Mbps	1 Gbps+
Latency	n/a	300–1000 ms	100–500 ms	<100 ms	1 ms
Service	Analog Voice	Digital Voice, SMS, MMS	Integrated High-Quality Audio, Video and Data	Dynamic Information Access, Variable Devices	Dynamic Information Access with AI Capabilities–IoT, Wearable Devices

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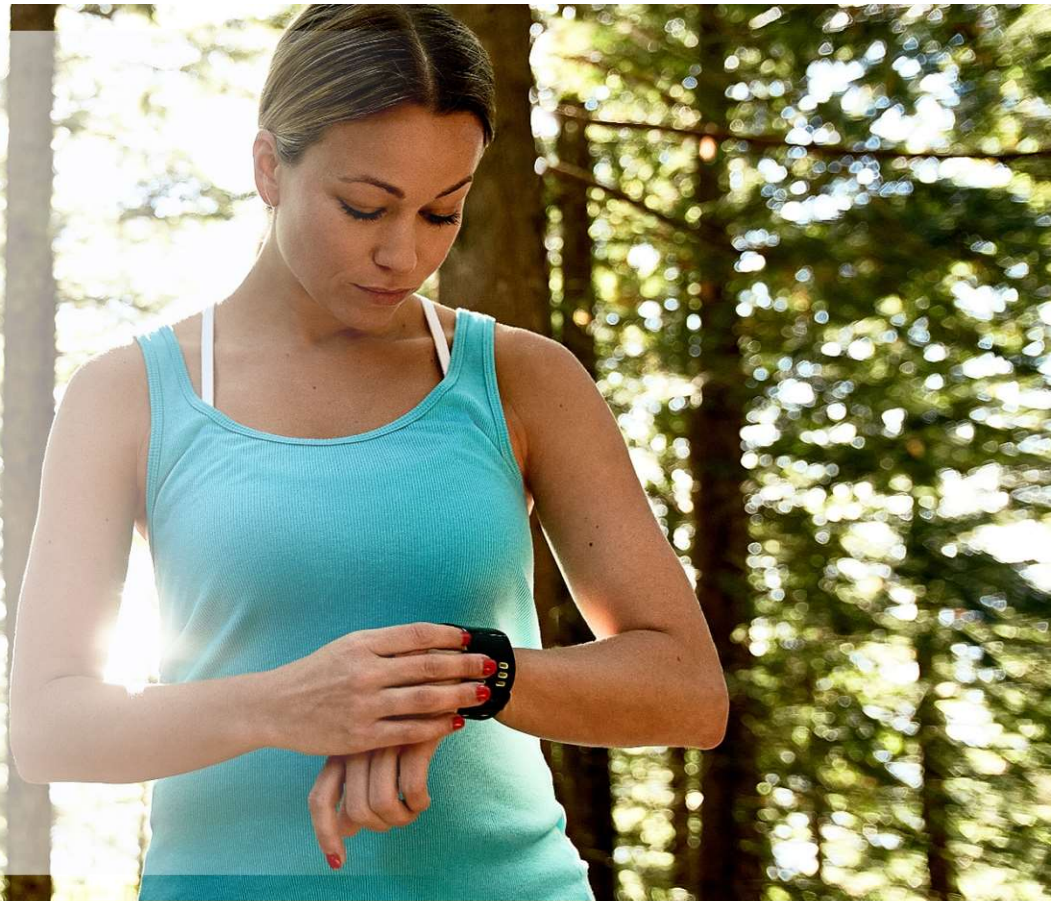
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Trend 3

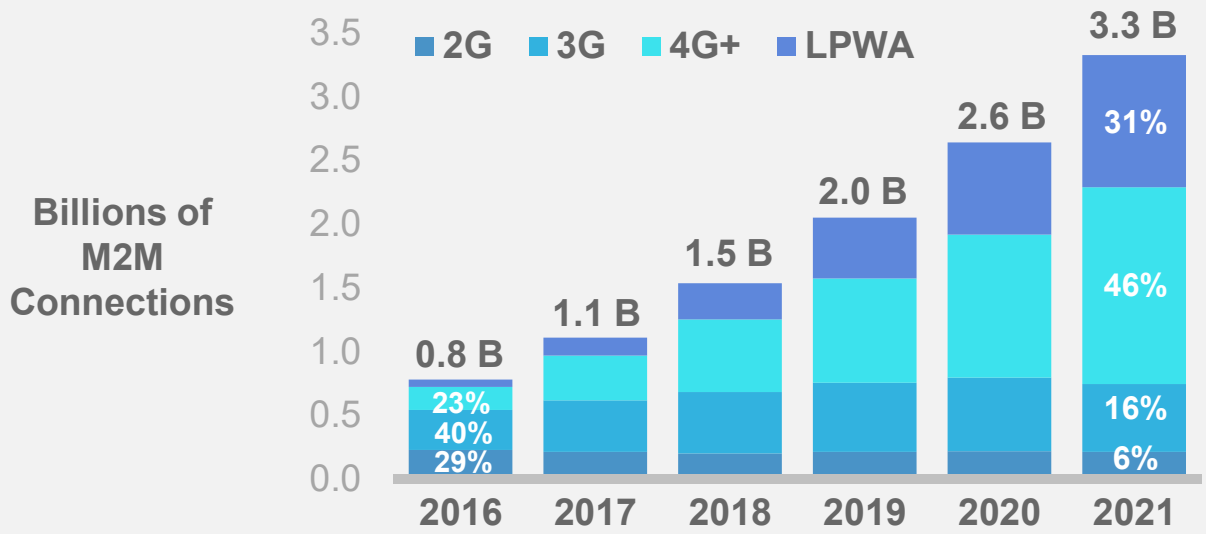
Measuring Mobile IoT Adoption—M2M and Emerging Wearables

- M2M Connections growth
- M2M by vertical
- M2M Device usage—traffic examples
- Wearables analysis



Global M2M Connection Growth

Global M2M Connections will Grow 4-Fold from 2016-2021; By 2021, 4G Will Have the Largest Global M2M Connections Share



34% CAGR
2016–2021

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*** In 2016, LPWA accounts for 7% of global mobile M2M connections.**

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

By 2021, M2M modules will be **29%** of total global mobile devices and connections and will account for **5%** (2.2 EBs/month) of mobile data traffic.

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

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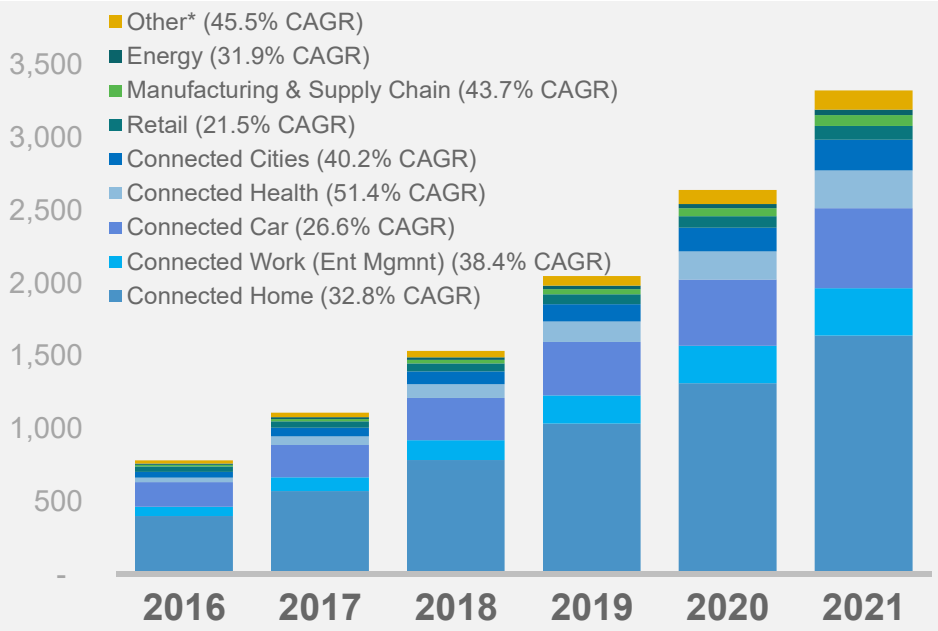
Global Mobile M2M Connections By Vertical

By 2021, Connected Home Largest, Connected Health Fastest Growth



34% CAGR
2016–2021

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***Other includes Agriculture, Construction & Emergency Services**

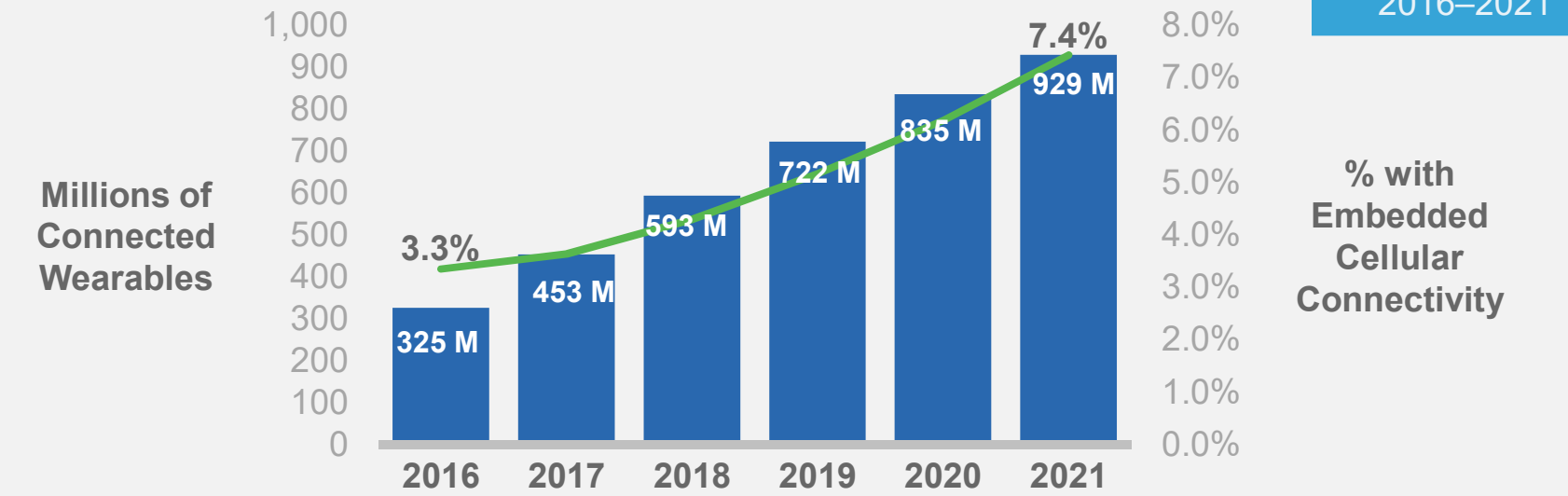
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

M2M Use Cases

M2M Application	Bandwidth Requirements	Latency Requirements	Security/ Privacy Issues	Continuity of Communication
Fleet Management & Vehicle Tracking	◔	◔	◑	◕
Public Transport	◕	◔	◑	●
Connected Car	◕	◕	●	●
Telemedicine	●	●	◔	◔
Smart Home	◕	◑	◕	◑
Smart Watches/Wristbands	◑	◔	◔	◑
Smart Electricity Metering	○	◔	◕	○
Street Lighting	○	◔	◔	○

Global Connected Wearable Devices

Global Connected Wearables will Grow 3-Fold from 2016-2021; By 2021, 7 Percent will Have Embedded Cellular Connectivity



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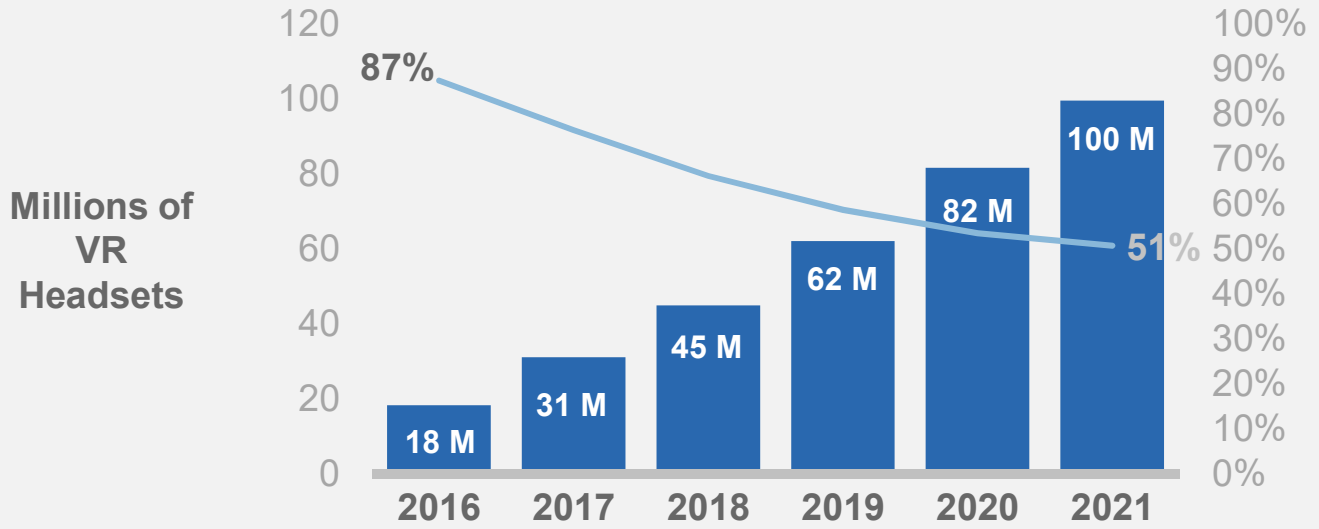
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global Virtual Reality Growth

Global VR Headsets will Grow 5-Fold from 2016-2021; More Than Half Will Be Connected to Smartphones



40% CAGR
2016–2021

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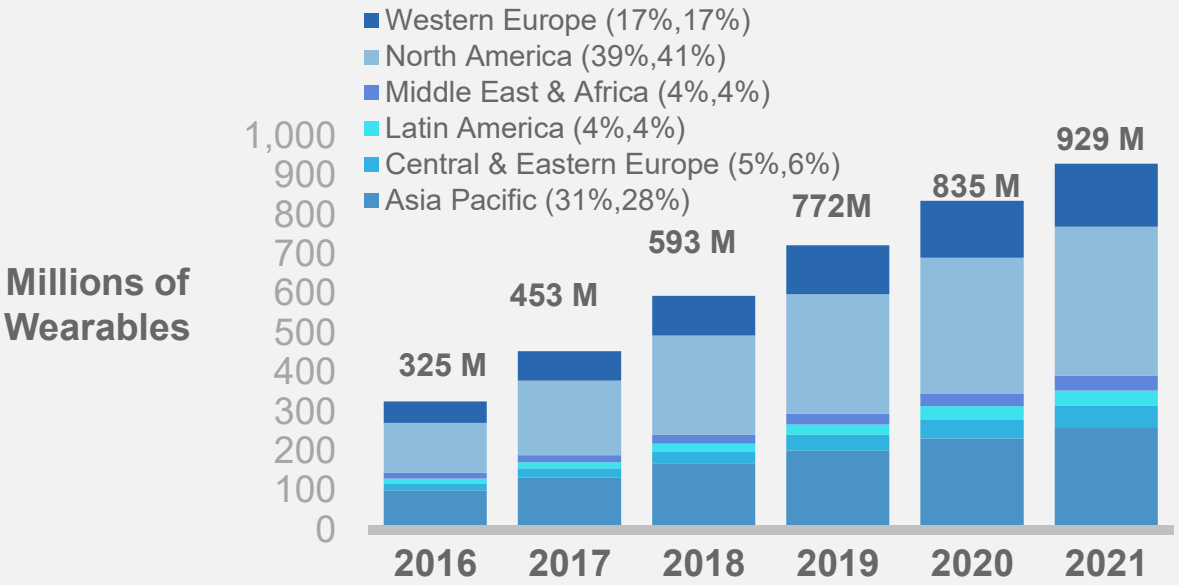
Source: IHS Technology; Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Regional Connected Wearable Devices

North America Will Have the Largest Share by 2021



23% CAGR
2016–2021

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* **Figures (n) refer to 2016, 2021 regional wearable devices share**

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

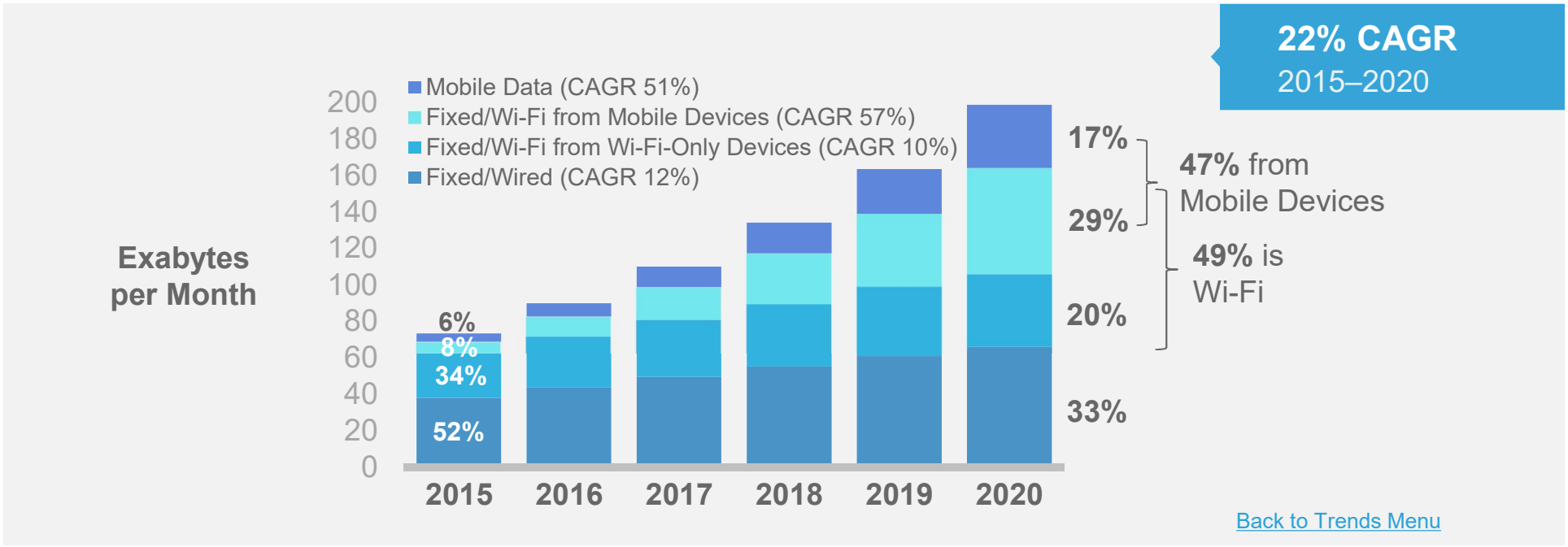
Trend 4

Analyzing the Expanding Role and Coverage of Wi-Fi

- Total mobile vs. Wi-Fi vs. fixed traffic growth
- Mobile offload
- Growth of Wi-Fi hotspots

Global IP Traffic by Local Access Technology

Starting in 2018, Fixed/Wi-Fi Traffic Surpasses Fixed/Wired Traffic



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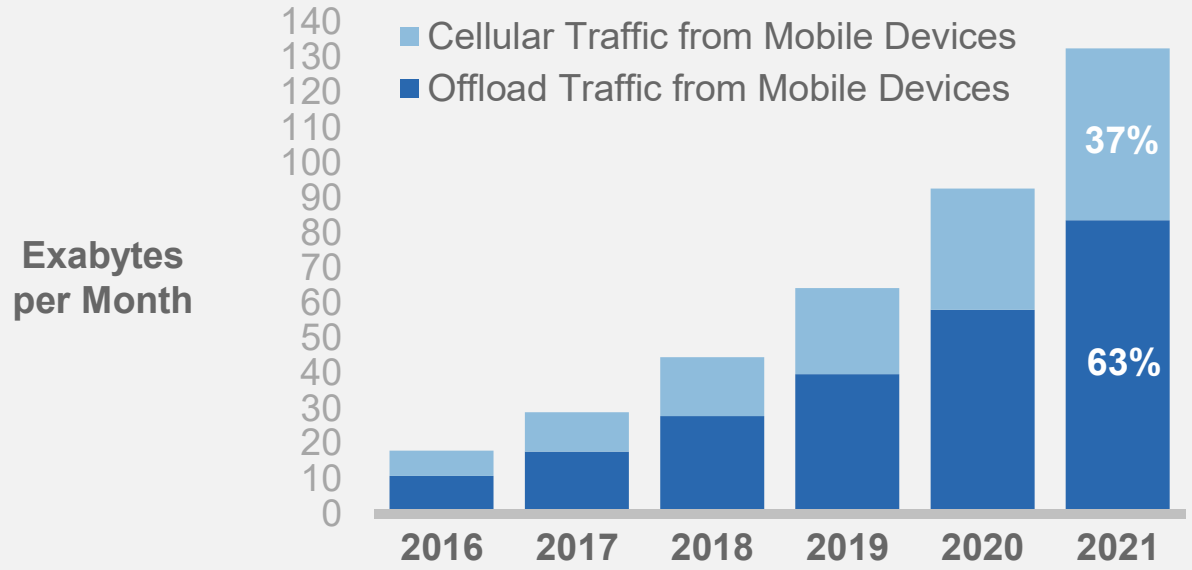
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Note: Fixed/Wi-Fi from Mobile Devices may include a small amount of Fixed/Wired from Mobile Devices

Global Mobile Data Traffic Offload*

63% of Mobile Traffic to be Offloaded by 2021
60% of Mobile Traffic Offloaded in 2016



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***Offload includes traffic from dual-mode devices (i.e., supports cell & Wi-Fi, excl. PCs) over Wi-Fi/small cell networks**

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

Unlimited Plans and High Speeds Can Reduce Offload

After years of tapering growth, mobile traffic growth in Korea accelerated in 2016, due to unlimited plans and despite the broad availability of Wi-Fi.

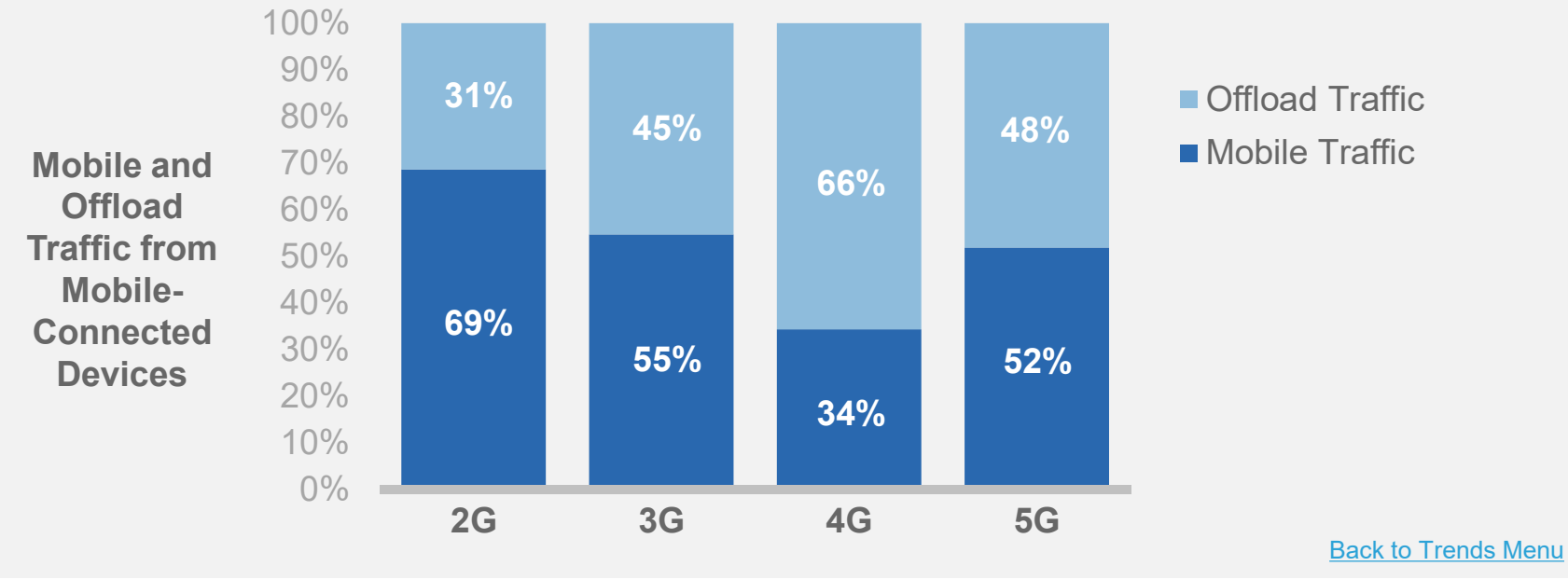
Numerous sports stadiums in the US reported that after years of majority of traffic offloaded to Wi-Fi, mobile traffic was over 50% in 2016.

Sprint announced that users reduced the amount of data they transmitted over Wi-Fi networks, from an average of 168 MB per day during the first three quarters of 2016 to 155 MB during the fourth quarter of 2016.

- Limited spectrum availability is unlikely to allow for widespread adoption of unlimited plans, and in several countries (Australia, Japan) Wi-Fi is contributing to fixed traffic growing as fast as mobile in 2016.

Global Mobile Data Traffic and Offload Traffic, 2021

4G Devices Offload More Traffic Than 3G and 2G



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***Offload includes traffic from dual-mode devices (i.e., supports cell & Wi-Fi, excl. PCs) over Wi-Fi/small cell networks**

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

Globally, the amount of traffic offloaded from tablets will be **72%** by 2021.

Globally, the amount of traffic offloaded from smartphones/ phablets will be **64%** by 2021.

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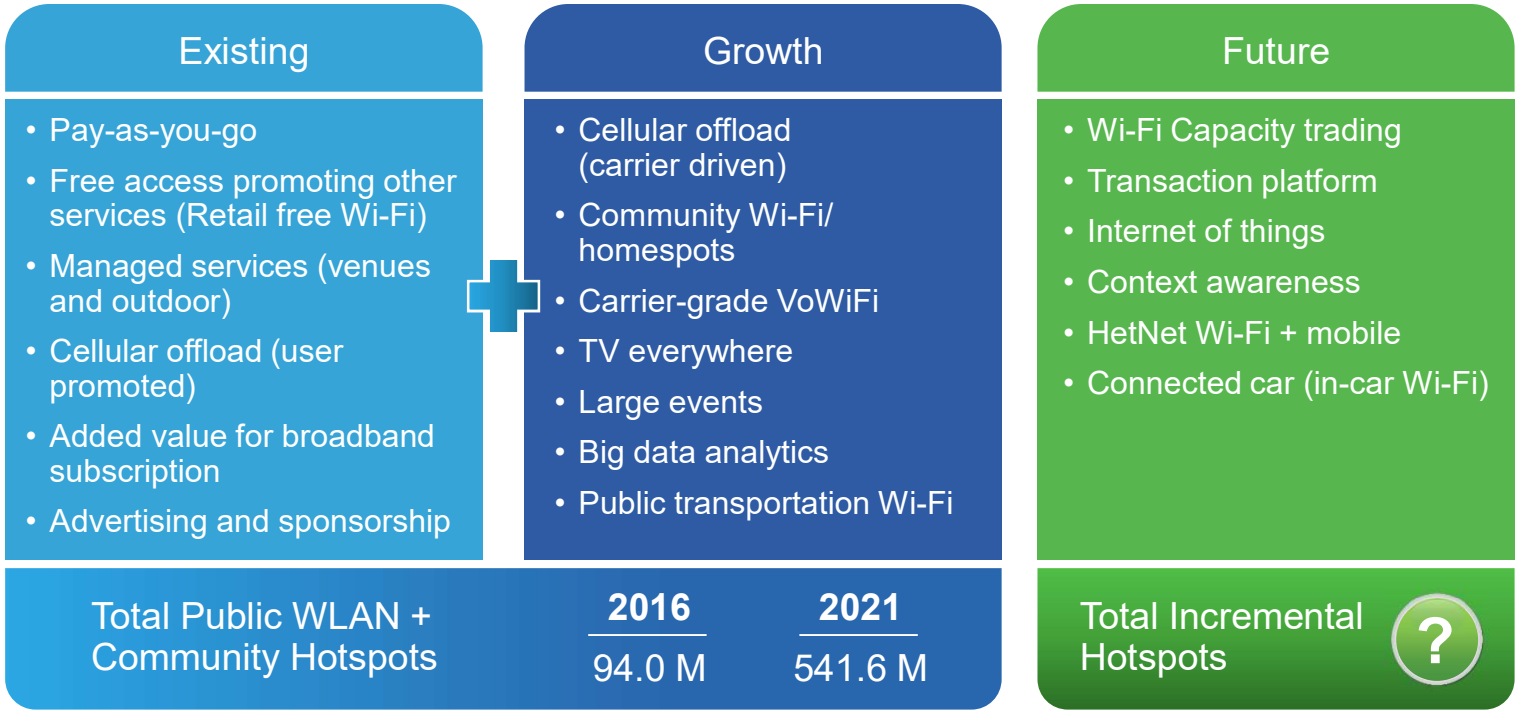
***Offload includes traffic from dual-mode devices (i.e., supports cell & Wi-Fi, excl. PCs) over Wi-Fi/small cell networks**

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

Global Wi-Fi Hotspot Coverage and Availability



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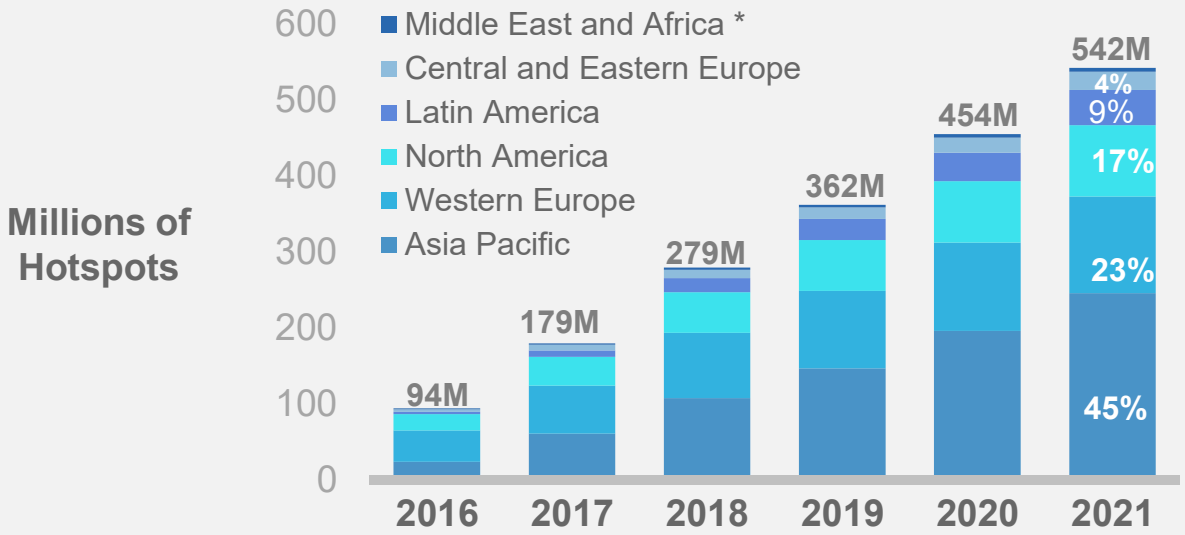
Source: Maravedis, Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global Public Wi-Fi Hotspots

Asia Pacific Leads with 246 Million (45%) Hotspots by 2021



42% CAGR
2016–2021

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*** Middle East and Africa represents 1% of global public Wi-Fi hotspots by 2021**

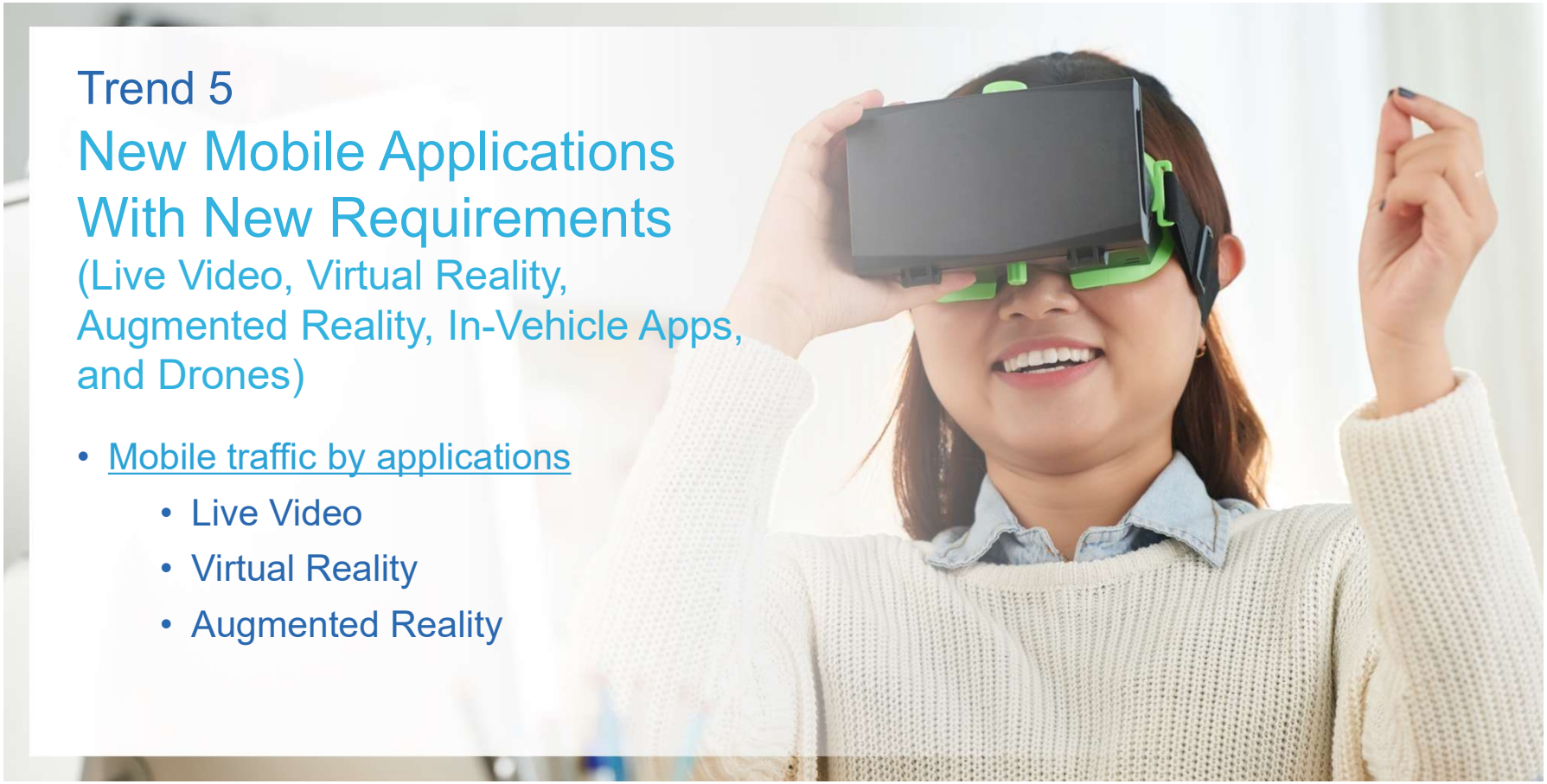
Source: Maravedis, Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Trend 5

New Mobile Applications With New Requirements

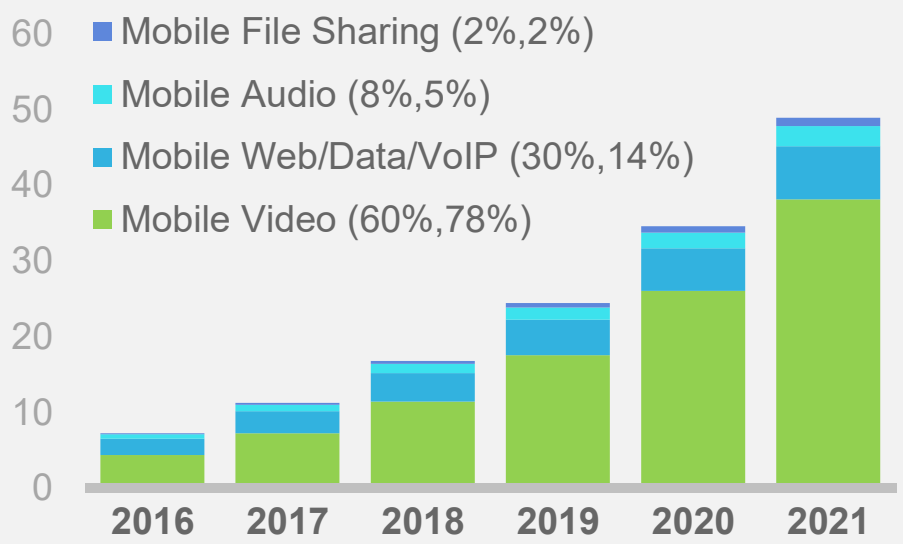
(Live Video, Virtual Reality, Augmented Reality, In-Vehicle Apps, and Drones)

- Mobile traffic by applications
  - Live Video
  - Virtual Reality
  - Augmented Reality



Global Mobile Data Traffic Growth / Apps

Video 78% of Mobile Data Traffic by 2021



47% CAGR
2016–2021

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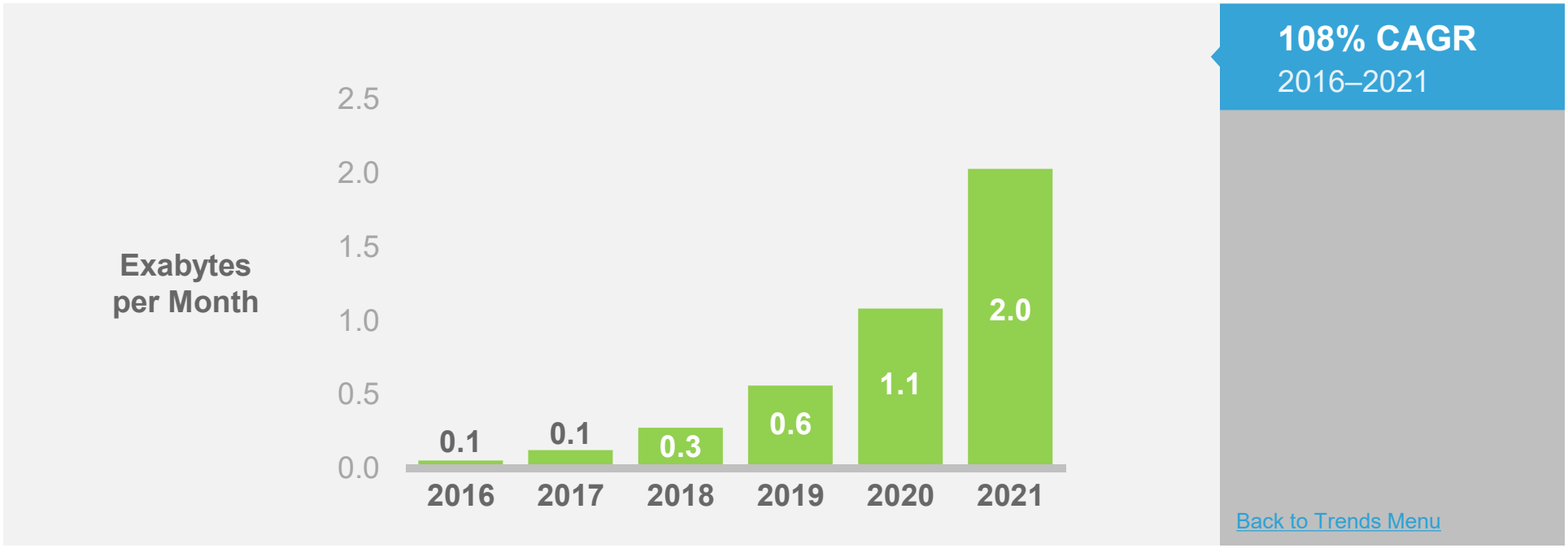
*** Figures (n) refer to 2016 and 2021 mobile data traffic shares**

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

High Growth for Live Video on Mobile

Live Video to Grow 39-Fold by 2021, 5% of Mobile Video Traffic



*** Figures (n) refer to 2016 and 2021 mobile data traffic shares**

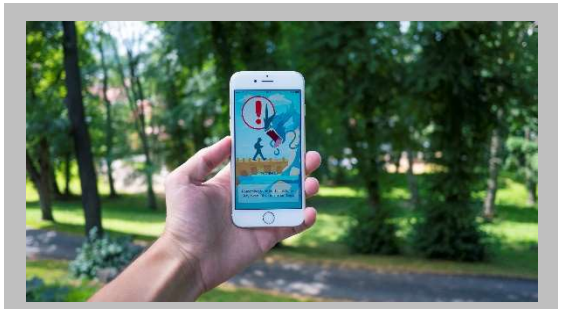
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

All the Realities: VR, AR, Mixed and Extended

Extended Reality (XR) is a term referring to all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables. Examples: flying drones, underwater exploration.

Mixed Reality: Mixed reality (MR), sometimes referred to as hybrid reality, is the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time. Examples: entertainment industry.

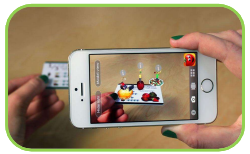
Virtual Reality (VR) is an immersive multimedia or computer simulated environment which allows one to interact with it. Examples: complete immersive gaming, virtual aviation training, medical/surgical training, mental treatment.



Augmented Reality: Augmented reality (AR) is a view of a real-world environment whose elements are supplemented and enhanced by computer-generated sensory input such as sound, video, or graphics Examples: tourism, retail- furniture visualizers, clothes visualizer.

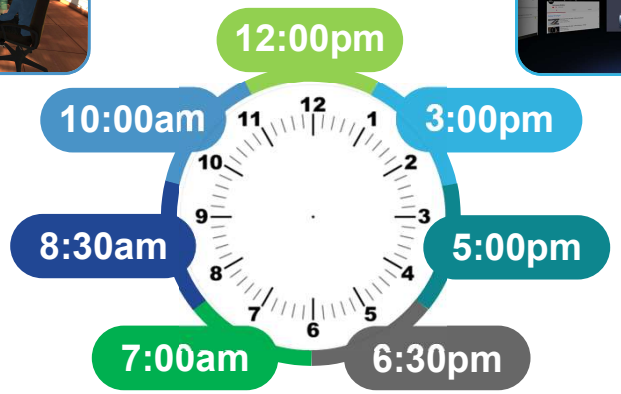
A Day in the Mobile Life of a Consumer Using AR and VR

Eating a healthy lunch with inputs from smartphone

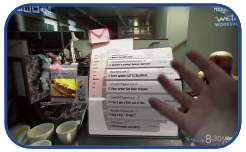


Attend a couple of meetings with your colleagues across the globe

Some VR web browsing on your laptop to do some research on your next product



Look at your emails on your laptop



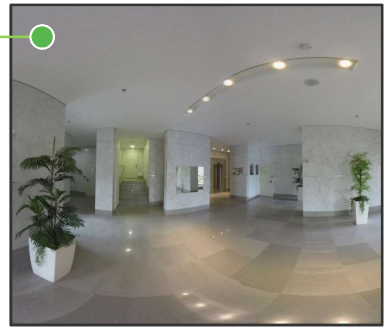
Attend an AR yoga class

With your morning coffee, see what is happening in the world on your tablet

Prepping for dinner using AR

Enterprise Apps Using AR and VR

Buy your next home using real estate VR tours on your mobile devices



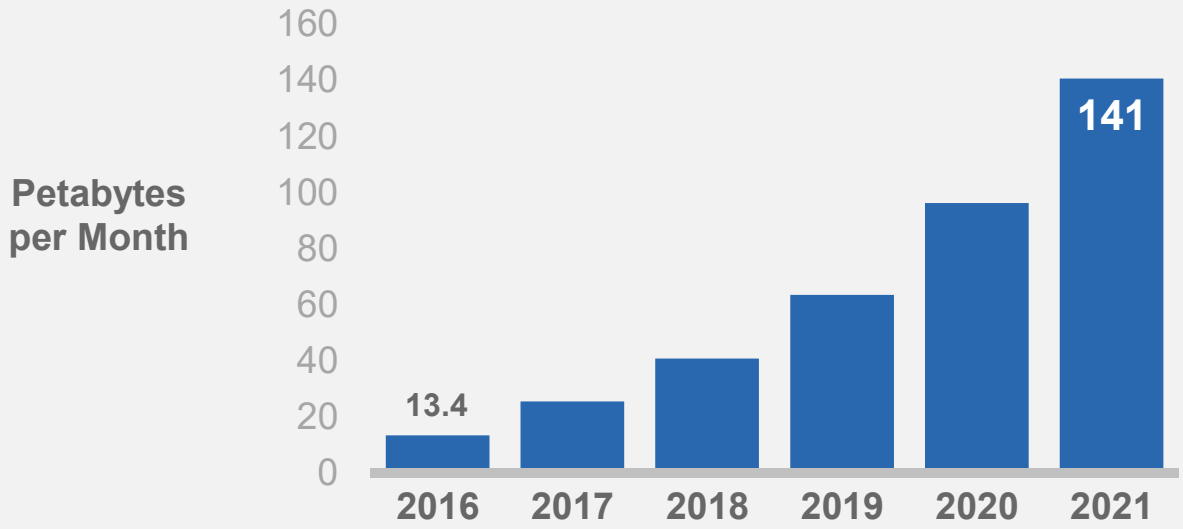
Visit your doctor from your own home when you are too sick to drive using telemedicine on mobile devices

A pilot gets his training and continuing education hours using flight simulation and training on VR

Choose and design your car features and interiors using AR on your mobile devices

Photo Source: Google.com, Businesswire.com/InTouch Heath, Roadtovr.com

Global VR Mobile Data Traffic Forecast



60% CAGR
2016–2021

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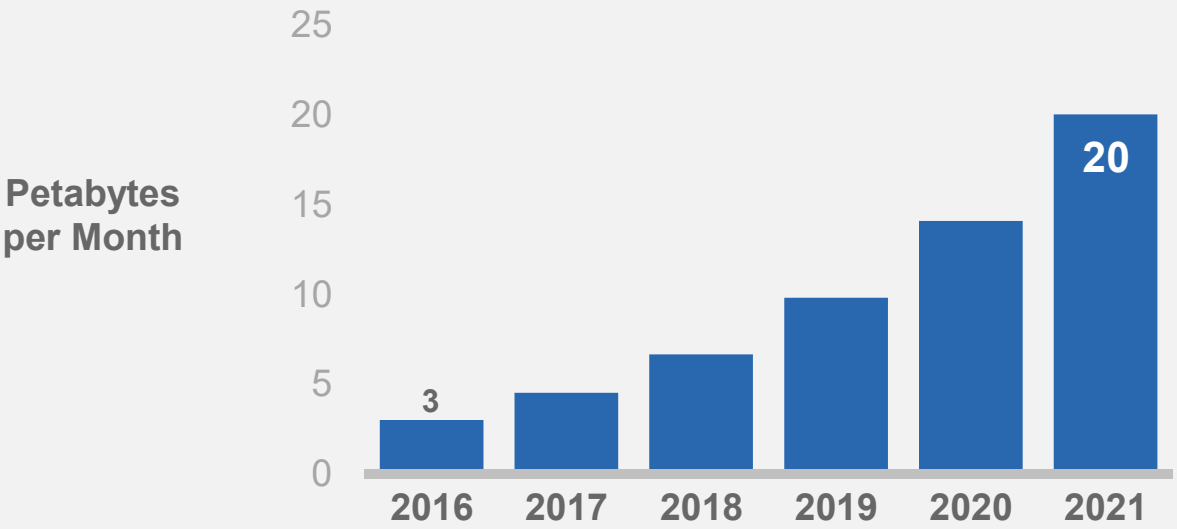
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global AR Mobile Data Traffic Forecast



46% CAGR
2016–2021

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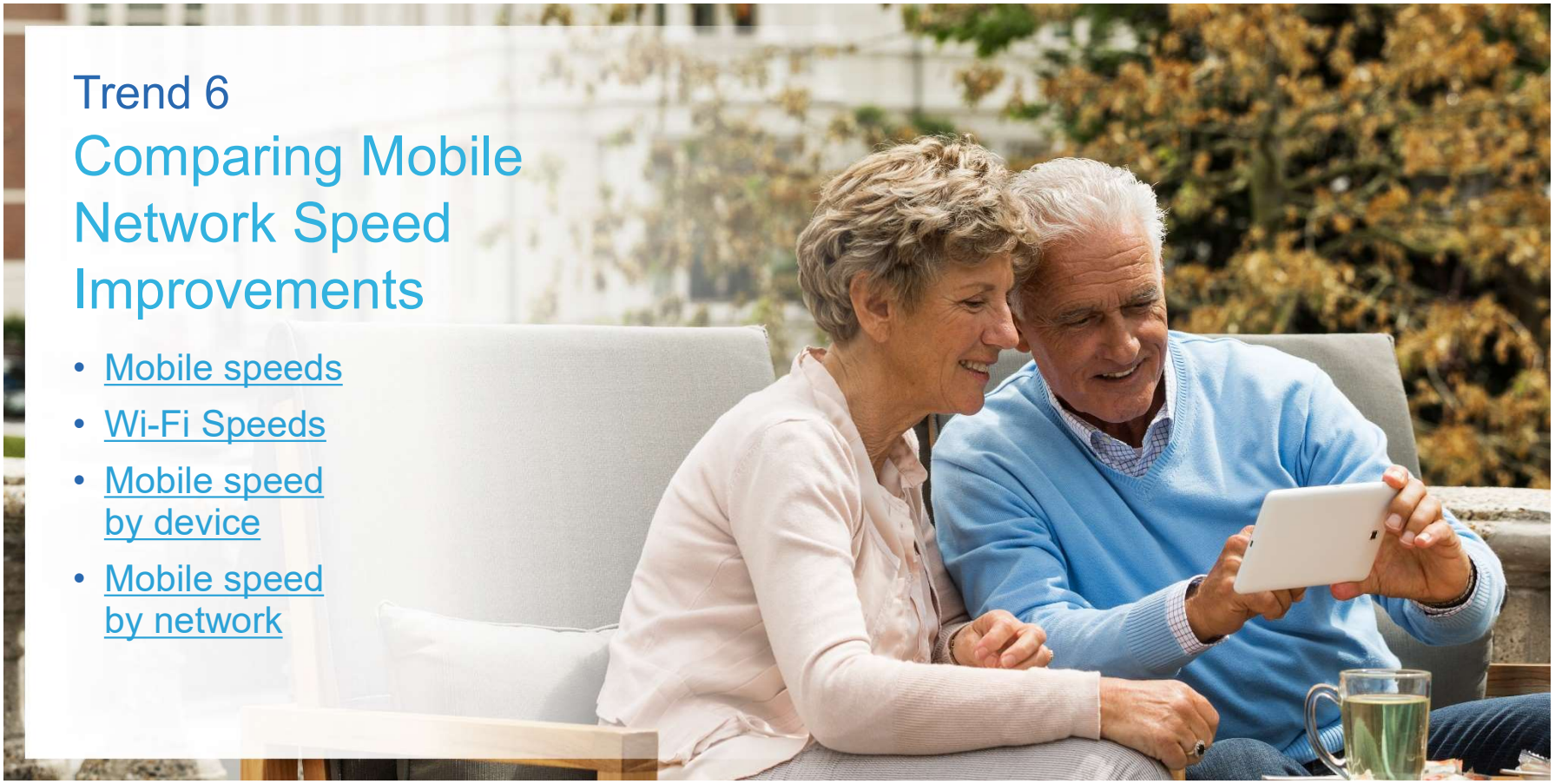
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021



Trend 6

Comparing Mobile Network Speed Improvements

- Mobile speeds
- Wi-Fi Speeds
- Mobile speed by device
- Mobile speed by network

Mobile Network Speeds Increase 3.0X by 2021

Average Cell Connection Speed (6.8 Mbps in 2016) Will Grow at a 24% CAGR—Reaching 20.4 Mbps by 2021

GLOBAL	2016	2021
Global Mbps	6.8	20.4
BY REGION		
North America	13.7	25.2
Western Europe	11.4	28.5
Central & Eastern Europe	6.3	18.4
Latin America	3.8	12.4
Asia Pacific	9.8	20.4
Middle East & Africa	3.8	10.8

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

Global Average Wi-Fi Speeds

Wi-Fi Exceeds Average Mobile (Cell) Speeds During 2016–2021

GLOBAL	2016	2021
Global Mbps	18.2	32.0
BY REGION		
North America	27.4	40.3
Western Europe	20.3	33.1
Central & Eastern Europe	16.7	31.4
Latin America	7.7	13.8
Asia Pacific	19.5	27.7
Middle East & Africa	4.9	7.9

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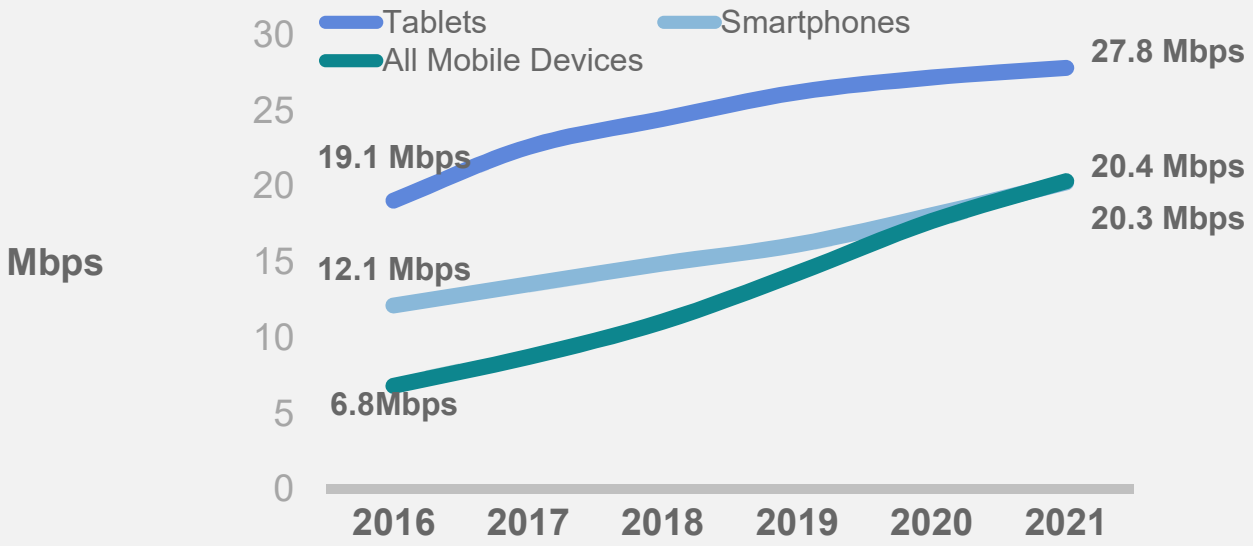
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global Mobile Speeds by Device Type

Tablet Speeds are 1.4x Higher than Average by 2021
Smartphone Speeds on Par With Average by 2021



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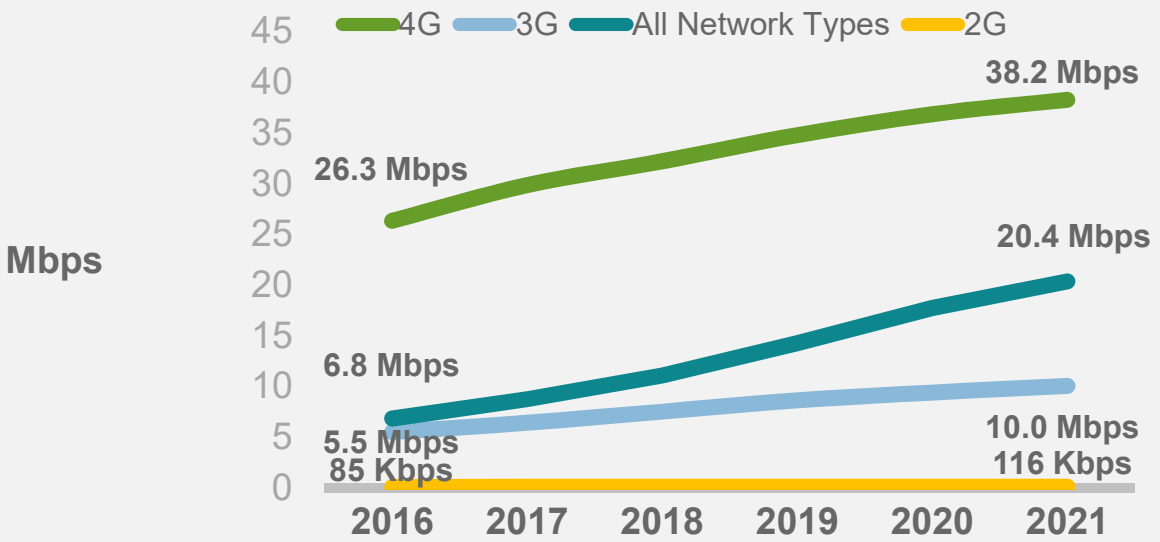
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Global Mobile Speeds by Network Type

4G Speeds will be 1.9X Higher than Average by 2021
Average Speeds Surpass 3-3.5G Speeds



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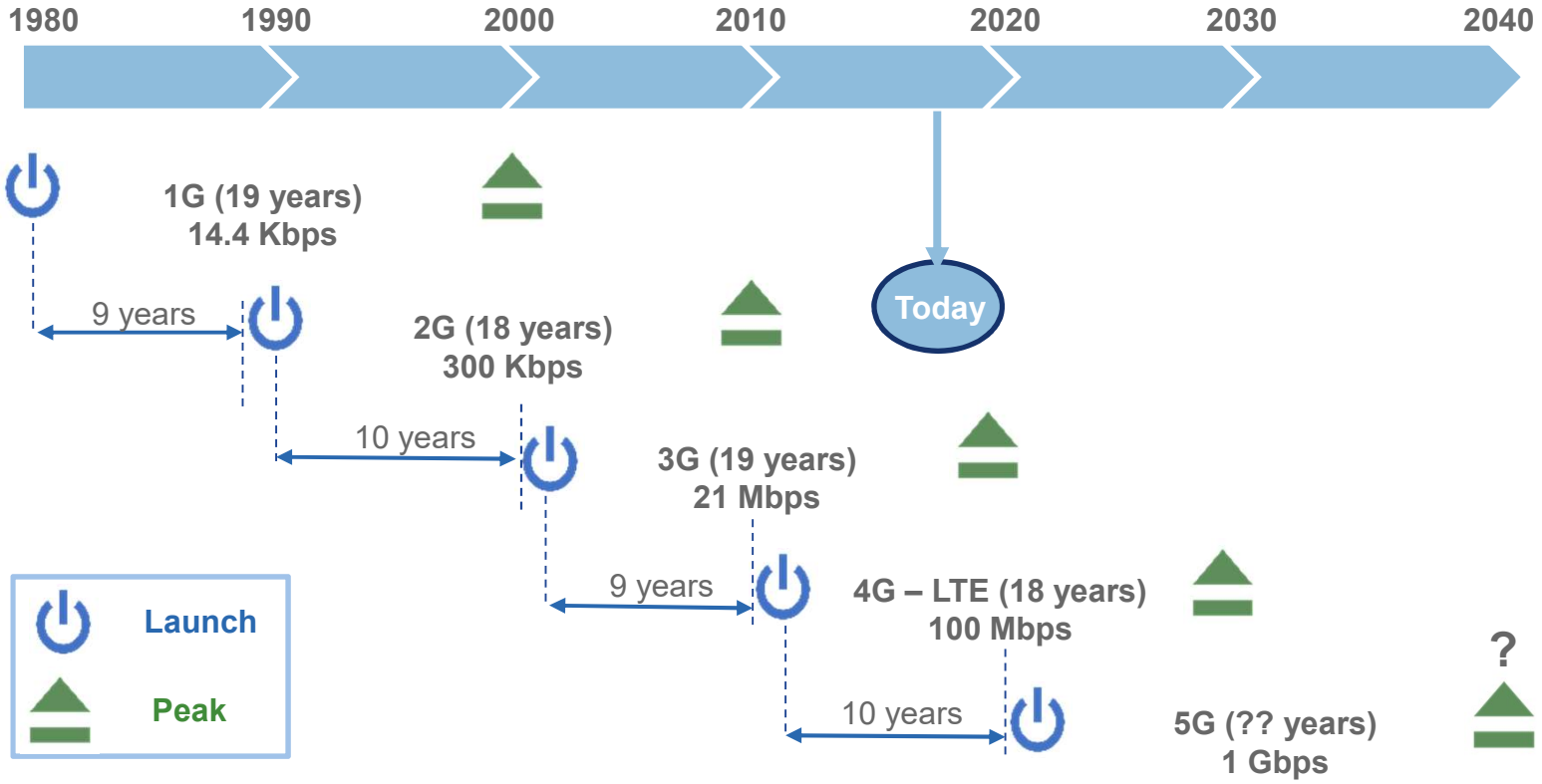
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

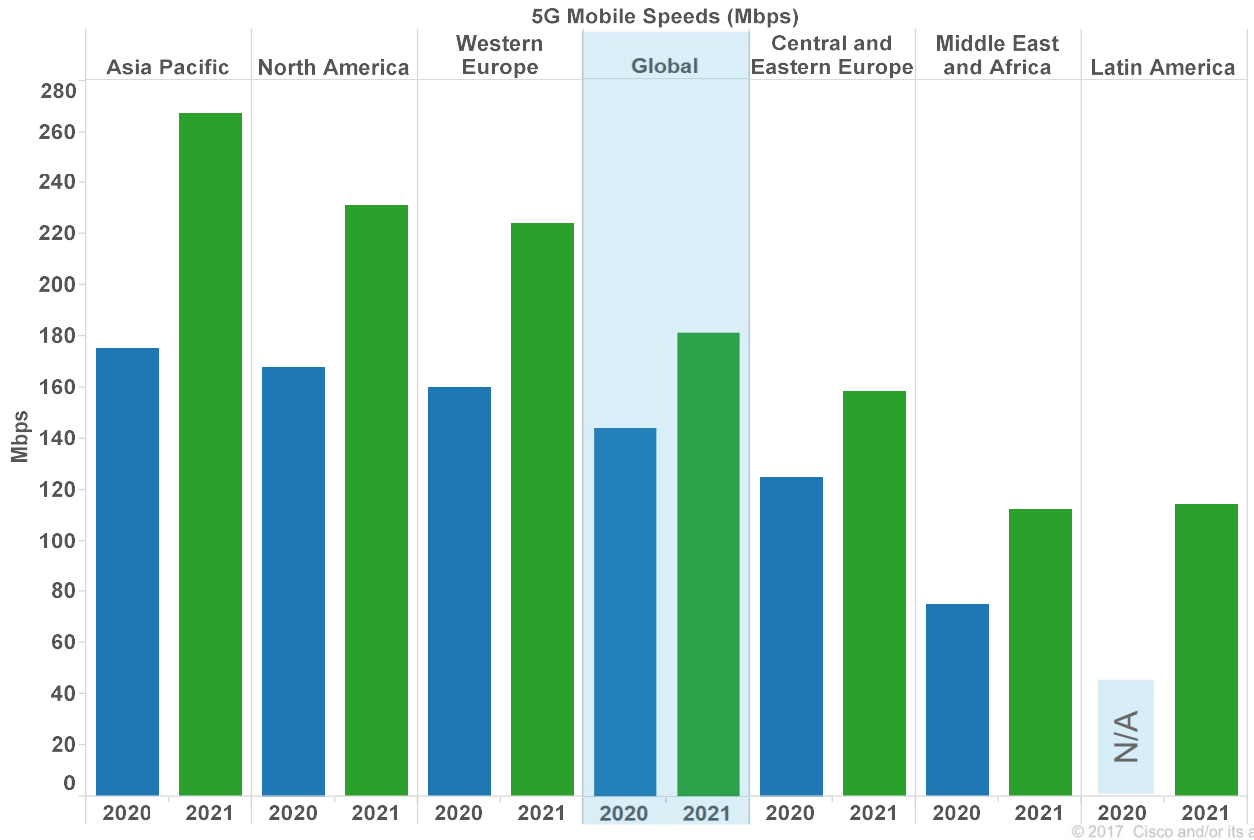
Mobile Speeds Evolution



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

5G Potential Speeds

First foray into 100+ Mbps mobile speeds



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

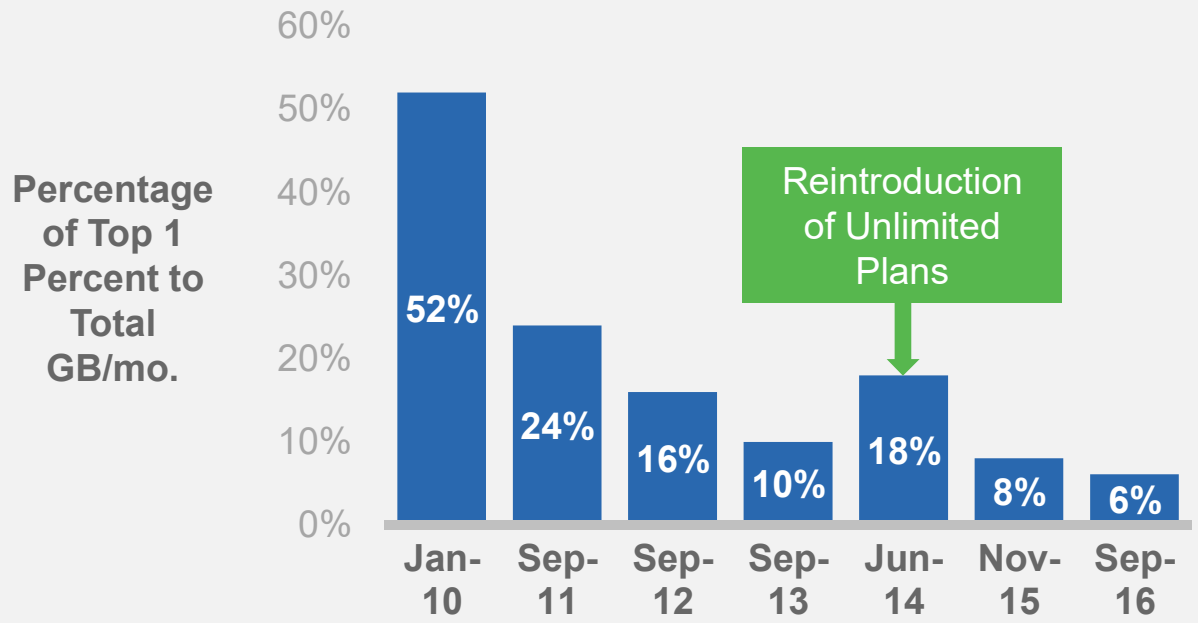
Trend 7

Reviewing Tiered Pricing—Unlimited Data & Shared Plans

- Top mobile user profile
- IOS vs. Android
- Tiered vs. unlimited plans
- Shared vs. regular plans

Top Mobile User Profiles: 2010–2016

Top 1 Percent Generated 6 Percent in September 2016



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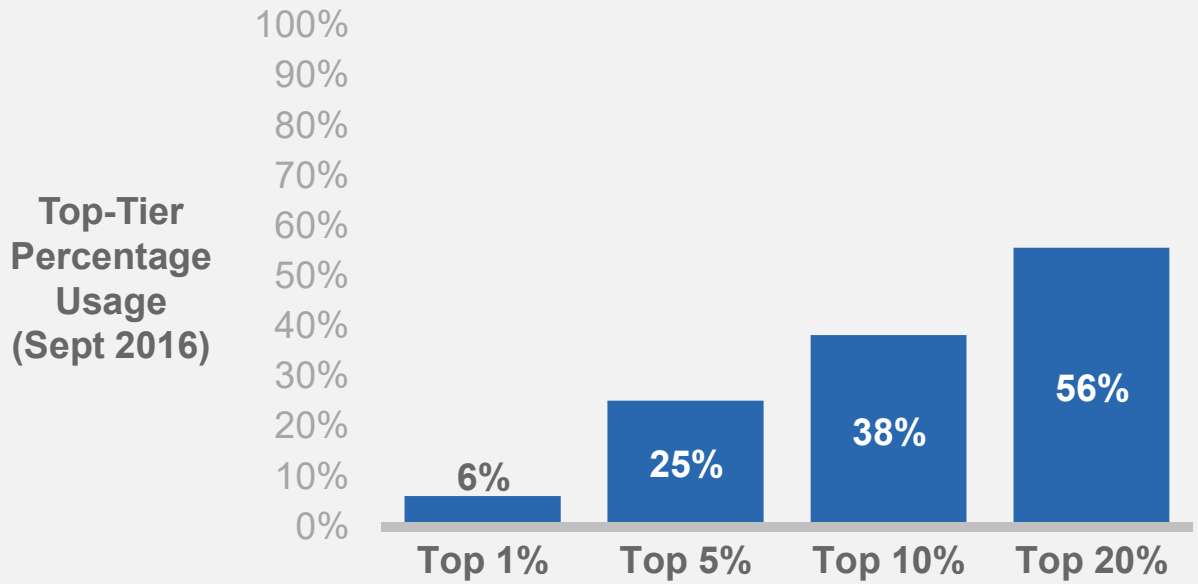
*** Study based on to North American Tier 1 and Tier 2 operators**

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

Top 20% Users Consume 56% of Monthly Traffic



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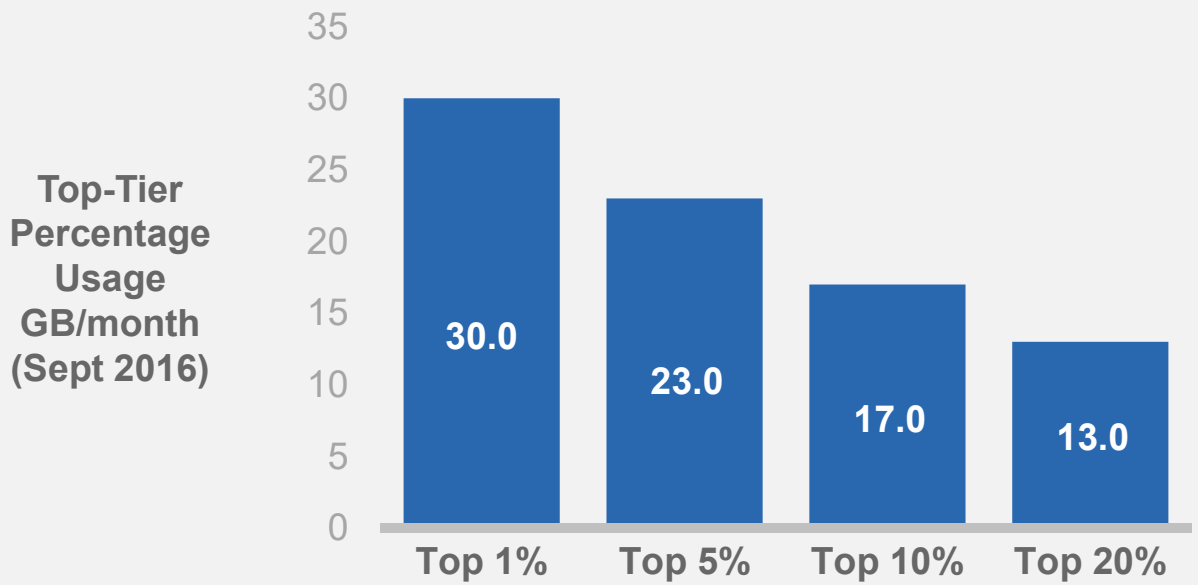
*** Study based on to North American Tier 1 and Tier 2 operators**

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

Top 20% Users Consume Nearly 13 Gigabytes per Month *



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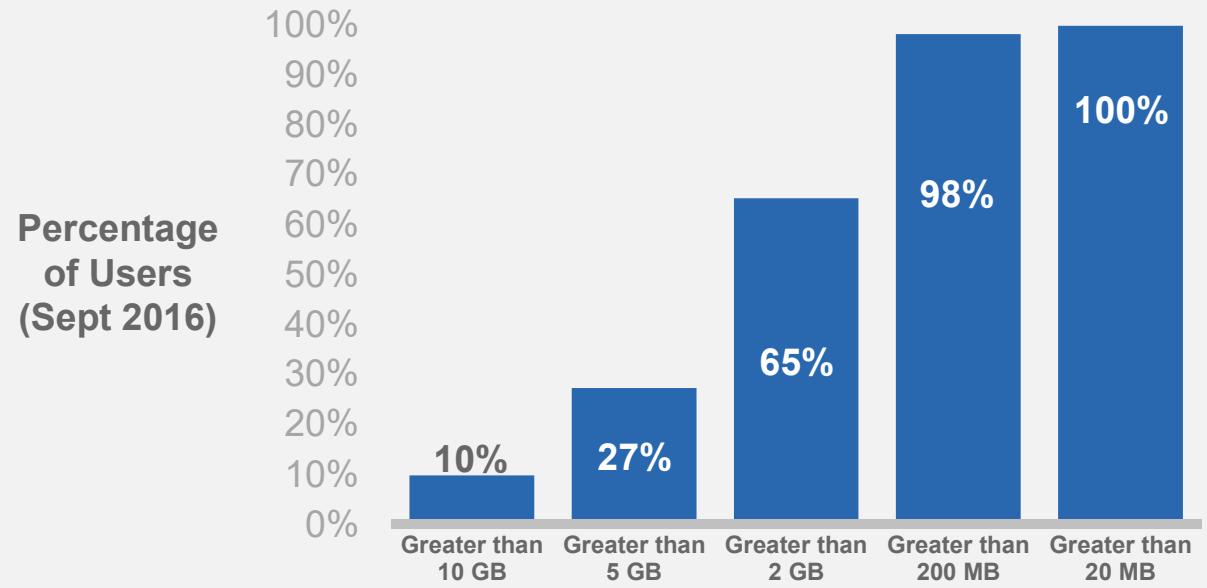
*** Study based on to North American Tier 1 and Tier 2 operators**

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

10 Percent of Users Consume 10 GB per Month

65 Percent Consume over 2 GB per Month *



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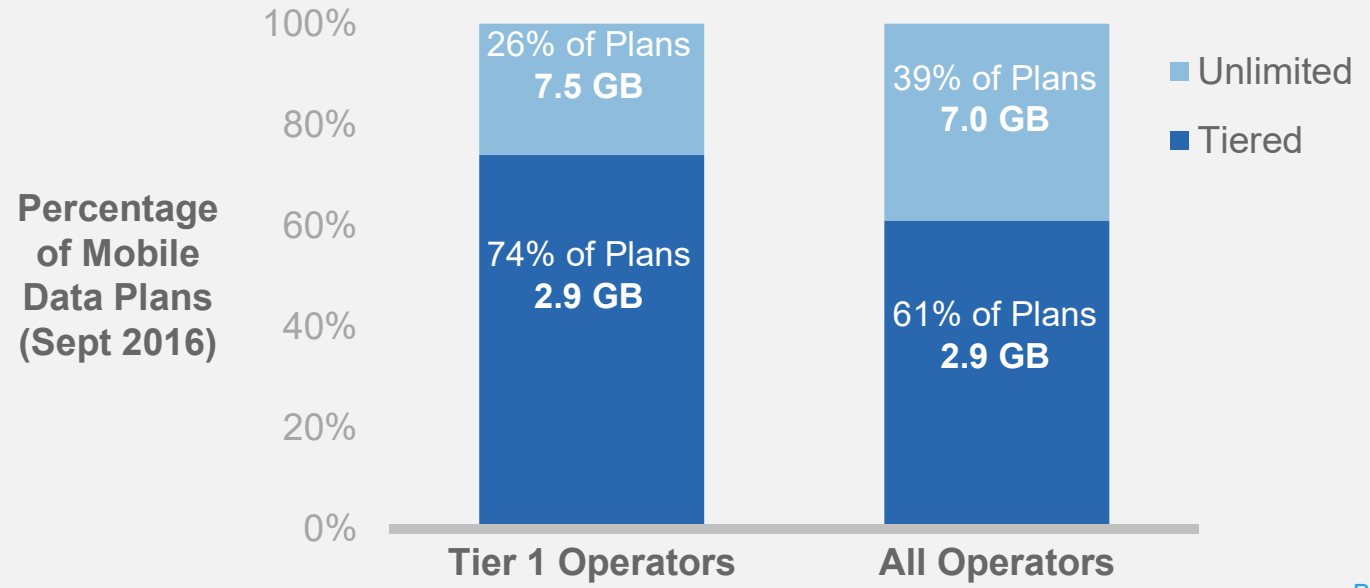
*** Study based on to North American Tier 1 and Tier 2 operators**

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

Tiered Plans Outnumber Unlimited Plans;

Unlimited Plans Continue to Lead in Data Consumption *



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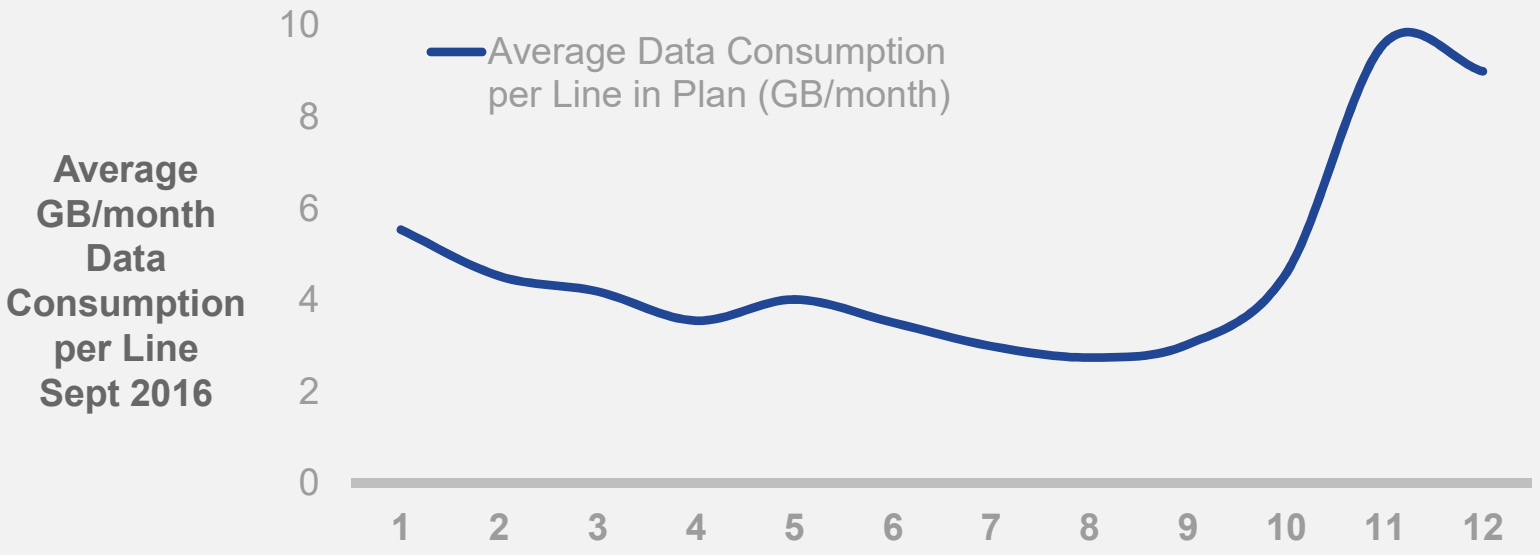
*** Study based on to North American Tier 1 and Tier 2 operators**

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

Data Consumption by Number of Lines per Plan/Subscription*



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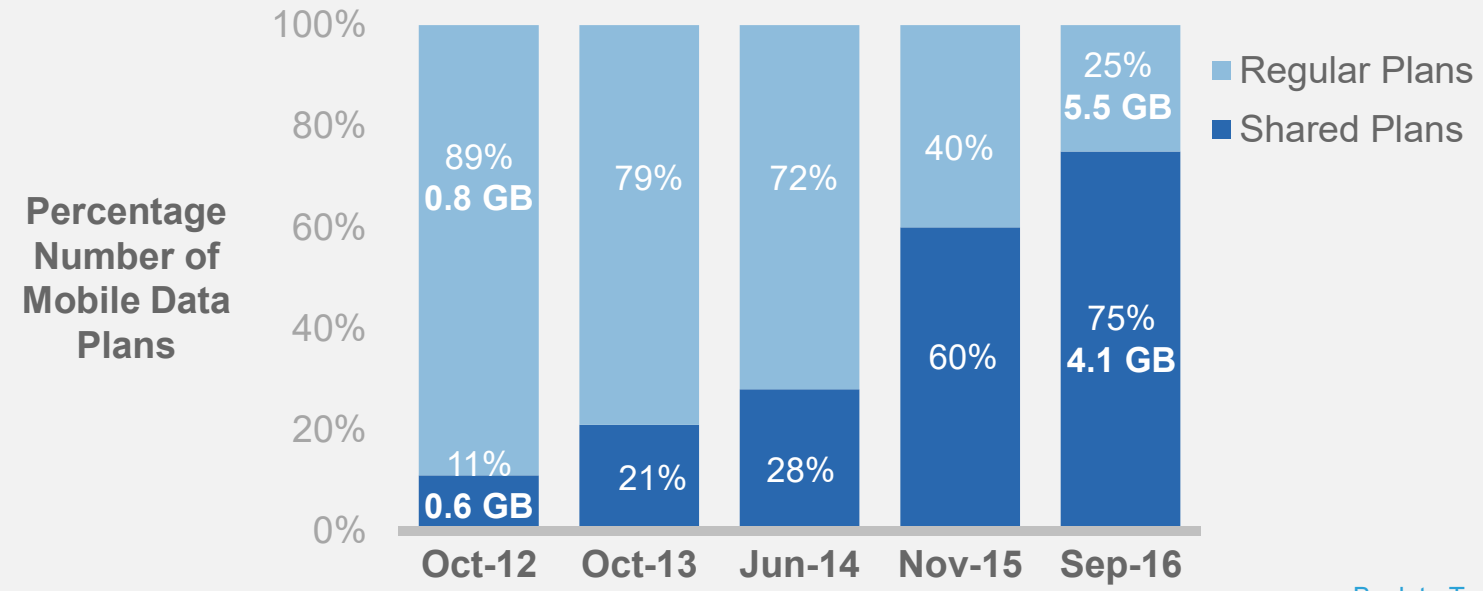
*** Study based on to North American Tier 1 and Tier 2 operators**

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

Number of Shared Plans Now a Majority

Shared Plans Average Data Usage Inching Closer to that of Regular Plans*



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*** Study based on to North American Tier 1 and Tier 2 operators**

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

New Wi-Fi Devices in the Mix: IoT Usage

If on a Mobile Data Plan, How Long Would it Take to Fill a 5GB Data Cap?

Streaming

chromecast

256 MB per hour
19 hours

SanDisk 

207 MB per hour*
24 hours

amazon.com

123 MB per hour*
41 hours

Cameras

GoPro Be a HERO.

476 MB per hour
11 hours

Parrot BEBOP DRONE

712 MB per hour
7 hours

Nikon

898 MB per hour
6 hours

Connected Car

OnStar

213 MB per hour
23 hours

Autonet mobile Introducing the wireless car

229 MB per hour
22 hours

* 530 MB per hour upload

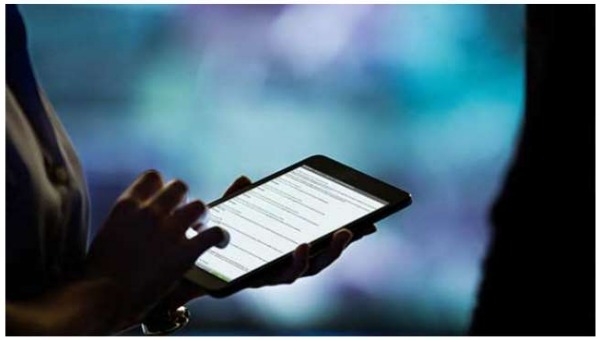
Source: Nielsen Mobile 2016, Cisco VNI Global Mobile Data Traffic Forecast, 2016–2021

Conclusion

Cisco VNI Mobile Forecast; 2016–2021

Use Our Tools & Resources @ www.cisco.com/go/vni

Mobile VNI Forecast Tools



Get mobile forecast highlights

Find global, regional, and country-level projections and data for 2016-2021.

Launch tool

Create Custom VNI charts

Use the VNI widget to create custom charts based on forecast data.

Launch VNI widget

Submit questions/comments via our public VNI community page:

https://communities.cisco.com/community/solutions/sp/vni-gci

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