USTelecom Industry Metrics and Trends 2018

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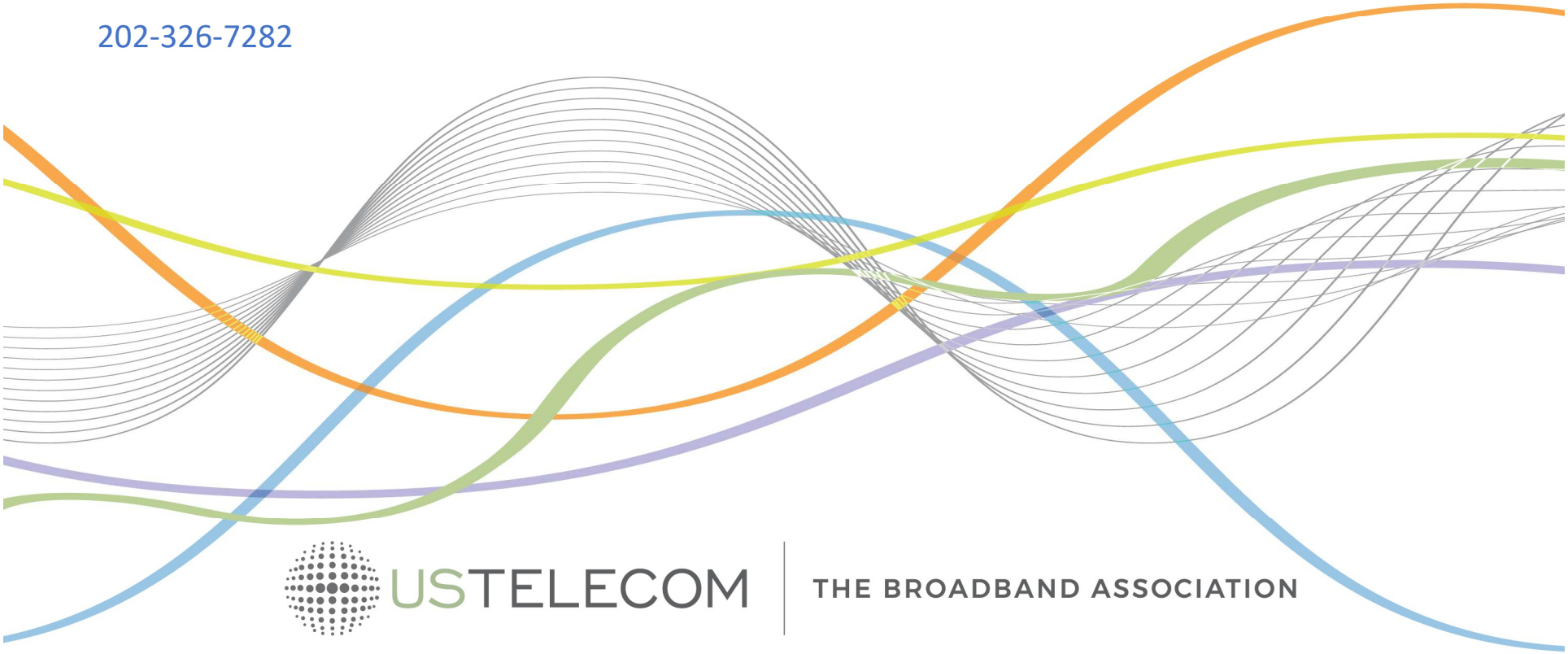
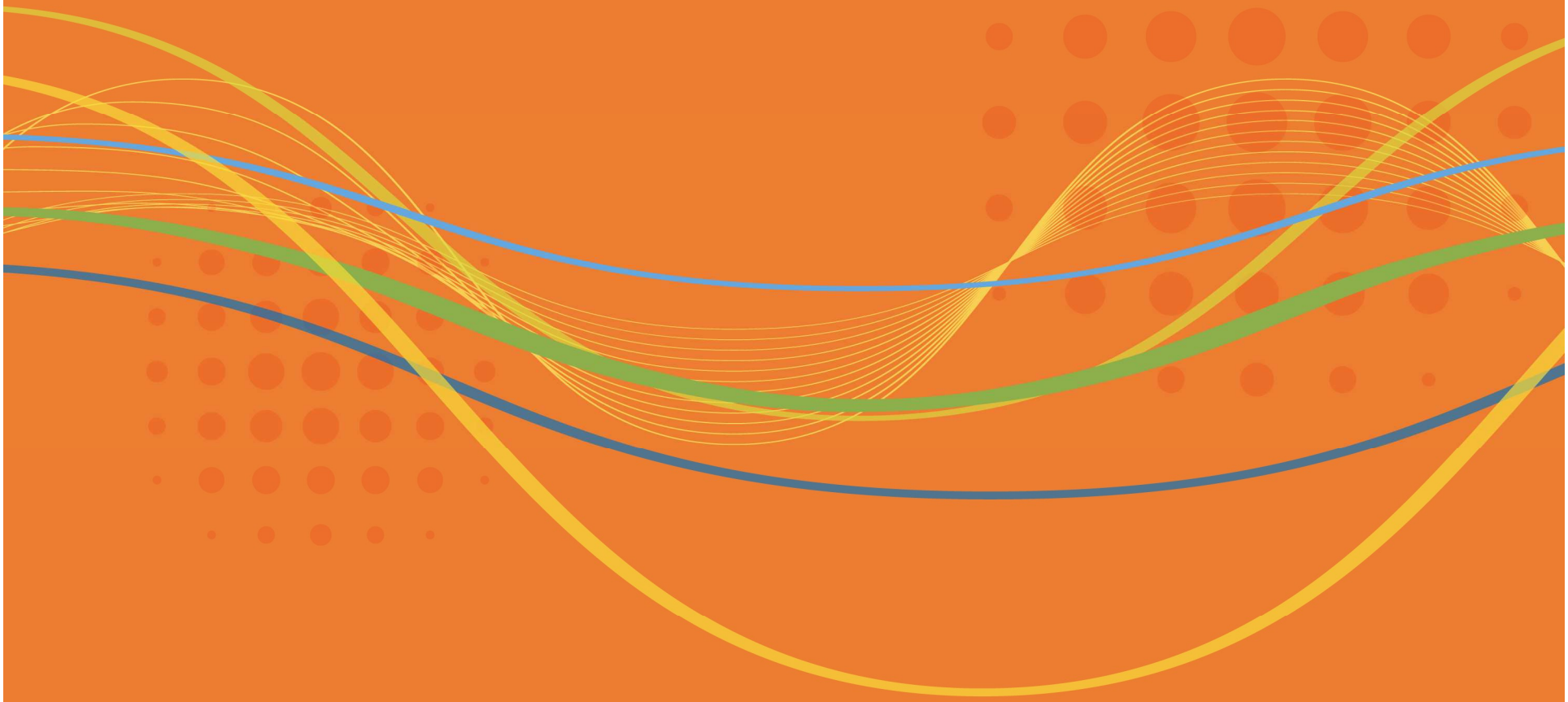


Contents

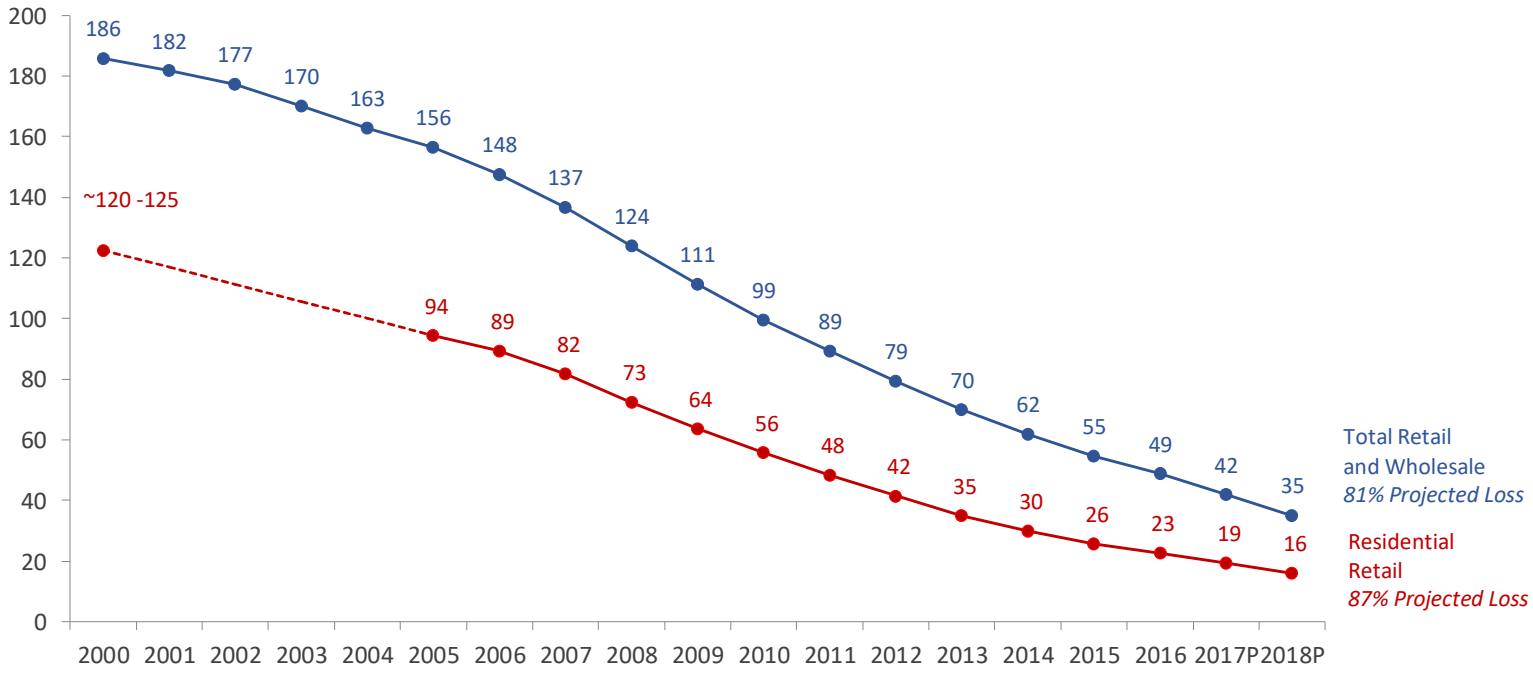
Note on data and projections: Unless otherwise noted, the data in this presentation are based on sources that are current through year-end 2016. Projections are denoted with a "P". In the first two sections, projections for 2017 and 2018 are USTelecom straight-line estimates based on the most recent 6-month trends. Accuracy of projections is not guaranteed, and may depend on factors such as level of aggregation, technological maturity, and adoption curves. In the third section, projection are provided directly by our source.

Note on terminology: As used in this presentation, broadband includes fixed and mobile services. Mobile broadband is provided over cellular wireless networks. Wired broadband is a subset of fixed broadband and predominantly includes services using fiber, DSL, and cable technologies. Fixed broadband includes wired broadband plus fixed wireless and, sometimes, satellite. The broadband deployment data below exclude satellite from fixed broadband while the broadband connections data include satellite in fixed broadband.

The Transition from Legacy Voice Networks to Mobile and Internet Communications

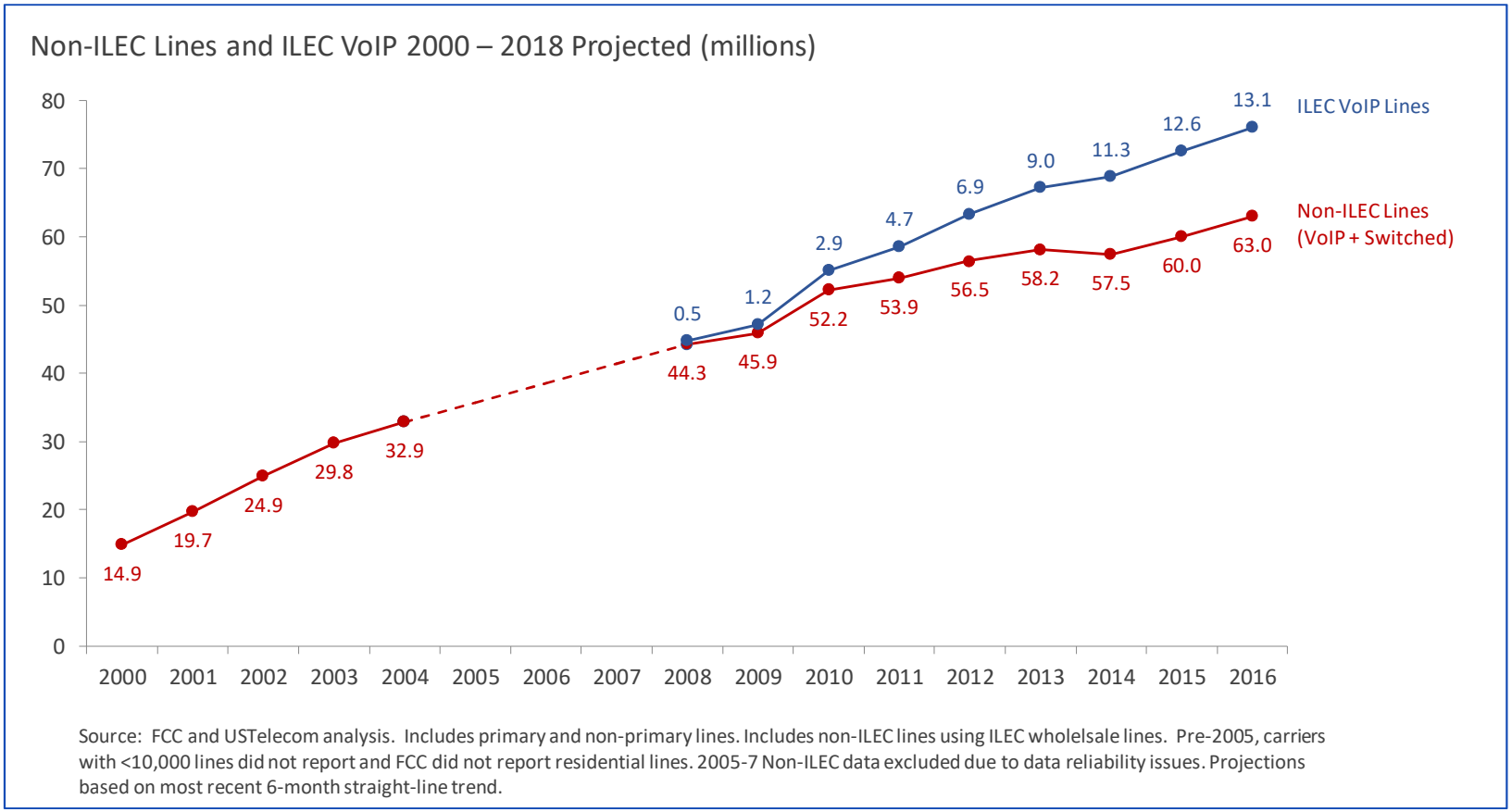


Dramatic Decline in Traditional Wired Voice Connections Continues



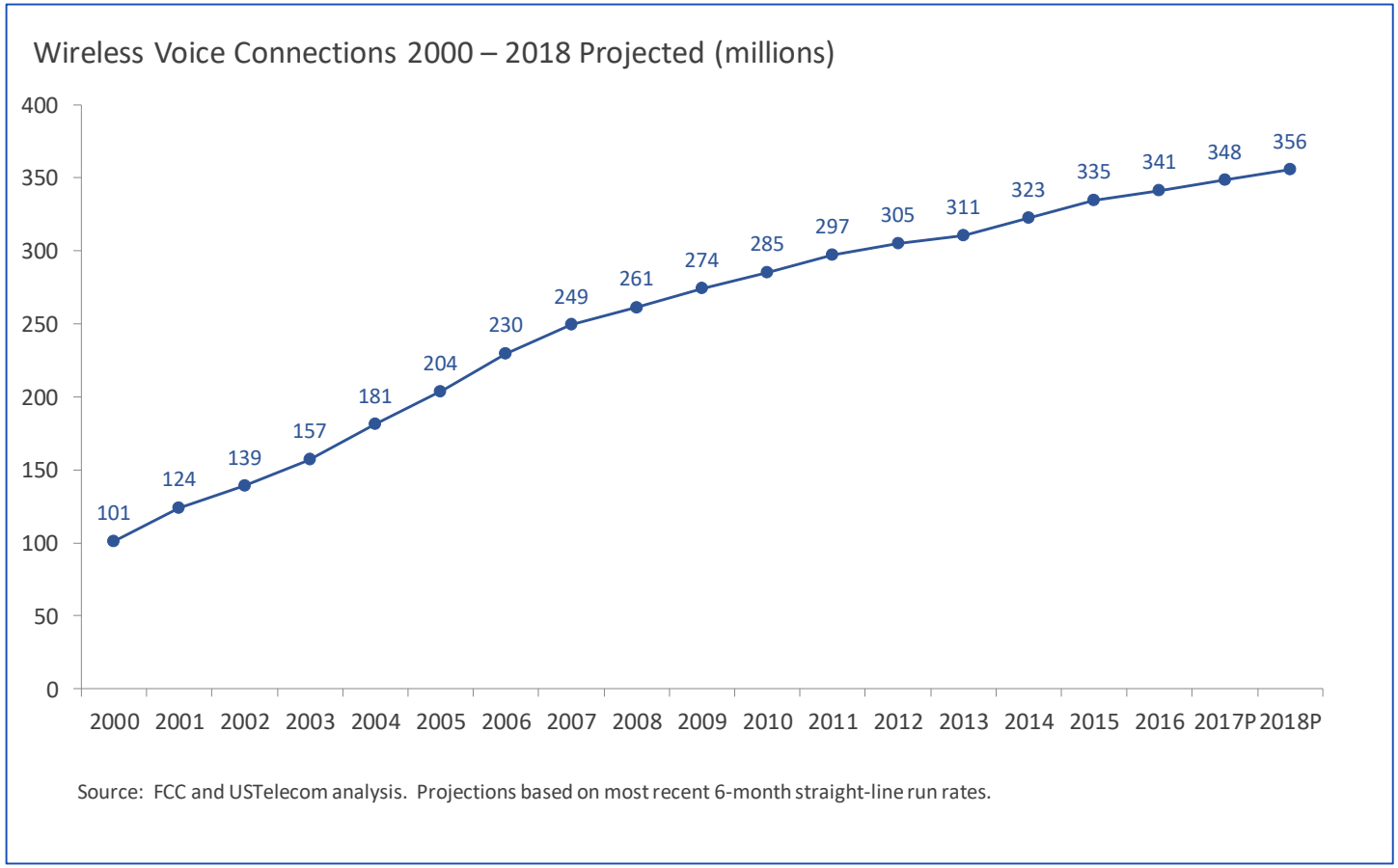
Source: FCC and USTelecom analysis. Includes primary and non-primary lines. Excludes ILEC VoIP and UNE-L (unbundled loops). Projections based on most recent 6-month straight-line run rates. Pre-2005, carriers with <10,000 lines did not report and FCC did not report residential lines.

Wired Voice Alternatives Are Growing



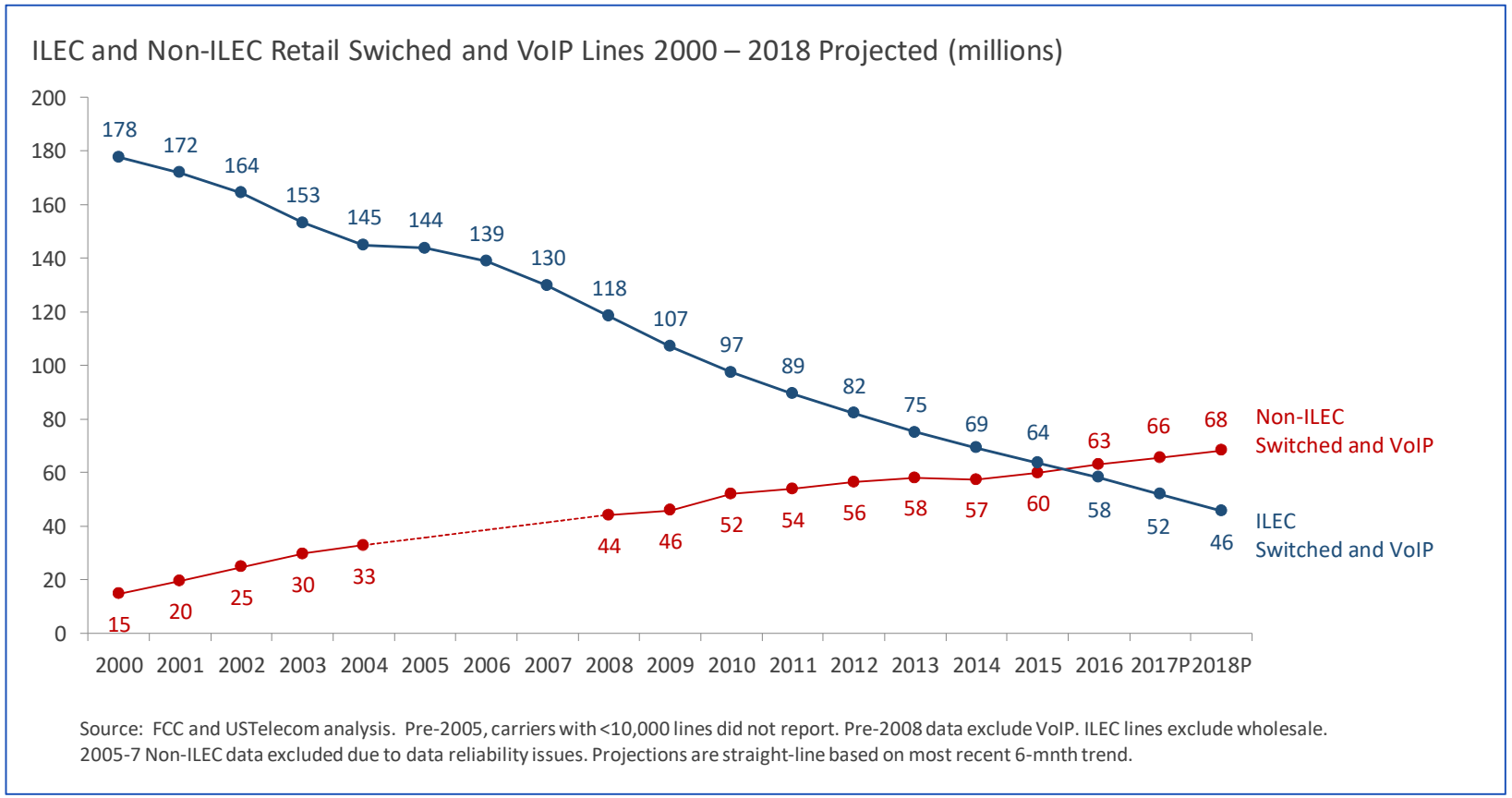
Source: FCC and USTelecom analysis. Includes primary and non-primary lines. Includes non-ILEC lines using ILEC wholelsale lines. Pre-2005, carriers with <10,000 lines did not report and FCC did not report residential lines. 2005-7 Non-ILEC data excluded due to data reliability issues. Projections based on most recent 6-month straight-line trend.

Wireless Voice Connections Are Growing Rapidly



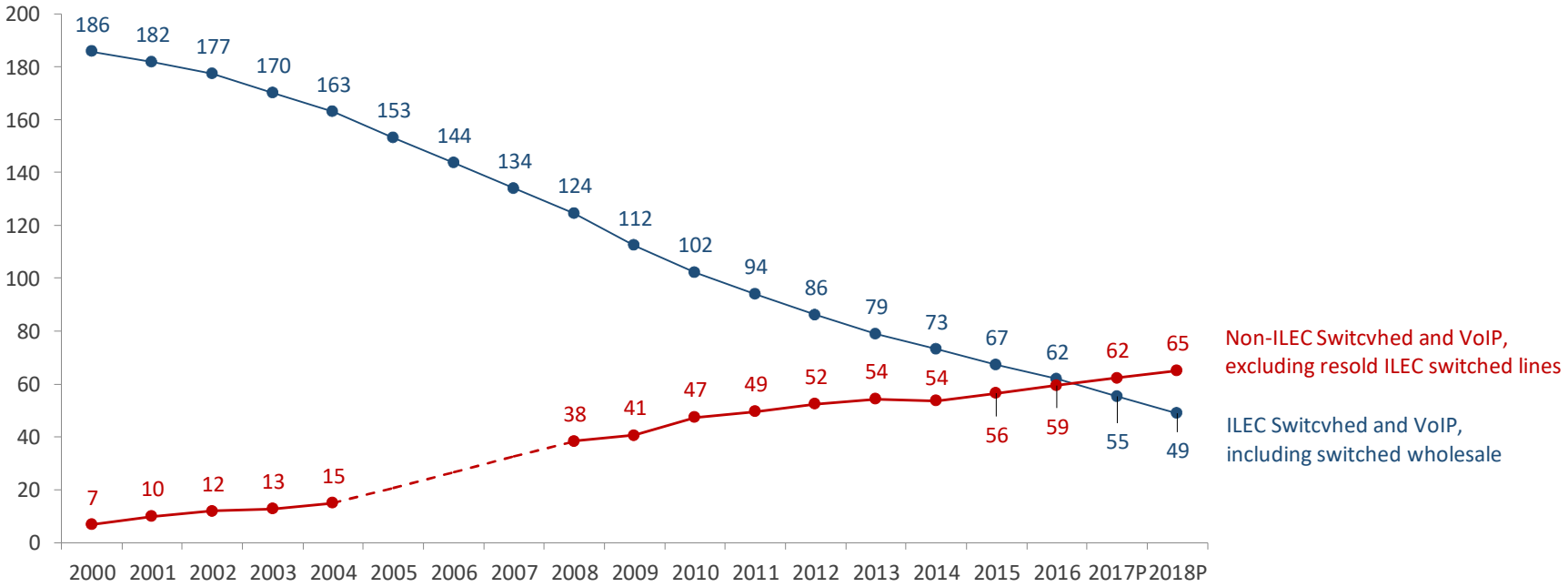
Source: FCC and USTelecom analysis. Projections based on most recent 6-month straight-line run rates.

Non-ILECs Have a Greater Share of Wired Voice Lines Than ILECs



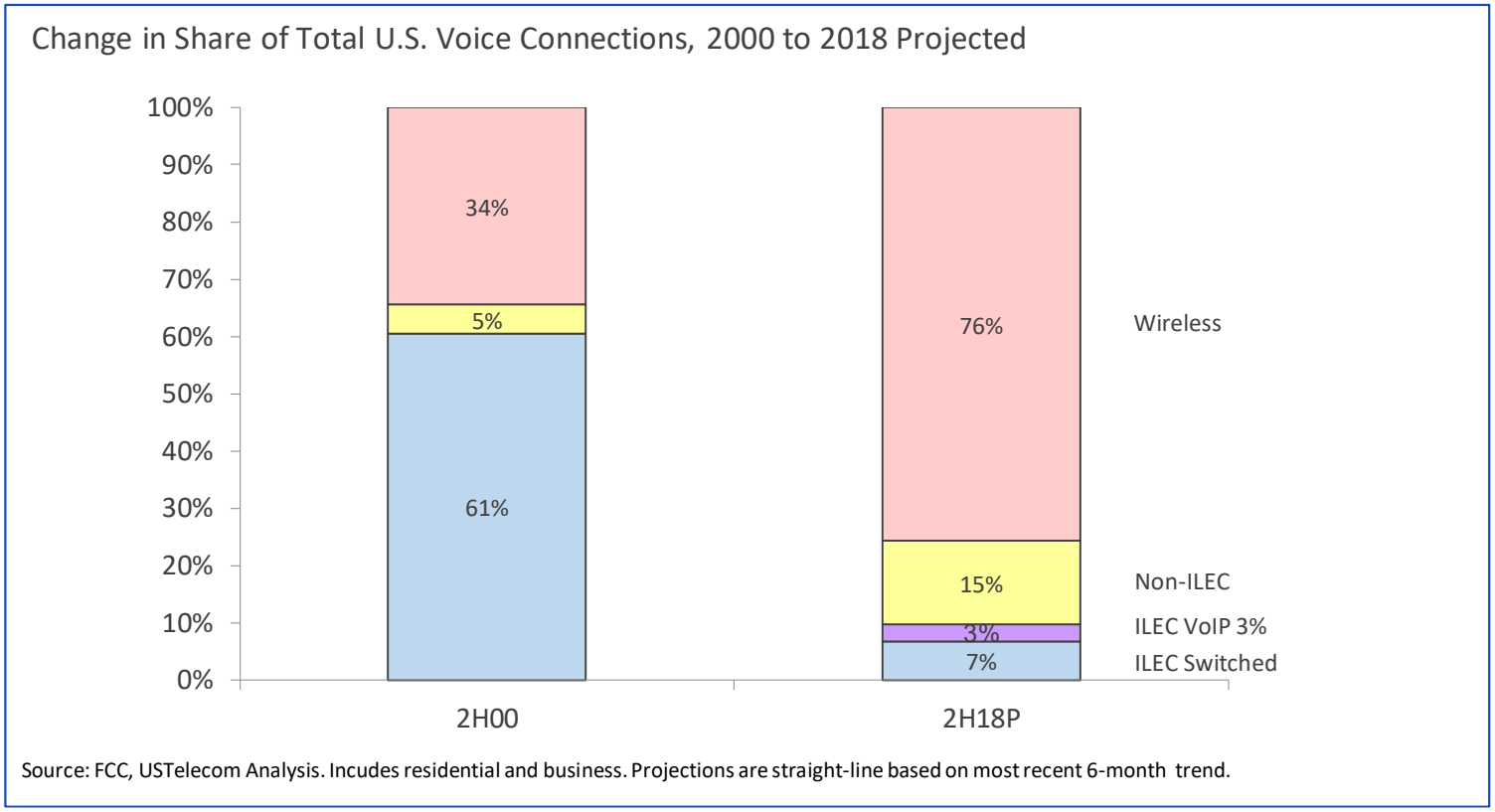
Source: FCC and USTelecom analysis. Pre-2005, carriers with <10,000 lines did not report. Pre-2008 data exclude VoIP. ILEC lines exclude wholesale. 2005-7 Non-ILEC data excluded due to data reliability issues. Projections are straight-line based on most recent 6-mnth trend.

Non-ILECs Have Also Surpassed ILECs in Wired Voice Even When Considering Wholesale Lines



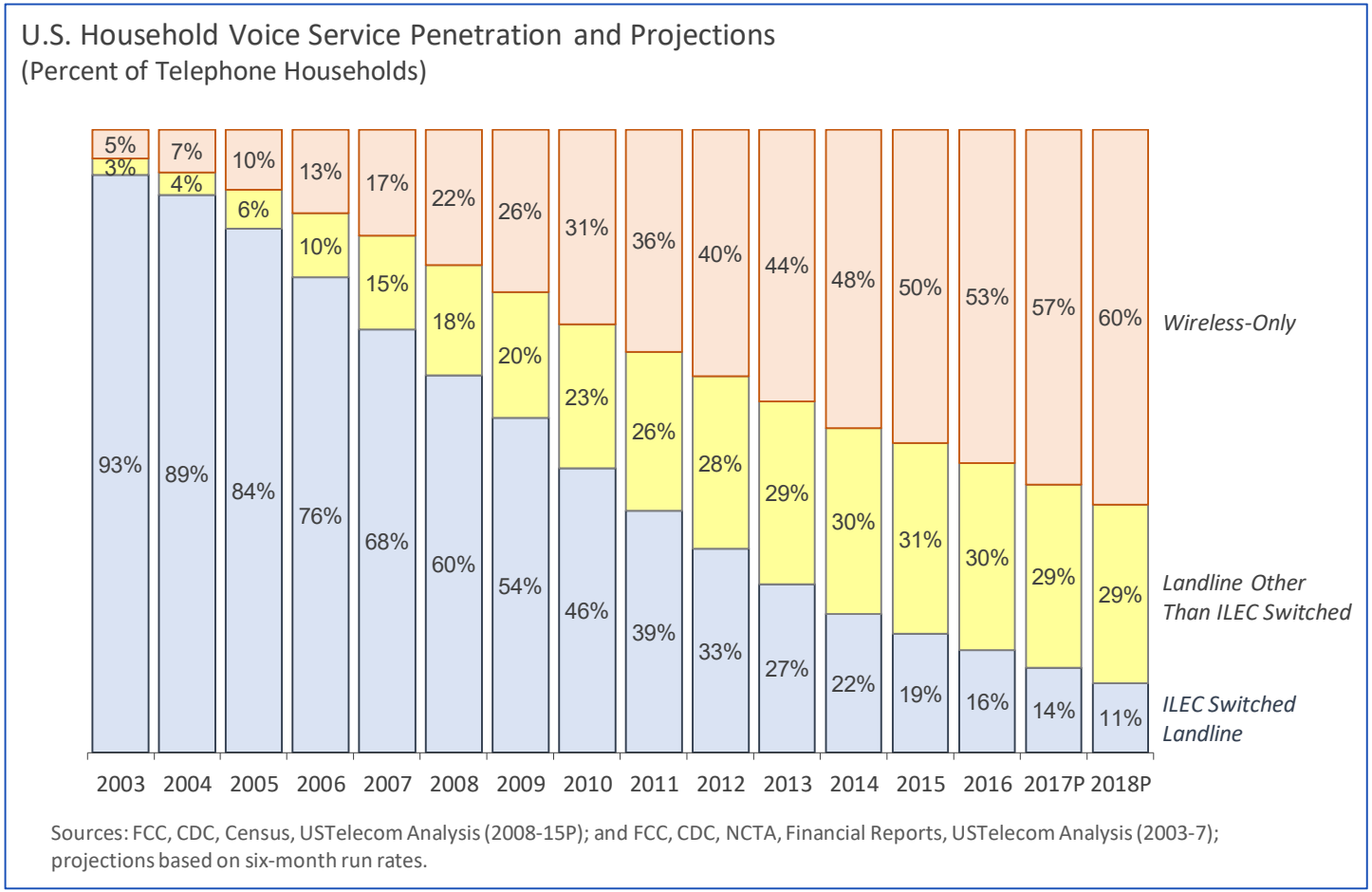
Source: FCC and USTelecom analysis. Pre-2005, carriers with <10,000 lines did not report. Pre-2008 data exclude VoIP. ILEC lines exclude wholesale. 2005-7 Non-ILEC data excluded due to data reliability issues. Projections are straight-line based on most recent 6-month trend.

There Are Three Times as Many Wireless as Wired Voice Connections in the U.S.



Source: FCC, USTelecom Analysis. Incudes residential and business. Projections are straight-line based on most recent 6-month trend.

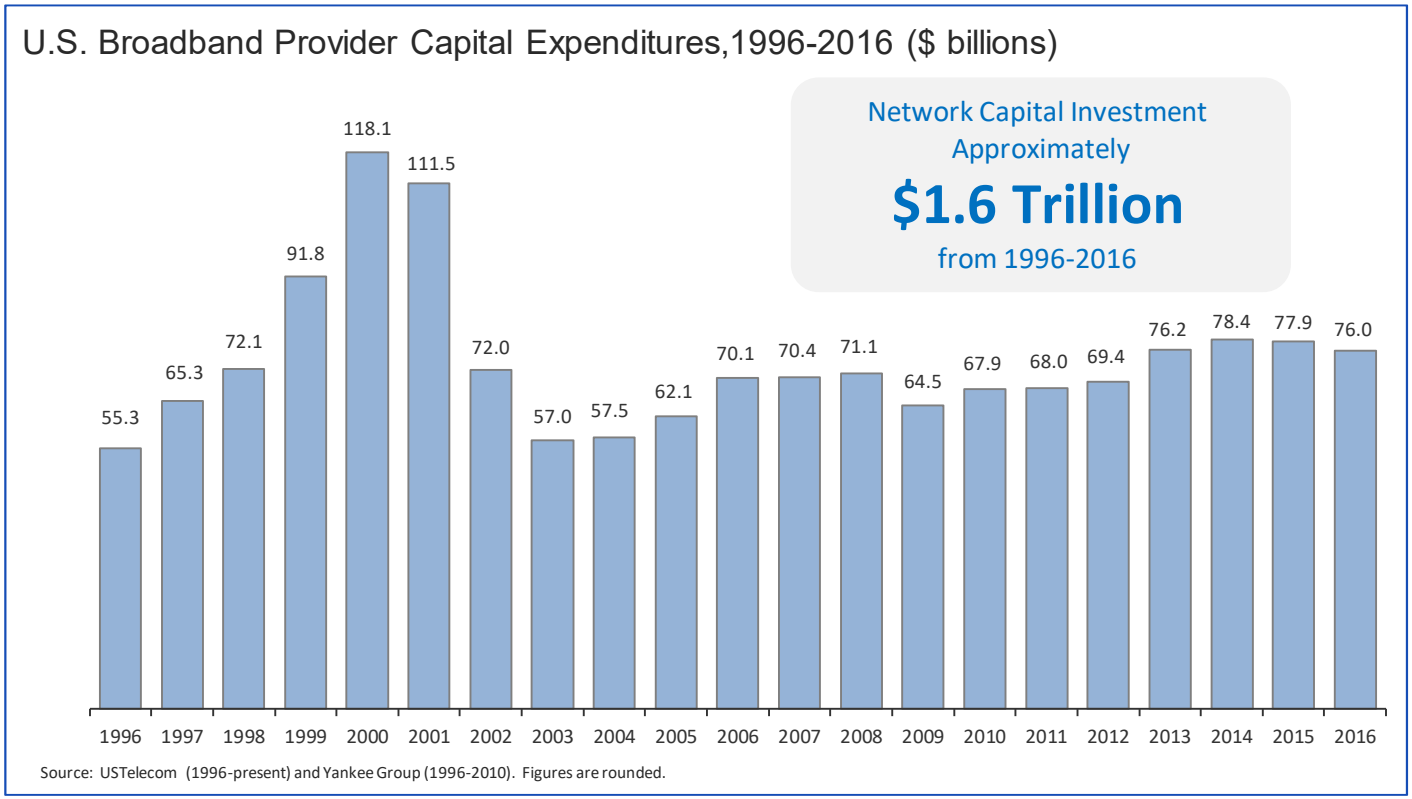
Households Have Shifted to Wireless and IP Voice



Sources: FCC, CDC, Census, USTelecom Analysis (2008-15P); and FCC, CDC, NCTA, Financial Reports, USTelecom Analysis (2003-7); projections based on six-month run rates.

Broadband Investment, Deployment and Adoption

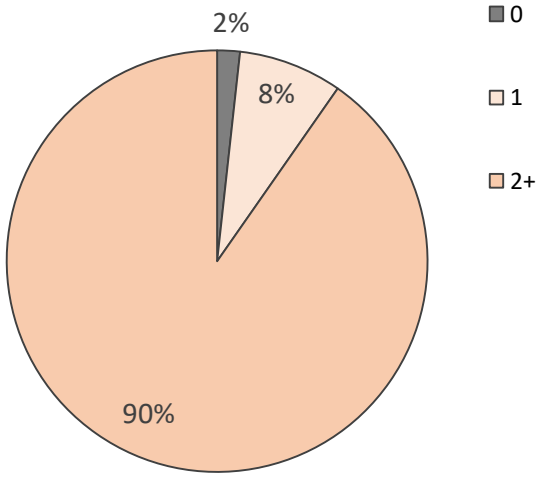
Competing Broadband Providers Have Invested $1.6 Trillion in Capital since 1996



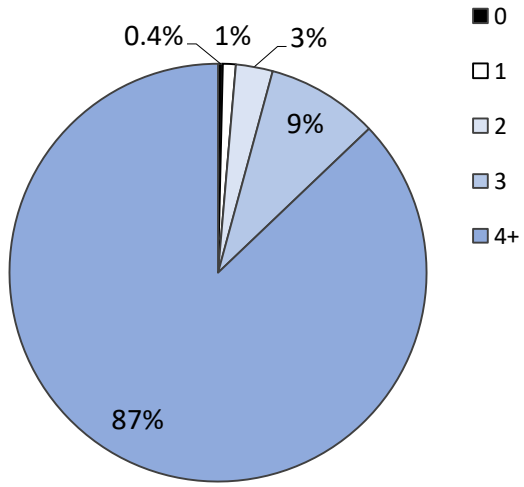
Data includes wireline, wireless, and cable providers.

Broadband Investment by Competitive Providers Has Brought Near-Nationwide Deployment

U.S. Fixed Broadband Choices Available at Any Speed
(% of Housing Units, Year-End 2016)

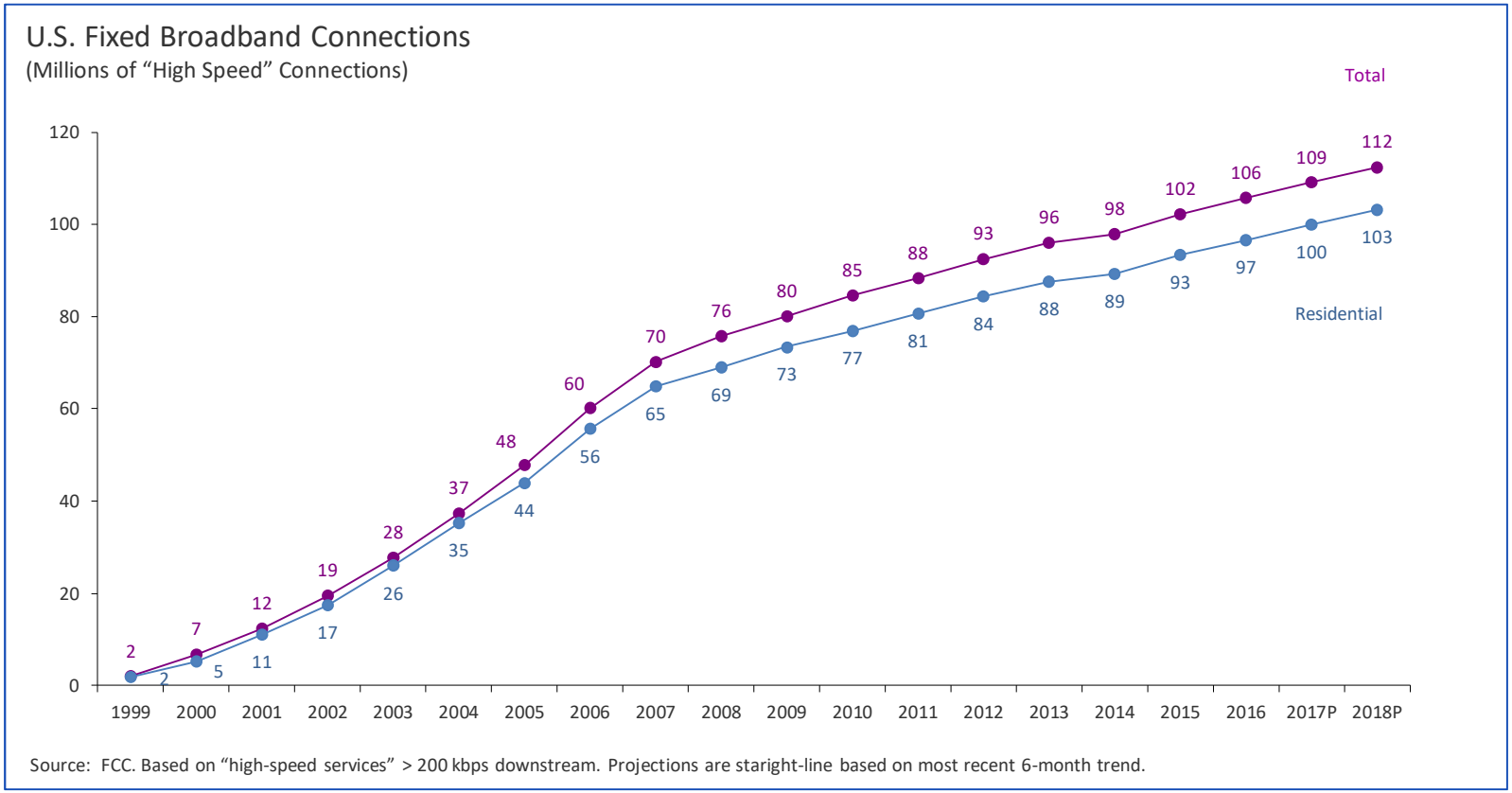


U.S. Wireless LTE Broadband Choices Available
(% of Housing Units, Year-End 2016)



Source: FCC, USTelecom, and Telcodata CensusNBM.com.

Investment Has Enabled Widespread and Ongoing Broadband Adoption

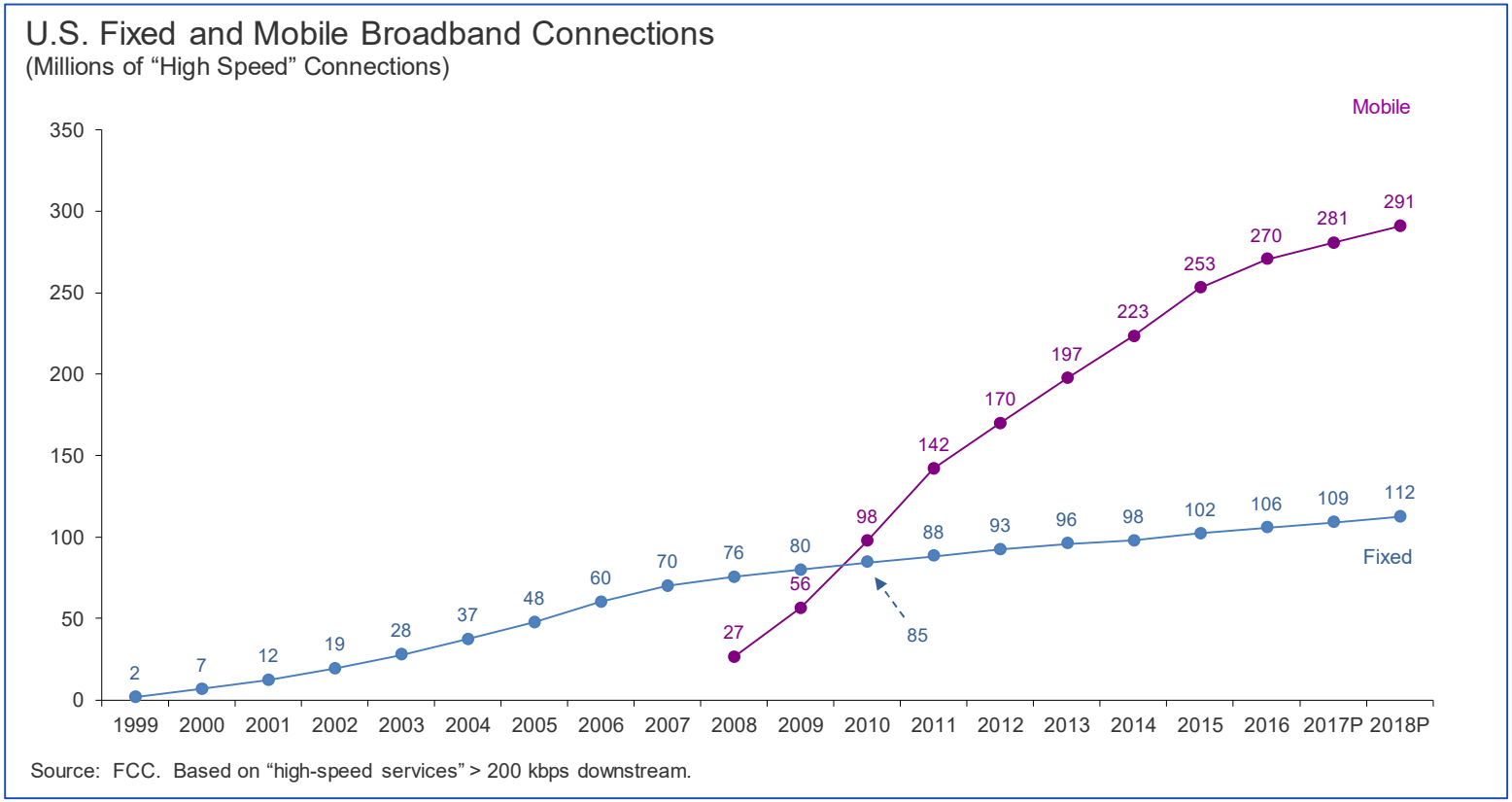


Fixed Broadband Penetration Is Nearing Four-Fifths of U.S. Households

Estimated U.S. Residential Fixed Broadband Penetration
(Percentage of U.S. Households with "High Speed" Connections)

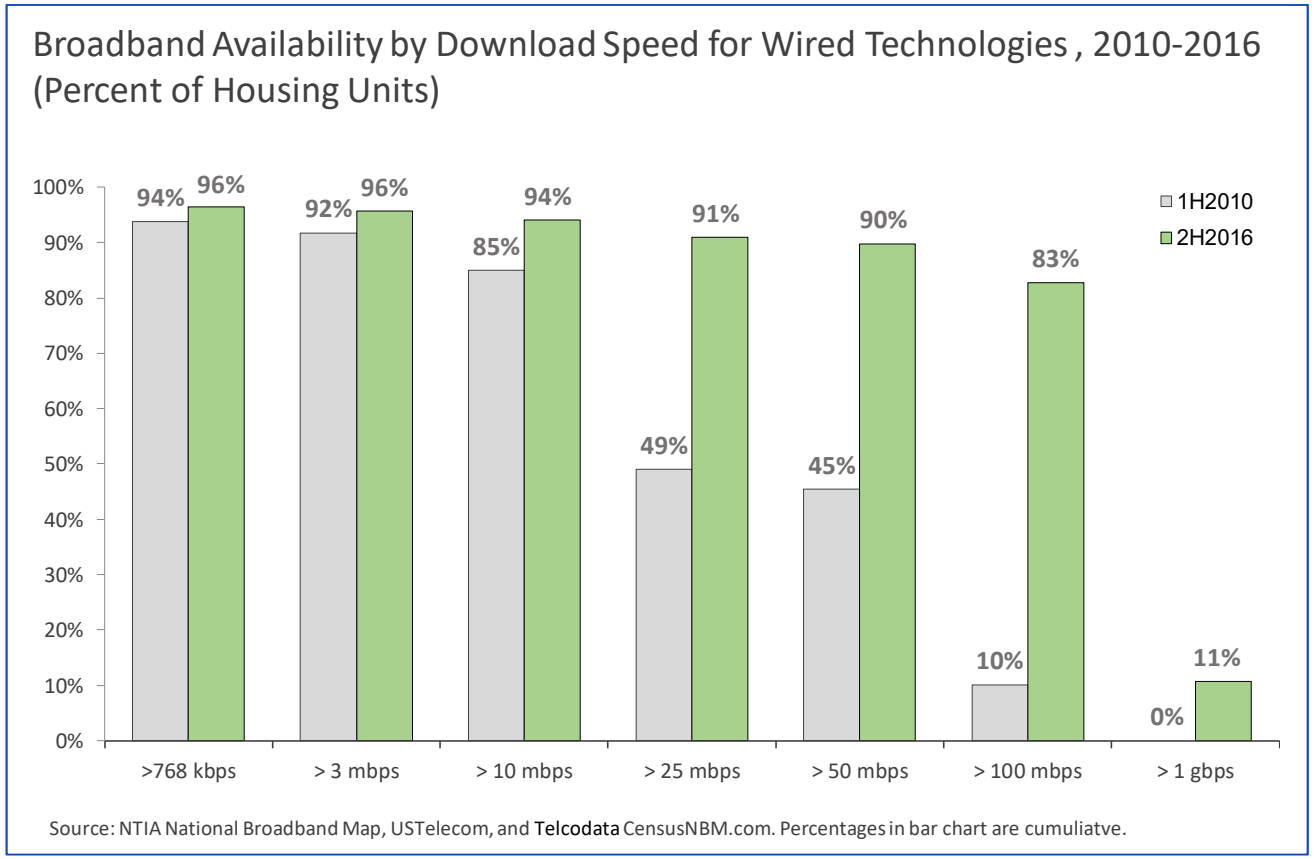
Source: FCC, Census, and USTelecom Analysis. Based on "high-speed services" > 200 kbps downstream. Projections based on most recent 6-month trend.

Mobile Broadband is Growing Rapidly



U.S. smartphone adoption estimates range from 77% of adults (Pew Internet, January 2018) to 82% of households (Consumer Technology Association, January 2018)

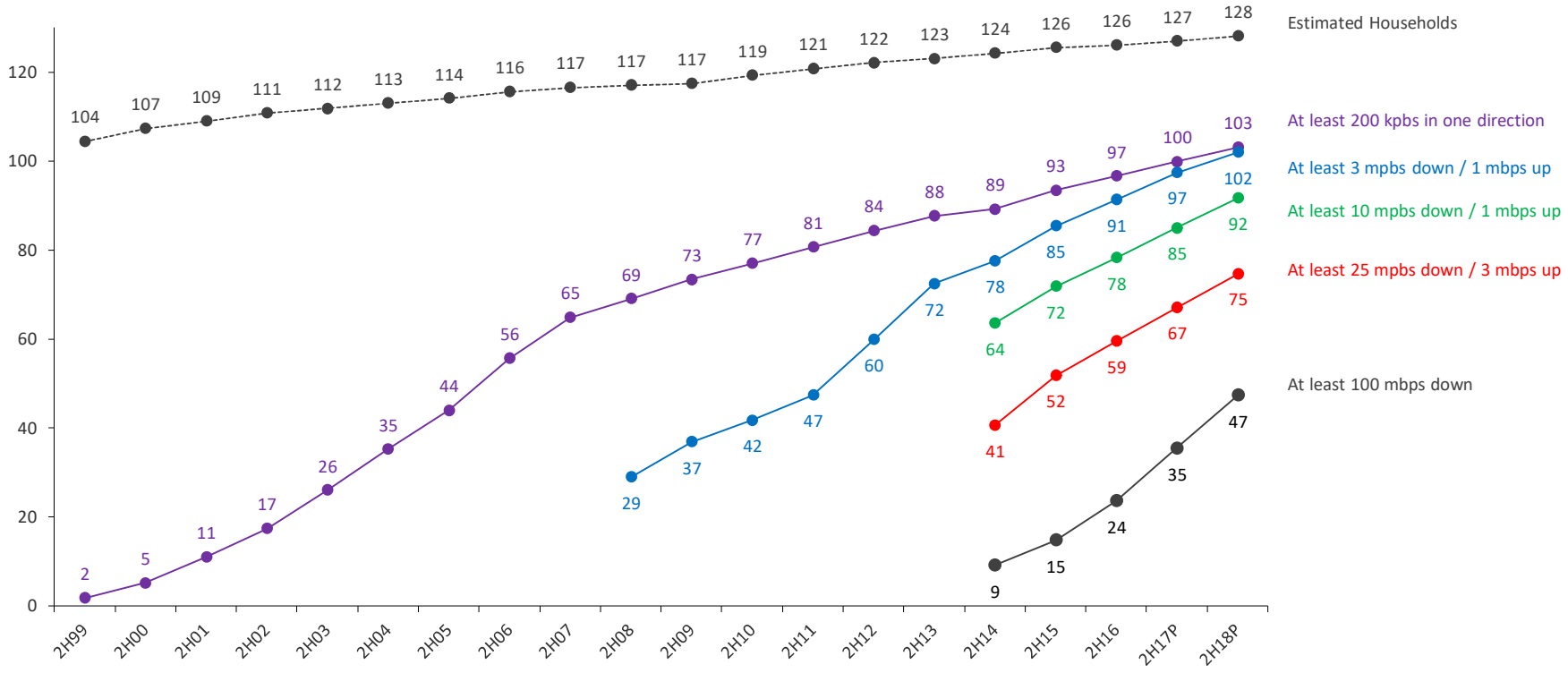
Providers Are Deploying Networks Capable of Providing Higher Speeds



Fourth generation mobile broadband was available to less and 1% of Americans in 2010 and 99.6% of Americans in 2016
Speeds are in excess of 10 mbps, in some cases approaching 20 mbps (opensignal.com)

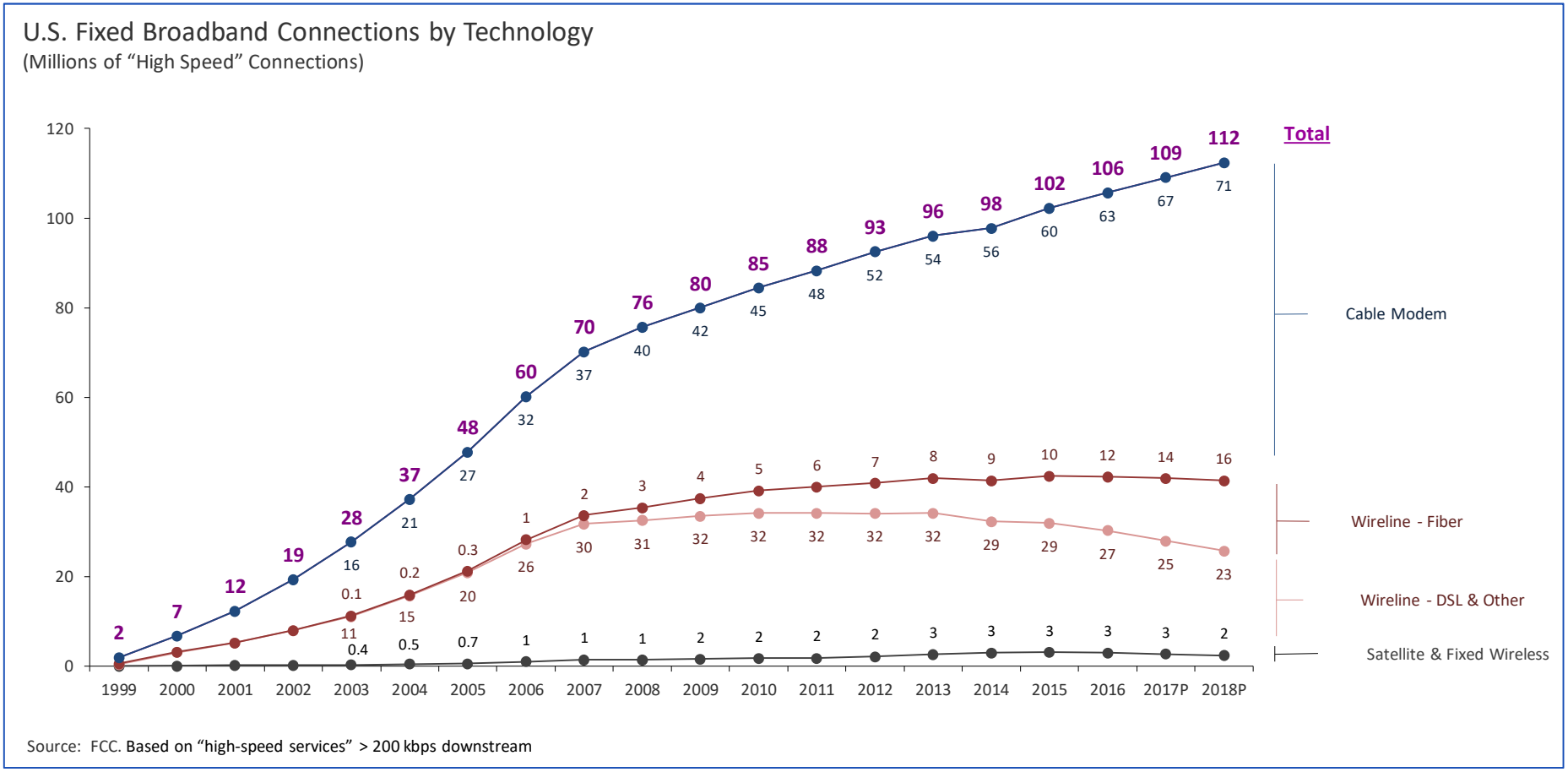
Consumer Are Choosing Services with Higher Speeds

U.S. Residential Fixed Broadband Connections by Speed and Households
(Millions of Connections)



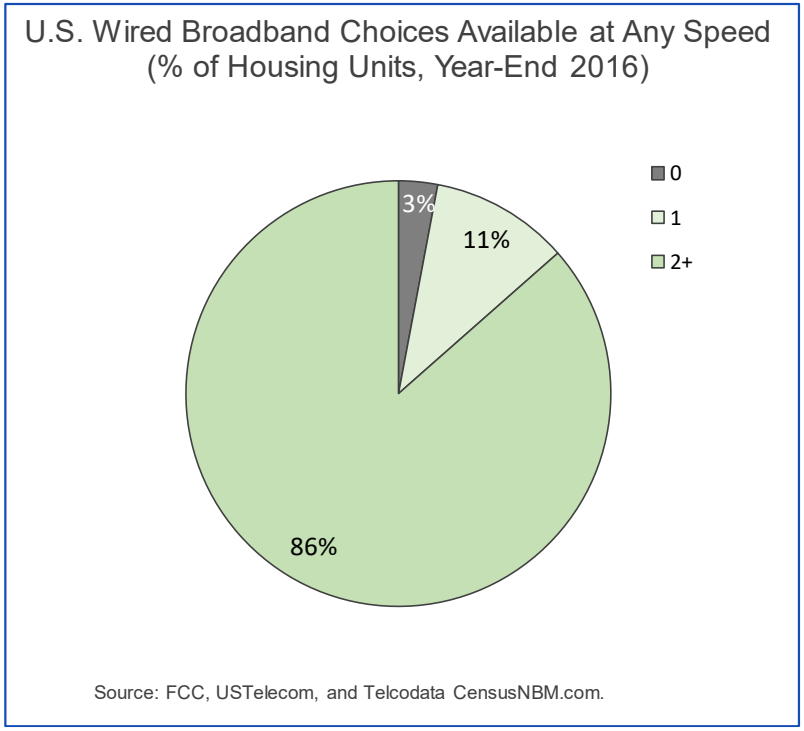
Source: FCC, Census, USTelecom. "At least" lower-speed categories are inclusive of higher-speed categories. Projections based on most recent 6-month trend.

Broadband Has Been a Competitive Industry from Its Inception



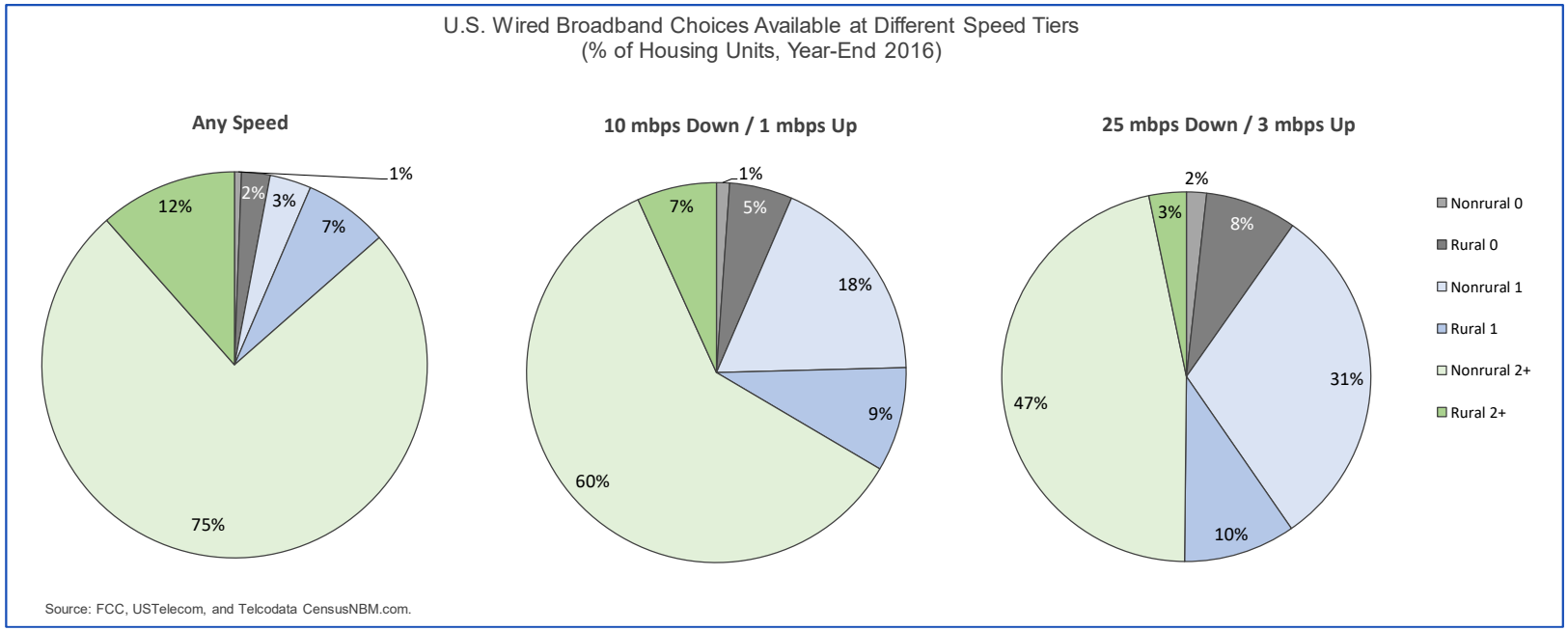
Source: FCC. Based on "high-speed services" > 200 kbps downstream

Core Competitive Broadband Infrastructure Is Widely Available



As shown above, mobile wireless broadband is also competitively deployed with 96 percent of Americans able to choose among three or more providers. The next several charts focus narrowly on wired broadband competition due to historical data limitations. Fixed broadband, which includes fixed wireless services, would show even greater competitive overlap.

Competitive Availability Varies with Speed

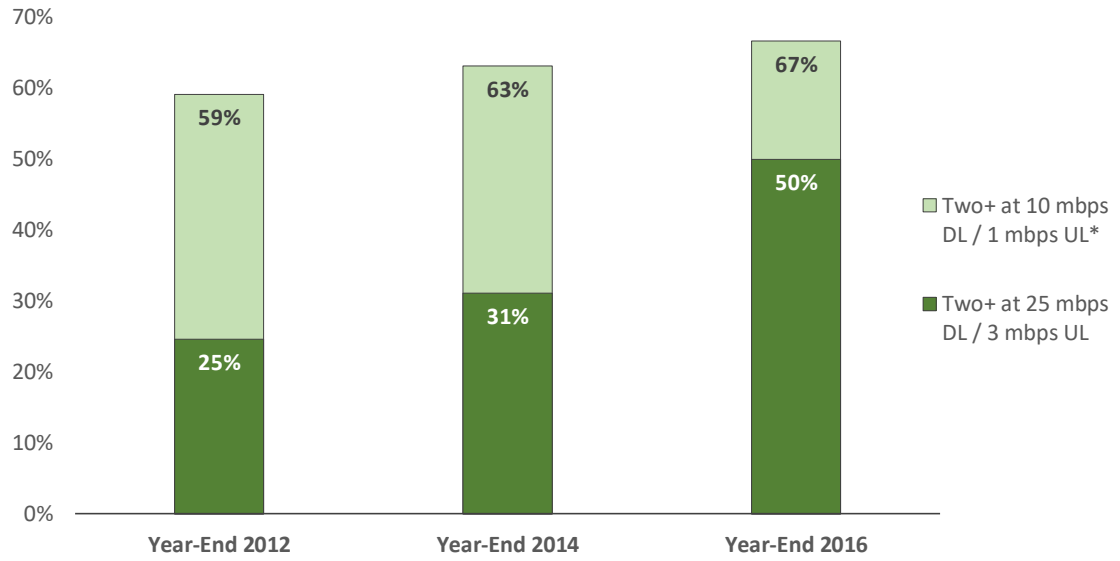


In a continual process of competitive leap-frog, wired broadband providers are at different stages of ongoing network upgrades

As Providers Invest in Network Upgrades… Competition at Higher Speed Is Growing

U.S. Broadband Competition: Services Deployed Widely and Speeds Growing Rapidly
(% of U.S. Housing Units with Two or More Wired Broadband Options Available at Selected Speed Tiers, 2012 to 2016)

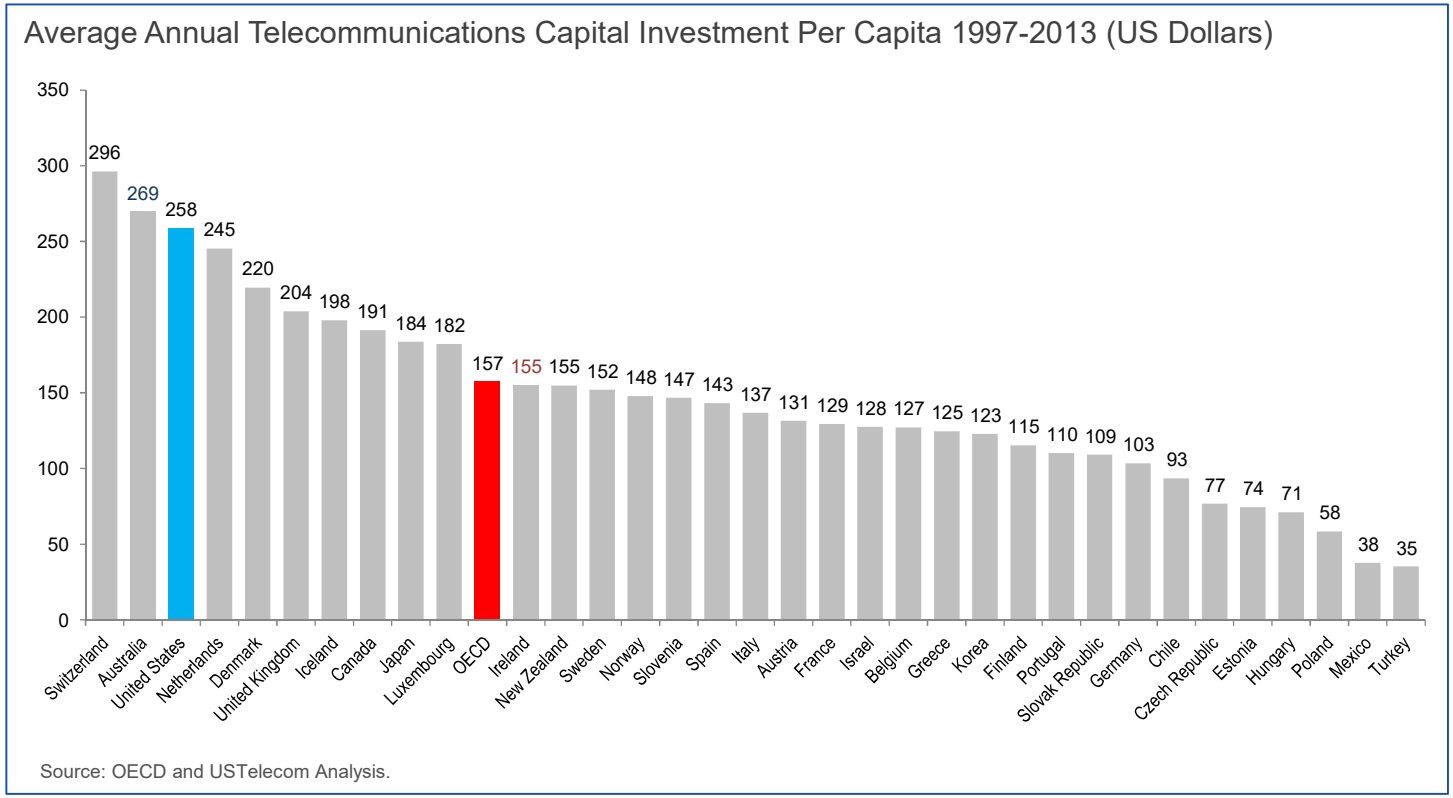
Two or more wired broadband providers are available to 86 percent of Americans and at least one option is available to 97 percent. Competition occurs dynamically over time as providers upgrade network speed and quality. In addition to wired options from telecom, cable, and others, multiple satellite and wireless options are available to nearly all Americans.



Sources: FCC, NTIA, USTelecom, and Telcodata CensusNBM.com.

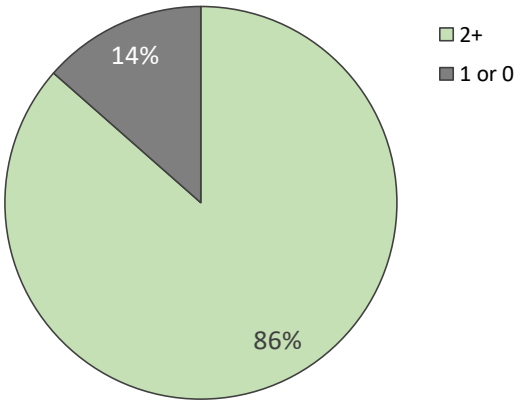
*10 megabit per second download / 1 megabit per second upload estimated for 2012 based on 10m download / 768 kilobit upload data available from NTIA. Data were adjusted proportionately according to FCC 2016 reported data for 10m DL / 1m UL and 10m DL / 768k UL.

U.S. Invests More in Broadband than Most Industrialized Nations



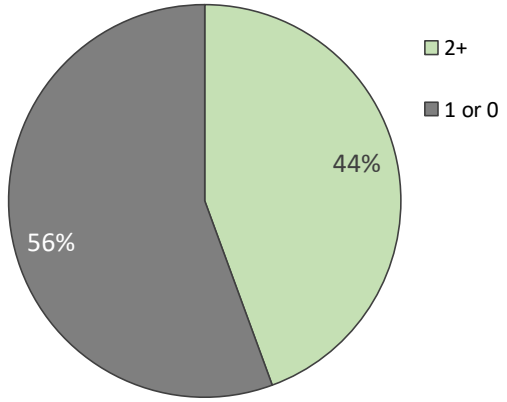
U.S. Investment Has Yielded More Competitive Choice than Europe

U.S. Wired Broadband Choices Available at Any Speed
(% of Housing Units, 2016)



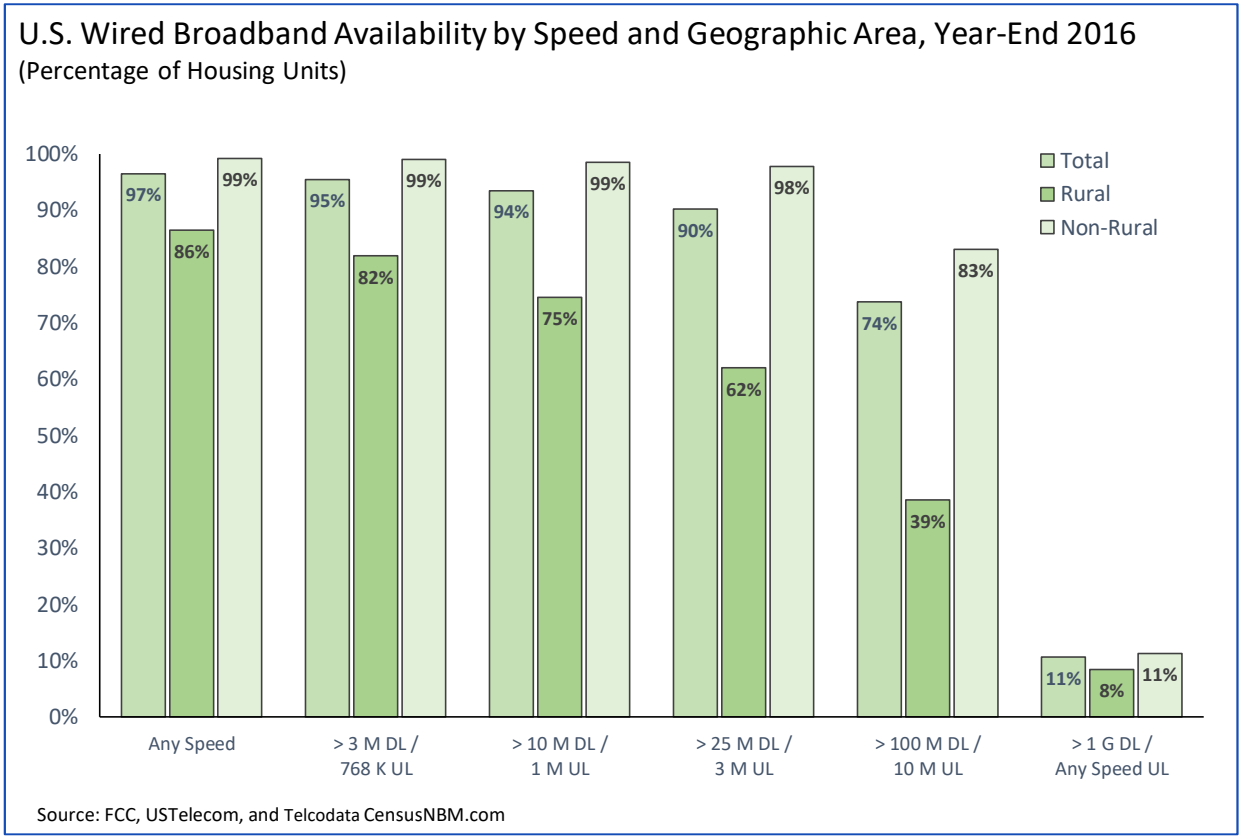
Source: FCC, USTelecom, and Telcodata CensusNBM.com.

EU28 Broadband Choices Available at Any Speed
(% of Households, 2016)



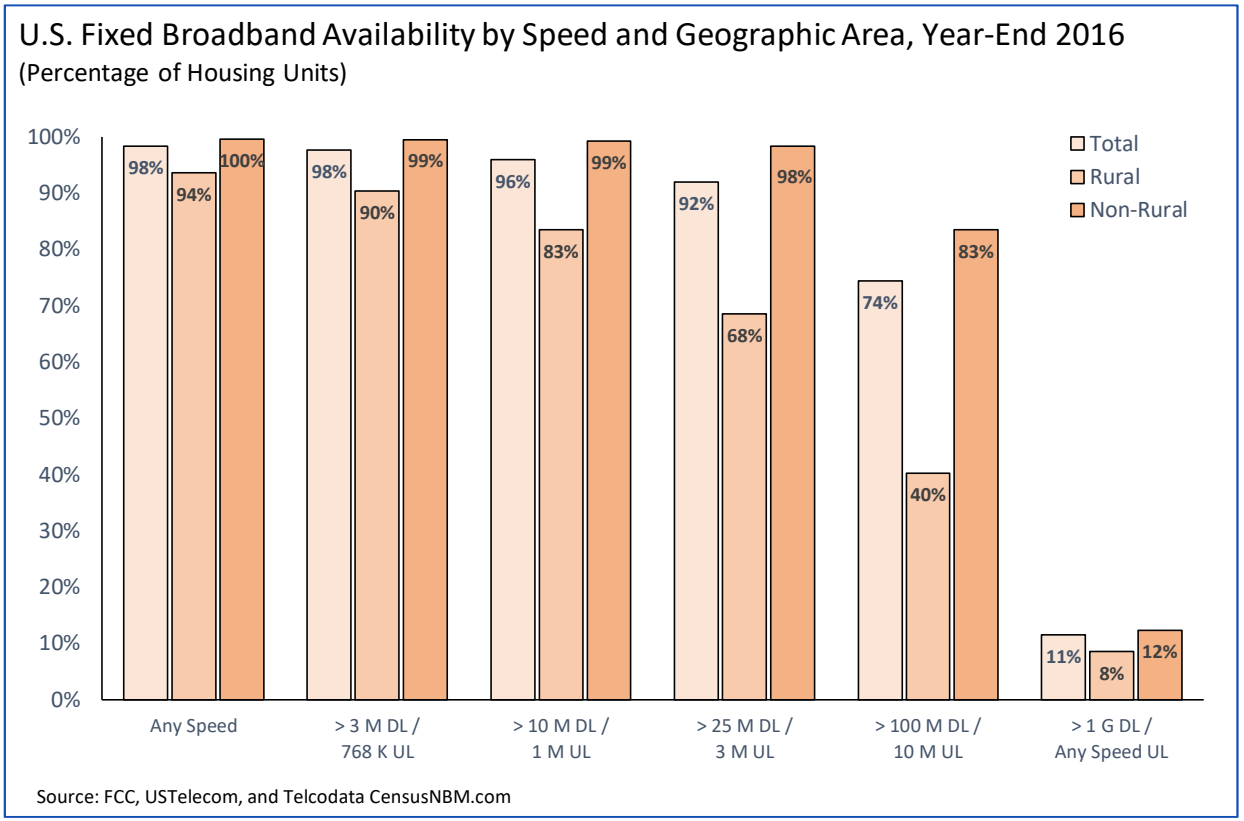
Source: European Union, USTelecom, and IHS Markit.

Broadband Gaps Remain in High-Cost Rural Areas



USTelecom supports direct, non-duplicative government support to broadband providers as the most economically and administratively efficient way to close broadband gaps

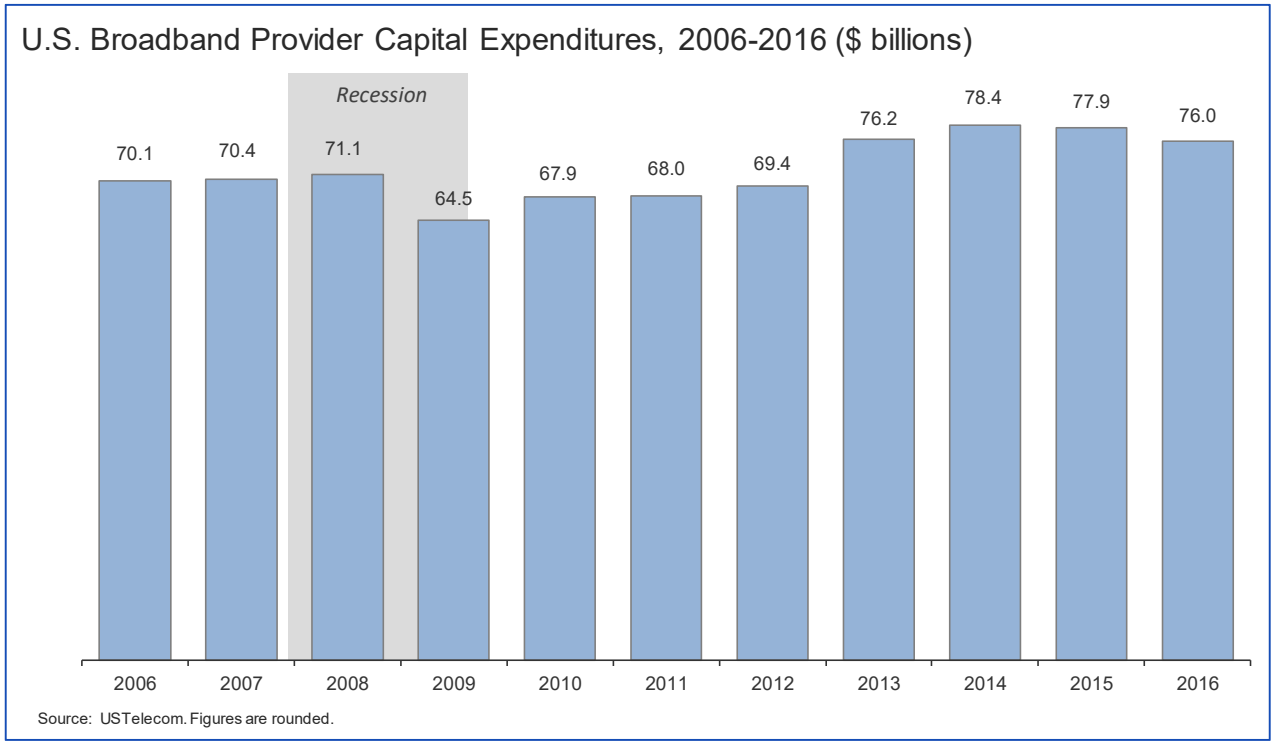
Fixed Wireless Eliminates Some Rural Coverage Gaps



These data include fixed terrestrial wireless

USTelecom supports flexible, cost-effective policies that do not impose rigid technology and speed requirements

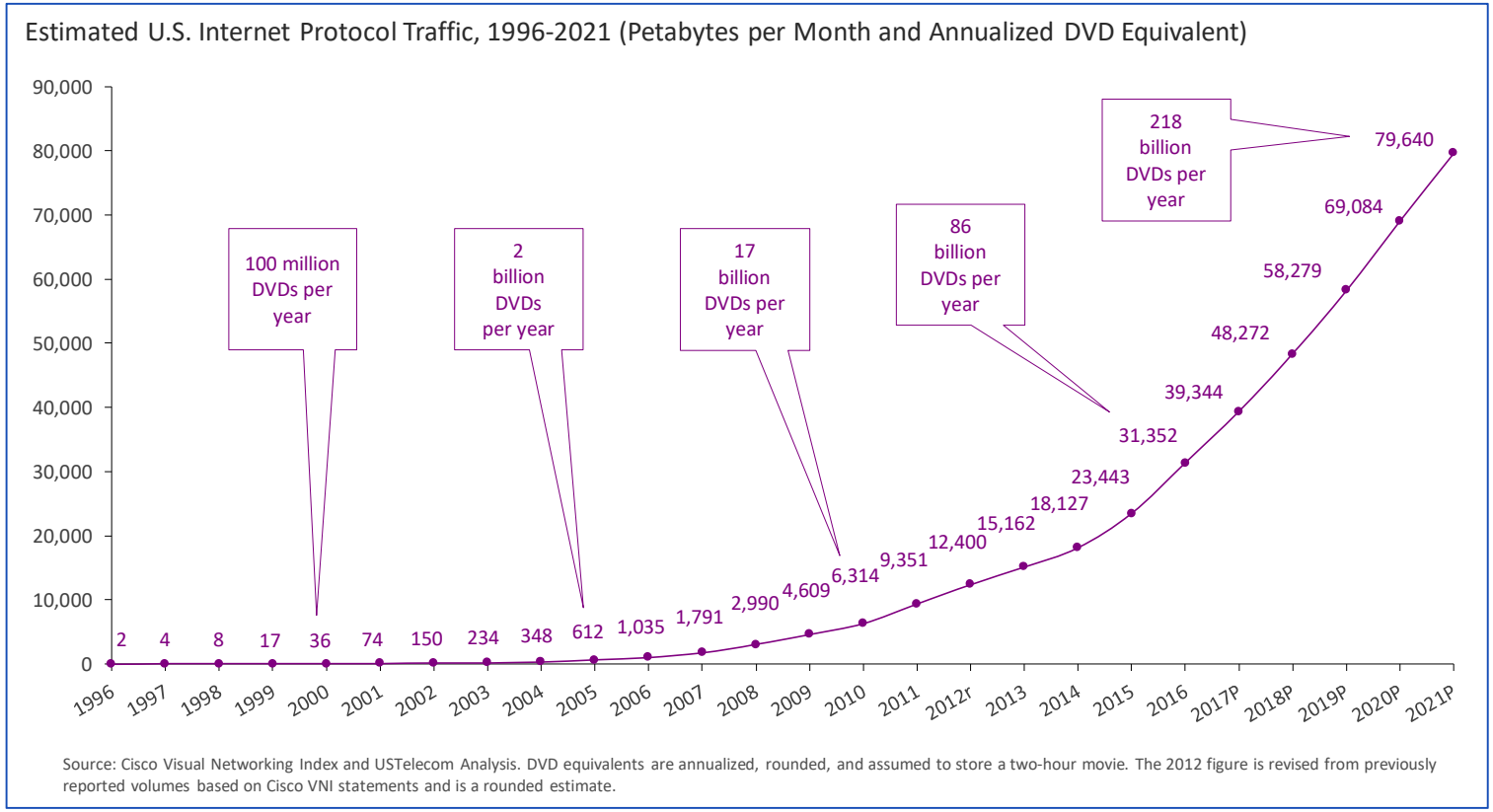
Broadband Capital Expenditures Declined in 2015 Coinciding with Heavy Title II Regulation



Addressing rural broadband gaps and maintaining international leadership will require increased broadband investment under an even-handed, light-touch regulatory framework

Internet Traffic Growth and Drivers

Internet Protocol Traffic Continues Rapid Growth

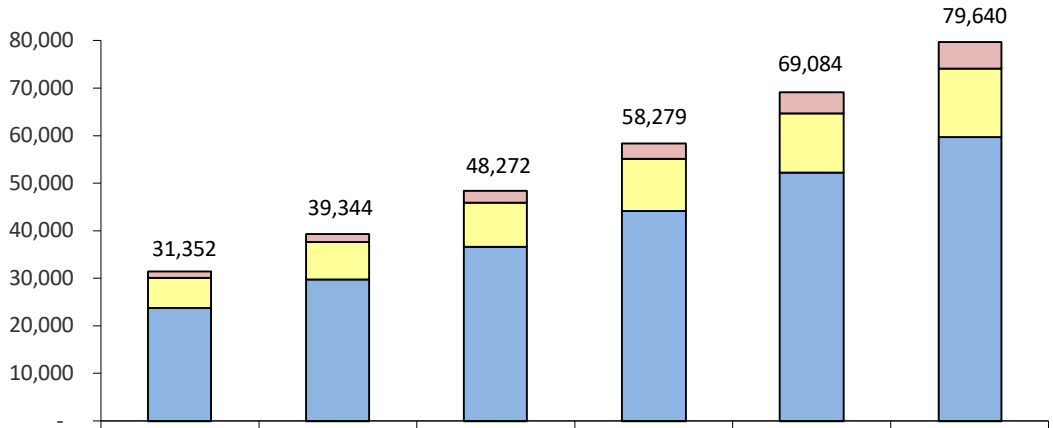


Source: Cisco Visual Networking Index and USTelecom Analysis. DVD equivalents are annualized, rounded, and assumed to store a two-hour movie. The 2012 figure is revised from previously reported volumes based on Cisco VNI statements and is a rounded estimate.

U.S. IP traffic is projected to grow 2.5x in the next five years

Video is the Biggest Driver of IP Traffic

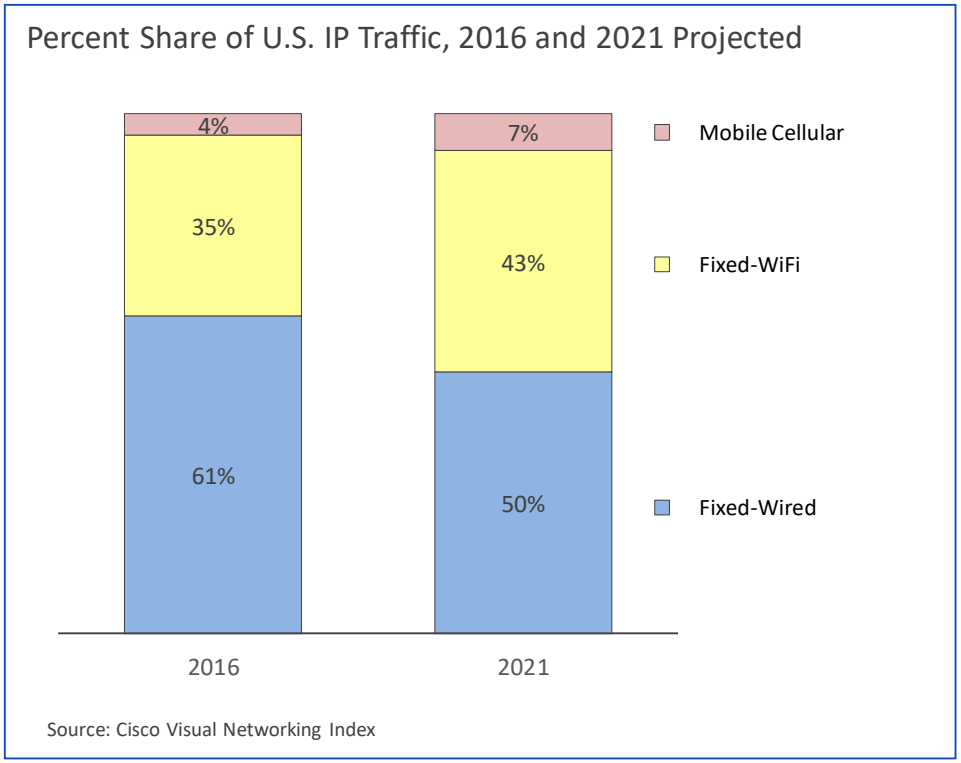
U.S. Internet Protocol Traffic, 2016-2021 (Petabytes per Month)



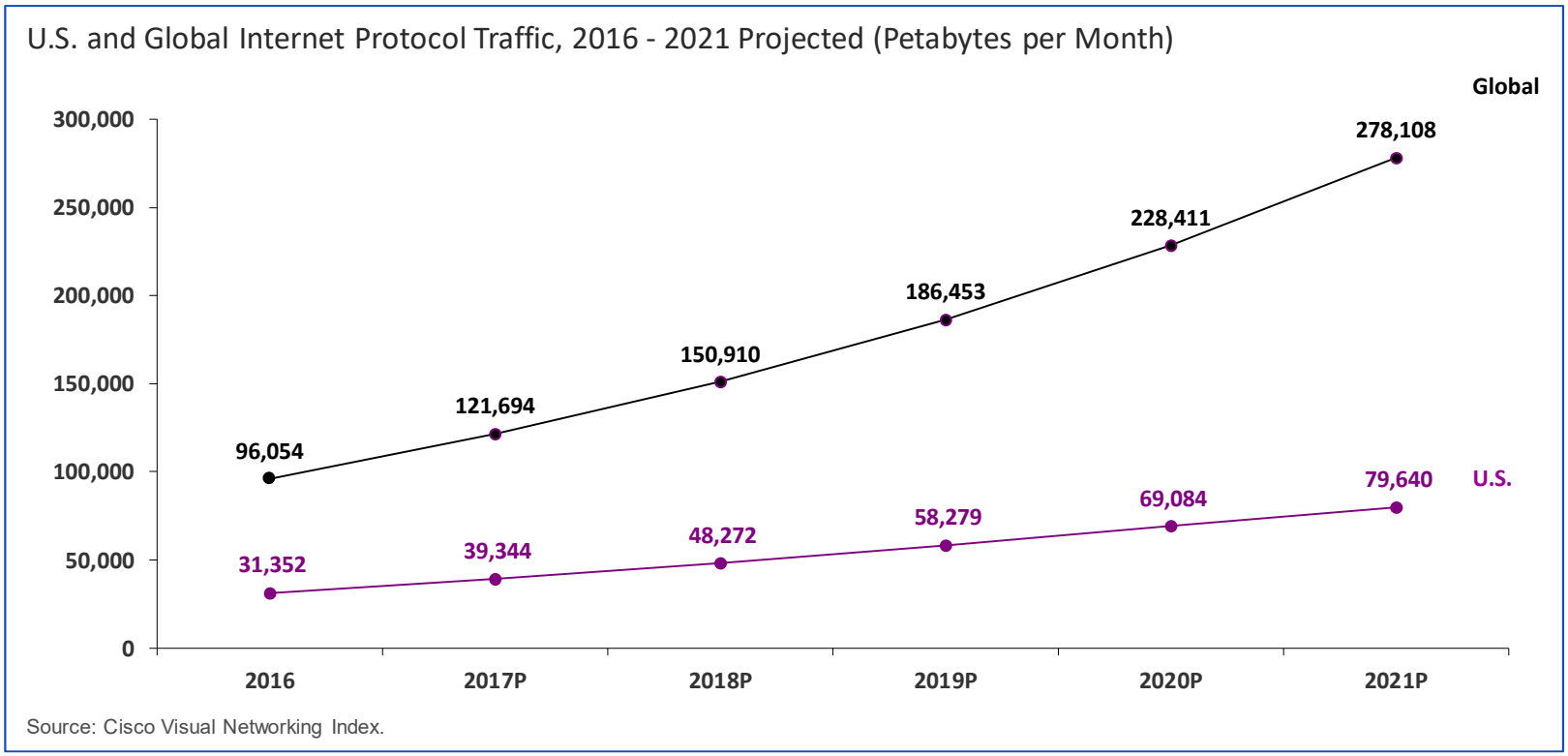
	2016	2017	2018	2019	2020	2021
Mobile	1,322	1,819	2,475	3,306	4,346	5,644
Fixed Consumer Data and Business	6,315	7,809	9,260	10,870	12,582	14,362
Fixed Consumer Video	23,715	29,716	36,537	44,104	52,157	59,634
Total	31,352	39,344	48,272	58,279	69,084	79,640

Source: Cisco Visual Networking Index and USTelecom analysis. Mobile and business include video; consumer data includes all consumer non-video.

Mobile and Wi-Fi Are Growing but Fixed Networks Remain Essential for All Traffic

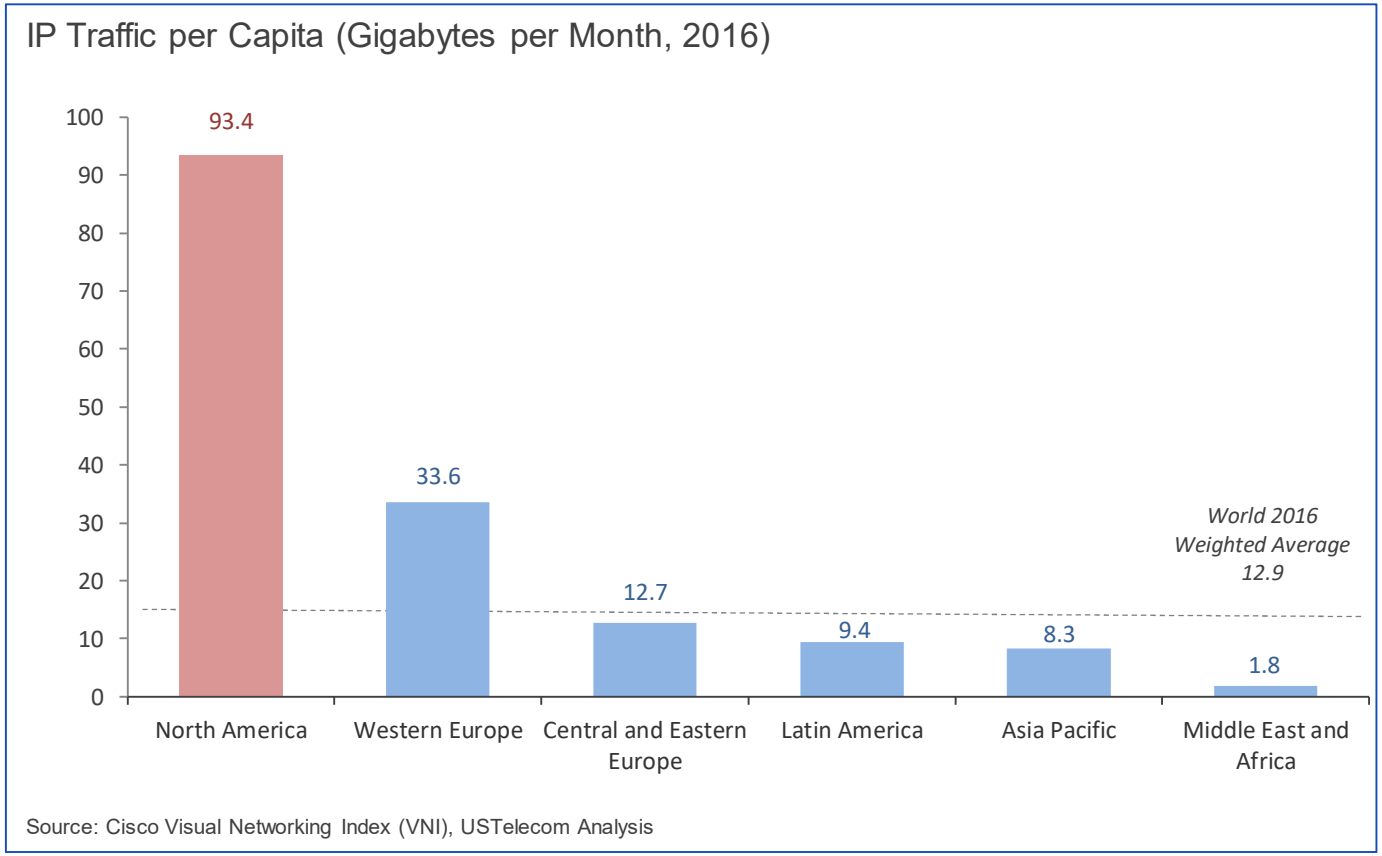


The U.S. Is a Global Leader in IP Traffic

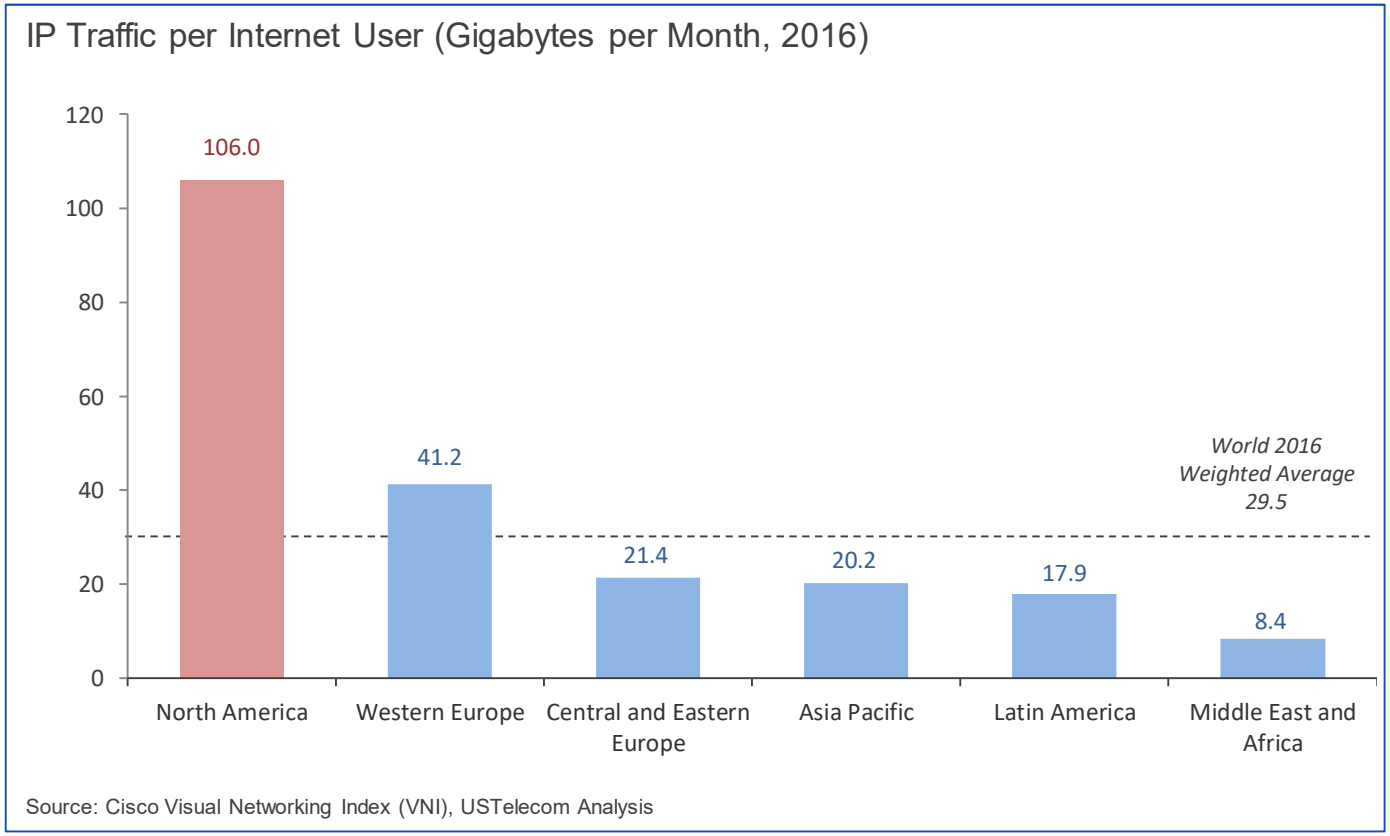


The U.S. is home to 4.4% of the world's population, but it generates nearly one-third of global IP traffic

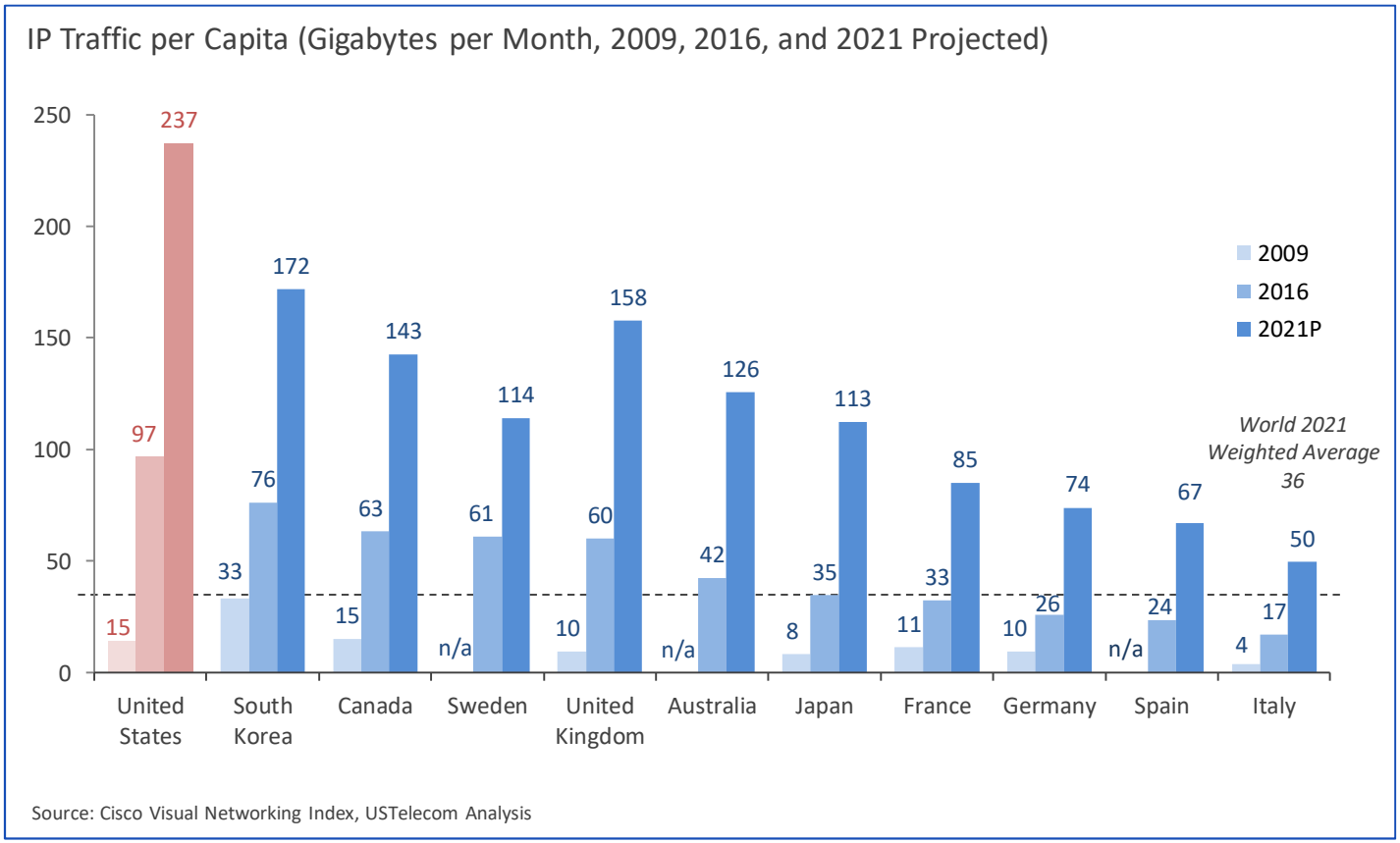
North America Leads in IP Traffic per Capita



North America Leads in IP Traffic per User

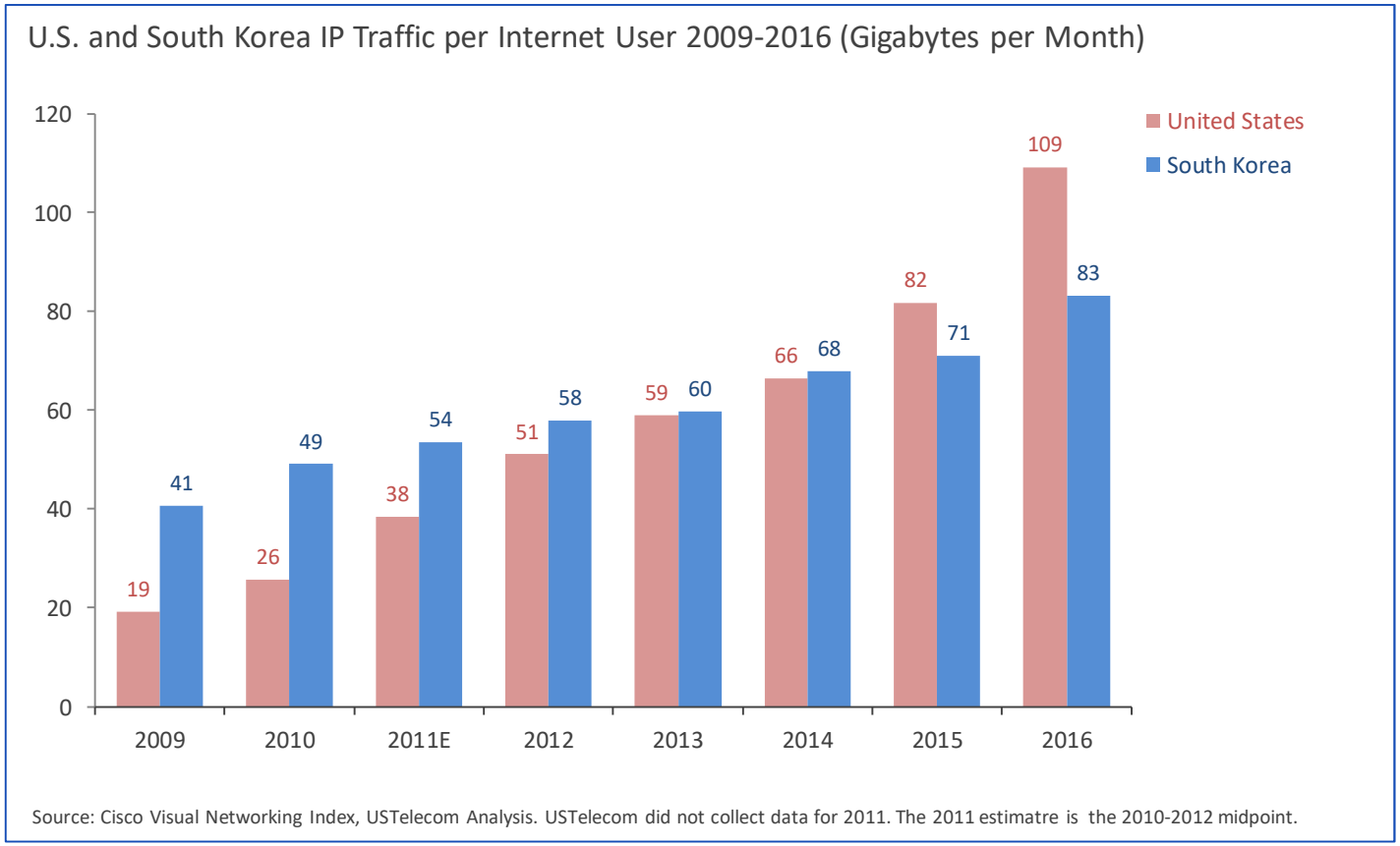


The U.S. Leads Other Industrialized Nations in IP Traffic per Internet User



Source: Cisco Visual Networking Index, USTelecom Analysis

The U.S. Has Surpassed Former Leader South Korea and Now Leads the World in Internet Traffic per User



Where Are We Headed?

- Continued migration of analog world online, from video to the Internet of Things
- Rationalization of networks
  - More fiber closer to network end-points for efficient multi-purpose use
  - Dynamic, software-based network operation and management
- Convergence of wireline and wireless with fiber and 5G
  - Cloud migrating closer to the user
  - Network functions migrating back to the data center
  - Lower latency as well as higher speeds
  - New forms of competition
- New networked applications
  - The usual suspects: autonomous vehicles, artificial intelligence, augmented reality/virtual, big data analytics, the Industrial Internet, the Internet of Things, smart cities, telemedicine
  - The unknown …

Additional USTelecom Industry Analysis Resources

- USTelecom Research Brief: *U.S. Broadband Availability Year-End 2016* (February 22, 2018)
- USTelecom Research Brief: *U.S. Internet Usage and Global Leadership Are Expanding* (November 27, 2017)
- USTelecom Research Brief: *Broadband Investment Continued Trending Down in 2016* (October 31, 2017)
- USTelecom Blog: *Achieving the Promise of Fiber-Enabled 5G Networks* (October 27, 2017)
- USTelecom Research Brief: *U.S. Broadband Availability Mid-2016* (August 25, 2017)