Before the
FEDERAL TRADE COMMISSION
Washington, DC 20580

In the Matter of	)	
	)	
Competition and Consumer Protection in the 21st Century Hearings	)	Project Number P181201
	)	
	)	

COMMENTS OF USTELECOM

TOPIC 2 - Competition and Consumer Protection Issues in Communication, Information, and Media Technology Networks

INTRODUCTION

USTelecom – The Broadband Association (USTelecom) respectfully submits these comments in response to the Federal Trade Commission's (FTC or Commission) notice of hearings and request for comments in connection with a forthcoming series of public hearings "to examine whether broad-based changes in the economy, evolving business practices, new technologies, or international developments might require adjustments to competition and consumer protection law, enforcement priorities, and policy."[1] We applaud the FTC for initiating this important examination of the need for modernized regulation and oversight; it is well-timed as the nation continues to focus on bringing about the next generation of advanced, high-speed technologies and services required to meet the communications and broadband needs of our government, consumers, and industry in the 21st Century.

The comments we submit today will largely address the broadband internet industry, and the implications of regulatory incursion into a space that, while arguably no longer considered

[1] Hearings on Competition and Consumer Protection in the 21st Century, Notice of Hearings and Request for Comments, 83 FR 38307 (Aug. 6, 2018) (Notice).

nascent, remains in many ways in an incubation stage. In just a couple of decades, the growth of internet access in the United States has gone from the days of dial-up modems and "you've got mail" to today's nearly ubiquitous availability of supercomputer power using a device that fits in your pocket.

This growth and innovation bodes well for the future of the vibrant internet industry. Facilities-based broadband providers, including USTelecom member companies, deserve much of the credit. They have invested more than $1.6 trillion into broadband infrastructure and technology since 1996. Decisions to invest at this level in largely sunk cost infrastructure facilities have been aided by U.S. policies that encourage and reward investment and innovation, in particular, Congress's declaration that "it is the policy of the United States … to preserve the vibrant and competitive free market that presently exists for the Internet … unfettered by State or Federal regulations."[2] As one global investment analyst noted, regulatory structures matter, and they may be the most influential determinant of outcomes.[3] It is therefore important, going forward, that America's world-leading internet growth not be stifled by unnecessary and overly burdensome regulation.

USTelecom appreciates this opportunity to add to the discourse on these important issues. We will address the importance of effective protections that ensure adequate disclosure of service terms and conditions and the need to apply such protections to all players in the internet ecosystem. Other uncodified net neutrality protections are likewise important, and we believe the FTC has ample Section 5 authority to identify and police violations of what have always been

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[2] 47 U.S.C. §230(b)(2)

[3] *See* HSBC, "Global Telecoms: Regulatory Heatmap – A Temperature Check," (Oct. 2016) ("the ramifications of regulatory decisions … extend to determining a given country's or region's prospects of securing an advantageous level of network investment").

basic consumer internet freedoms and rights. We also will provide data on how competition has increased and is thriving due to internet provider investment and innovation, and discuss the importance of clearing out regulatory underbrush – that is, exercising restraint rather than intervention – to ensure that competition and infrastructure deployment continue unabated. Our comments will also examine some of the unique competition and consumer protection issues associated with the internet and online commerce. We also look forward to participating in the forthcoming hearings and public discussions of these and other topics.

DISCUSSION

(a) Whether contemporary industry practices in networked industries continue to present competition and consumer protection concerns like those discussed in the prior reports.

The FTC staff's 2007 *Broadband Connectivity and Competition Policy Report*[4] summarized findings on broadband internet connectivity in general and network neutrality in particular, addressing both competition and consumer protection issues. The report examined the then-current and future state of broadband competition, and primarily addressed two broad areas of consumer protection concerns: clear and conspicuous disclosure of material terms, and security and privacy issues created by broadband internet access services.

Broadband internet access provider industry practices – namely, innovation and infrastructure investment – coupled with light-touch regulation have brought about the increased competition and availability of services Americans now enjoy. For more than a decade, we have seen steady, measurable changes in the broadband market in terms of speed, availability, and access. Most notably, new smart phones and tablets have generated explosive demand for

[4] FED. TRADE COMM'N STAFF, BROADBAND CONNECTIVITY COMPETITION POLICY (2007), available at https://www.ftc.gov/sites/default/files/documents/reports/broadband-connectivity-competition-policy/v070000report.pdf.

mobile broadband services, and many consumers are increasingly starting to turn to mobile services predominantly or exclusively for broadband access and internet usage. Fixed broadband providers have responded by deploying ever faster services using a range of technologies, from newer generation cable and DSL services, to fiber, to fixed wireless and satellite broadband services. Meanwhile, edge providers, app developers, and other technology companies that offer internet-dependent products and services have flourished as consumers have adopted a wide range of new applications, from sharing economy services, to gaming and streaming music and media services, to wearable technologies and social media. Innovations in artificial intelligence, virtual/augmented reality, mobile financial services, the industrial internet, and the internet of things are constantly changing the internet landscape for the better.

(i) Broadband Competition

With regard to the evolution of broadband competition, USTelecom has closely tracked this marketplace and reported on the state of broadband competition from several perspectives. Data on the current state of broadband competition and deployment are analyzed and presented in the attached slide deck (Exhibit A)[5] and research brief (Exhibit B).[6] For purposes of these comments and Exhibits A and B, fixed broadband includes wired broadband (e.g., xDSL, fiber, and cable) and fixed wireless broadband (e.g., terrestrial fixed wireless and satellite, though the USTelecom analyses exclude satellite unless specifically stated). We note, however, that because mobile wireless broadband is widely used and in many cases can achieve speeds

[5] "USTelecom Industry Metrics and Trends 2018," Slide Deck by Patrick Brogan, VP – Industry Analysis, USTelecom (Mar. 1, 2018) (Exhibit A).

[6] "U.S. Broadband Availability Year End 2016," Research Brief by Patrick Brogan, VP – Industry Analysis, USTelecom (Feb. 22, 2018) (Exhibit B).

comparable to some fixed offerings, any comprehensive assessment of broadband competition must take mobile offerings into account.

Historically, the broadband marketplace has always been a dynamic one. Static analyses[7] are inadequate for assessing fixed broadband competition because they do not reflect that the technology is in a constant state of change such that competition is intensifying within and across non-traditional sectors. Therefore, accounting for both actual and potential competition is essential to making meaningful determinations about the state of competition.[8]

One key indicator of competition is broadband deployment by multiple providers in the same geographic areas. USTelecom's broadband availability analysis uses CensusNMB.com data from Telcodata to analyze the overlap of competitive footprints at a range of speeds.[9] Exhibits A and B both show the current levels of competition for wired broadband and the state of competition for fixed broadband (including fixed wireless, but excluding satellite).[10]

It is important to note that the analyses in Exhibits A and B are not limited to arbitrary speed categories. Although it may be appropriate to be aspirational by assessing broadband

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[7] Examples of static analysis methodologies include traditional antitrust tools such as SSNIP (small but significant non-transitory increase in price) tests; Herfindahl-Hirschman Index (HHI) analysis; and, generally, snapshots in time that look at static market shares and arbitrary speed cut-offs.

[8] *Business Data Services in an Internet Protocol Environment; Technology Transitions; Special Access for Price Cap Local Exchange Carriers; AT&T Corporation Petition for Rulemaking to Reform Regulation of ILEC Rates for Interstate Special Access Services,* Report and Order, 32 FCC Rcd 3459 (2017).

[9] *See* Exhibit A at 13, 20-22; Exhibit B at 10, Charts 9 & 10, which show the current levels of competition for wired broadband; and Exhibit B at 11, Charts 11 & 12, which show the state of competition for fixed broadband (including fixed wireless, but excluding satellite). Telcodata derives its CensusNMB.com broadband deployment data from the Federal Communications Commission (FCC) Form 477 data from 2014 to 2016 and the National Broadband Map for prior years. Telcodata uses Census population and household data in the CensusNBM.com data. *See* Exhibit B at 15-17 for a detailed explanation of the data and methodology.

[10] *See* Exhibit A at 13 and 20-21; Exhibit B at 10 and 11.

availability at incrementally higher speed thresholds, it also is essential to use a framework that takes account of how broadband is actually deployed over time. Using such a framework, we first note that the underlying foundation of fixed broadband infrastructure is widely deployed: 97 percent of households have at least one wired broadband option; 98 percent if fixed wireless is included; and nearly the entire country if satellite and mobile wireless broadband are included.[11] Second, the steady increase in broadband speed options suggest that higher speeds are routinely deployed through upgrade cycles.[12] Third, the data likewise suggest that new technologies and players from outside the traditional broadband internet industry have emerged to challenge existing technologies and providers.

As demonstrated in Exhibit A, deployment at higher speeds is continually increasing in a process of competitive leapfrog. As of the end of 2016, there were at least two providers of basic wired broadband infrastructure available to 86 percent of U.S. households—90 percent if fixed wireless is included.[13] Mobile wireless broadband over fourth generation LTE technology was available to 99.6 percent of U.S. households as of the end of 2016 and 96 percent of Americans could get mobile broadband from three or more providers.[14] In addition, competitive deployment of wired broadband – areas where at least two wired providers have deployed facilities – is increasing over time at higher speeds as providers upgrade networks for faster

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[11] *See, e.g.*, Exhibit B at 1-3 and Charts 1 and 2.

[12] *See, e.g.*, Exhibit A at 17 and Exhibit B at 6, Chart 6, showing the growth of broadband at various speed categories from 2010 to 2016. Note that USTelecom only provides data for "wired" broadband in its historical broadband deployment analyses because the National Broadband Map, which was in use from 2010 through 2013, did not report a fixed broadband category that included both wired and fixed wireless broadband.

[13] *See e.g.*, Exhibit A at 13 and 20; Exhibit B at 3, Chart 2, and 11, Chart 11.

[14] *See e.g.*, Exhibit A at 13; Exhibit B at 1, Chart 1.

service.[15] The portion of U.S. households with two or more wired broadband providers available at 10 Megabits per second download and 1 Megabit per second upload grew from 59 percent in 2012 to 67 percent in 2016.[16] The portion of U.S. households with two or more wired broadband providers available at 25 Mbps download and 3 Mbps upload grew from 25 percent to 50 percent.[17]

Broadband adoption and subscription data from the FCC Form 477 data provide further evidence that the market is functioning well. First, the subscription data show that adoption at higher speeds is growing. For example, the data on page 18 of Exhibit A indicate that consumer demand for and adoption of better, faster service have steadily increased, which drives ongoing investment in competitive supply at higher and higher speeds over time. Moreover, subscription share data indicate that fixed broadband has been competitive from its inception. As demonstrated on page 19 of Exhibit A, at the end of 2016, cable providers held 63 percent of the overall fixed broadband market, telephone companies (DSL or fiber) held 35 percent, and satellite and fixed wireless providers held two percent. In other words, the FCC's Form 477 broadband subscription data, in combination with the FCC's Form 477 broadband deployment data, demonstrate that consumer demand for greater speeds is driving constant cycle of competitive investment to supply greater speeds.

The FTC should not limit competitive analysis narrowly to "fixed" broadband, because mobile technology is increasingly competing for fixed broadband business and traditional notions of fixed broadband are changing. Today's fourth Generation (4G) mobile speeds are on

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[15] *See* Exhibit A at 22 and Exhibit B at 3, Chart 3. Historical data are available only for wired broadband.

[16] *Id.*

[17] *Id.*

par with some DSL services.[18] A portion of customers use mobile broadband only and some portion of these consumers appear to have a choice.[19] When 5G mobile becomes available, all indications are that it will be even more powerful. While the FCC recently found that mobile broadband services are not "currently full substitutes for fixed service," it must continue to monitor developments as technology and markets evolve to determine if and when that finding is no longer appropriate.[20] As an indicator of the potential for fixed-mobile broadband substitution, household voice mobile substitution started out slowly but mobile gradually overtook switched wireline as the more dominant household voice service. In 2003, wireless-only voice households accounted for only five percent of telephone households but now they account for over 60 percent. Additionally, 5G fixed wireless has the potential to be a

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[18] *See e.g.,* "State of Mobile Networks: USA (July 2018)" at https://opensignal.com/reports/2018/07/usa/state-of-themobile-network (visited Aug. 9, 2018) (showing download speeds ranging from more than 10 Mbps to more than 20 Mpbs and upload speeds between 2 Mbps to 4 Mbps). Compare to Exhibit B at Appendix A (showing DSL available to 87 percent of households at any speeds and 57 percent with at least 10 Mbps download and 1 Mbps upload).

[19] *See e.g.*, Pew Research Center, "Internet/Broadband Fact Sheet" at http://www.pewinternet.org/fact-sheet/internet-broadband/ (visited Aug. 9, 2018) (showing that 20 percent of U.S. adults own smart phones but do not use broadband at home). *See also,* Pew Research Center, "U.S. Smartphone Use in 2015" (Apr. 2, 2015) at http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/ (visited Aug. 9, 2018) at 3 (stating that three percent of the ten percent of U.S. adults surveyed in October 2014 who had smartphones only lived in locations where they had home broadband service available).

[20] *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, 2018 Broadband Deployment Report, GN Docket No. 17-199, FCC 18-10, at 8.. (Feb. 2, 2018).

competitive alternative to traditional fixed broadband.[21] Satellite services are also increasing in range and availability, becoming a more attractive option for many consumers.[22]

Taken with subscription share data and ongoing deployment data, growth is also an indicator the competition is thriving. For example, fixed and mobile broadband subscriptions continue to grow[23] and online traffic growing at a faster rate than broadband subscriptions.[24]

(ii) Transparency

Broadband internet service providers (ISPs) are required under current FCC transparency regulations to disclose clear and accurate information about their services, including network management practices, performance, and commercial terms and conditions, sufficient to enable consumers to make informed choices about their services.[25] There is a prevalent but flawed theory that ISPs function as "gatekeepers" between end users and edge providers, which led to the misguided application of monopoly-era regulations to broadband internet access services.[26] But there is scant evidence that such a gatekeeper role exists.[27] Not only is broadband

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[21] *See, e.g.*, Verizon Press Release, "Verizon 5G home internet service coming to Indianapolis" (Aug. 14, 2018) available at https://www.verizon.com/about/news/verizon-5g-home-internet-service-coming-indianapolis (visited Aug. 17, 2018) (stating that Verizon will have deployed 5G residential broadband and television service via fixed wireless in Houston, Indianapolis, Los Angeles, and Sacramento in 2018).

[22] *See* Reply Comments of Hughes Network Systems, GN Docket 17-199 (Oct. 6, 2017).

[23] *See e.g.*, Exhibit A at 14, 15, 16, and 18.

[24] *See e.g., id.* at 29 and 30.

[25] *See* 47 C.F.R. § 8.1

[26] Peter Swire, Justin Hemmings, Alana Kirkland, *Online Privacy and ISPs: ISP Access to Consumer Data is Limited and Often Less than Access by Others*, The Institute for Information Security & Privacy at Georgia Tech (May 2016).

[27] *See, e.g.*, Jeffrey Eisenach, American Enterprise Institute, AEI Economic Studies, *Broadband Competition in the Internet Ecosystem* (Oct. 2012) available at http://www.aei.org/wp-content/uploads/2012/10/-broadband-competition-in-the-internet-ecosystem_164734199280.pdf (visited Aug. 17, 2018).

competition among ISPs robust, as discussed above, edge providers have thrived on the broadband Internet. For example, financial markets value Amazon, Apple, Facebook at $4.1 trillion, while valuation of AT&T, Comcast, and Verizon is at $738 billion.[28] Over the last twelve months, five edge companies increased their revenues by 18% while the three so-called broadband "gatekeepers" increased their revenue by only 0.3%.[29] As of 2017, those five edge companies (Amazon, Apple, Facebook, Google, and Microsoft) had at least $587 billion in cash and investments on their books, which is more than the combined $494 billion market capitalization of the three largest USTelecom members as of August 17, 2018: AT&T ($241m), Verizon ($227m), and CenturyLink ($26m). And of course, broadband providers vary greatly in size, further hampering their reach (and thus their ability to operate as effective gatekeepers). With over 1,900 broadband providers in the U.S., no one-size fits all conclusion about blanket gatekeeper control is supportable.

(iii) Privacy and Security Risks

Edge providers, as recent reports have shown, can pose a greater risk to consumer security and privacy than ISPs. An edge provider, for example, can choose from a variety of alternative routes to convey its traffic to an ISP and its customers, effectively removing any

[28] Yahoo! Finance at https://finance.yahoo.com/ (visited Aug. 17, 2018). Figures are based on intraday market capitalization.

[29] *See id.; see also* Charter Communications, Inc., United States Securities Exchange Commission Form 10K for the fiscal year ended December 31, 2016 (Mar. 3, 2017) available at http://ir.charter.com/phoenix.zhtml?c=112298&p=irol-reportsannual (visited Aug. 20, 2018), and CenturyLink Inc.. United States Securities Exchange Commission Form 10K for the fiscal year ended December 31, 2017 (Feb. 28, 2018) available at http://ir.centurylink.com/sec-filings (visited Aug. 20, 2018). Figures for Charter and CenturyLink are Pro Forma to include the full year impact of acquisitions of Time Warner Cable and Brighthouse by Charter, and Level 3 by CenturyLink. Microsoft figures are based on fiscal year ending June 30, 2018 and Apple figures are based on a fiscal year ending September 30, 2017.

leverage the ISP may have.[30] Various commenters have explained that those many alternative routes – enabled by a well-functioning market – prevent an ISP from acquiring monopolistic leverage over edge providers.[31] Indeed, "[a]ny edge provider can get its traffic delivered to an ISP's customers *without any direct commercial relationship with that ISP*."[32] That is because networks accept and deliver traffic from any number of other networks, whether on a "peering" basis (without payment, two networks agree to exchange traffic between each other's customers), a "transit" basis (one network pays another to deliver traffic between any two locations), or an "on-net-only" basis (with payment, but only between the two networks' customers).[33]

In stark contrast to ISPs, Google and Facebook have ample access to sensitive customer data and have leveraged that access to dominate the market for internet advertising, receiving much of its substantial and growing revenue stream.[34] Given the current structure of the market

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[30] Reply Comments of AT&T Services, Inc., GN Docket Nos. 10-127, 14-28, at 101-02 (Sep. 15, 2014) (AT&T Reply Comments).

[31] *See id.* at 100; Reply Comments of National Cable & Telecommunications Ass'n at 35, GN Docket Nos. 10-127, 14-28 (Sep. 15, 2014) ("[A]ny commercial dispute between an ISP and a network provider does not prevent an edge provider from delivering its content through one of the various other paths available."); Letter from Kathryn A. Zachem, Comcast, Corp., to Marlene H. Dortch, Secretary, FCC, at 4, GN Docket Nos. 10-127, 14-28 (Jan. 30, 2015) (Zachem Letter).

[32] Zachem Letter at 5.

[33] AT&T Reply Comments at 95-99; *see also* Comments of CenturyLink, GN Docket Nos. 10-127, 14-28, at 17-20 (Jul. 17, 2014) (comparing various providers' offers).

[34] *See e.g.*, Scott Cleland, "Why Aren't Google Amazon & Facebook's winner-Take-All Networks Neutral?" available at: http://blog.heartland.org/2017/07/why-arent-google-amazon-facebooks-winner-take-all-networks-neutral/ (visited August 20, 2018). *See also*, Matthew Ingram, Fortune, "Google and Facebook Account For Nearly All Growth in Digital Ads" (April 26, 2017) available at http://fortune.com/2017/04/26/google-facebook-digital-ads/ (visited August 20, 2018); and Claire Ballentine, New York Times, "Google-Facebook Dominance Hurts Ad Tech Firms, Speeding Consolidation" (August 12, 2018) available at https://www.nytimes.com/2018/08/12/technology/google-facebook-dominance-hurts-ad-tech-firms-speeding-consolidation.html (visited August 20, 2018).

for internet advertising, it is particularly important to ensure that firms wishing to enter or grow from relatively small positions not be handicapped by unnecessary or unique regulatory burdens. Only through vigorous and fair competition will markets be able to begin chipping away at the large edge players' dominance over internet advertising with price discipline and by offering more-consumer friendly practices.

Although ISPs are important players in the overall internet ecosystem, and thus could potentially play an important role in the digital advertising industry, they do not have any unique access to consumer information that would justify special rules applicable only to them. Yet, we nearly had such rules imposed in 2015 when the FCC reclassified broadband ISPs under Title II of the Communications Act, thereby wresting authority away from the FTC, and attempting to impose particularly stringent rules on ISPs.[35] Fortunately, the rules were revoked by the Congress in a rare exercise of its Congressional Review Act (CRA) authority.[36] But it was a close call, nearly depriving the market of the full disciplining impacts of effective competition by handicapping an entire class of potential entrants from offering alternatives to the dominant edge providers. As demonstrated in Peter Swire's preeminent paper on the subject, internet service providers do not have unique visibility over broadband customer information relative to other internet entities that come into contact with the same data,[37] and therefore should not be handicapped in this evolving market. Indeed, internet service providers have unusually strong

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[35] *See Protecting and Promoting the Open Internet*, Report and Order on Reconsideration, Declaratory Ruling, and Order, 30 FCC Rcd 5601 (2015).

[36] 5 U.S.C. § 801 *et seq*.

[37] Peter Swire, Justin Hemmings, Alana Kirkland, *Online Privacy and ISPs: ISP Access to Consumer Data is Limited and Often Less than Access by Others*, The Institute for Information Security & Privacy at Georgia Tech (May 2016).

incentives to deal fairly with end users on notice-and-choice issues because ISPs face competition, thus creating a business imperative to maintain subscribers' goodwill.

(b) The welfare effects of regulatory intervention to promote standardization and interoperability.

One reliable guidepost for whether regulatory intervention is needed or will bring about positive outcomes is the existence of effective competition. Competition, perhaps more than any regulation or statutory requirement, will best ensure that internet access service providers behave in accordance with the consumers' needs and society's requirements. Where competition fails, existing regulatory and antitrust requirements will provide enforceable protections for consumers without stifling investment and innovation.

The internet has always been a free and open space for providers, consumers, and businesses alike to create, interact, be creative, and excel. The interconnectedness of the internet belies any notion that more regulation is needed to promote standardization and interoperability in this space. Everyday Americans have harnessed the power and openness of the internet to become entrepreneurial millionaires and billionaires.

In fact, more and excessive regulatory intervention over internet access would seem to threaten the welfare of providers and consumers. Consumer- and industry-driven innovation and investment flourish with light-touch regulatory intervention. The FCC has recognized this in recent proceedings, noting in its latest order adopting additional measures to accelerate wireline broadband deployment that "[r]emoving regulatory barriers causing unnecessary costs or delay when carriers seek to transition from legacy networks and services to broadband networks and

services is [important] to encourage deployment of next-generation networks and to close the digital divide."[38]

A stark example of how regulatory intervention can disrupt and even harm the internet ecosystem is the imposition of Title II regulation under the guise of protecting net neutrality – largely a solution in search of a problem. USTelecom analysis shows a decline in industry investment in broadband networks and infrastructure in 2015 and 2016, [39] after the FCC reclassified internet access service as a telecommunications service subject to monopoly-era regulations that burden common carriers with decades-old red tape that were established at a time when consumers had a choice of only one local service provider. After peaking in 2014, and dipping in 2015 and 2016, preliminary indications are that broadband capital investment returned to growth in 2017.[40] Thus, in this particular industry, federal regulatory micro-management will likely cause more harm than good.

(c) The application of the FTC's Section 5 authority to the broadband internet access service business.

The FTC's deep expertise in evaluating harm to consumers and to competition in every industry has for decades helped the agency protect consumers and the competitive process. Although some have raised concerns about the FTC's ability to handle technology and internet

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[38] *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, FCC 18-74, ¶ 1 (rel. Jun. 8, 2018).

[39] *See* USTelecom, Historical Broadband Provider Capex, available at https://www.ustelecom.org/broadband-industry-stats/investment/historical-broadband-provider-capex.

[40] *See* Jonathan Spalter, USTelecom Blog, *Broadband CapEx Investment Looking Up in 2017* (Jul. 25, 2018) available at https://www.ustelecom.org/blog/broadband-capex-investment-looking-2017 (visited Aug. 16, 2018) (citing preliminary data showing that U.S. broadband companies, excluding independent competitive local providers and fiber operators, invested between $72 and $74 billion in network infrastructure in 2017, compared to $70.6 billion in 2016, an increase of at least $1.5 billion).

issues, the agency has a wide range of expertise on technical issues such as internet privacy and data security. Moreover, the staff uses its significant internal technological experience, supplemented with outside expertise and coordination with other government agencies such as the FCC, to evaluate consumer harm in tech-heavy industries like broadband.

Section 5 of the Federal Trade Commission (FTC) Act prohibits unfair methods of competition, including conduct that violates the antitrust laws.[41] Action by the FCC in the *Restoring Internet Freedom Order*[42] to restore the information services classification to broadband internet access services paved the way for the FTC to once again use its legal, economic, and technological expertise to address anticompetitive, unfair, or deceptive acts by all parties in the internet ecosystem. That authority is broad enough to reach not just internet service providers, but also edge providers, which is necessary to ensure that consumers can have a relatively common set of expectations as they use the internet.

Respectfully submitted,

By: _____

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[41] *See* 15 U.S.C. § 45(a)(1).

[42] *Restoring Internet Freedom*, Declaratory Ruling, Report and Order, and Order,33 FCC Rcd 311 (2018).

Dated: August 20, 2018

Exhibit A

USTelecom Industry Metrics and Trends 2018

March 1, 2018

Patrick Brogan, VP Industry Analysis

USTELECOM | THE BROADBAND ASSOCIATION

Contents

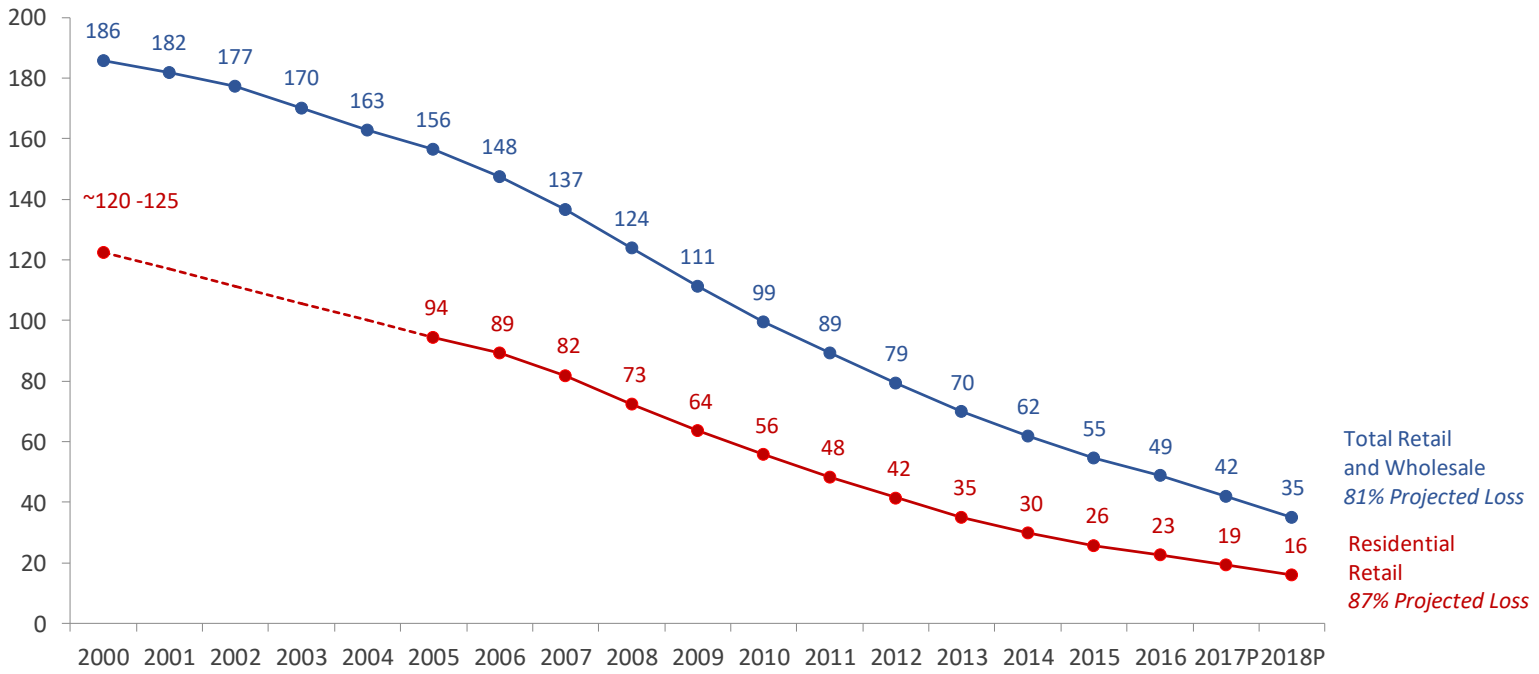
1. The Transition from Legacy Voice Networks to Mobile and Internet Communications
2. Broadband Investment, Deployment and Adoption
3. Internet Traffic Growth and Drivers

<u>Note on data and projections</u>: 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.

<u>Note on terminology</u>: 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.

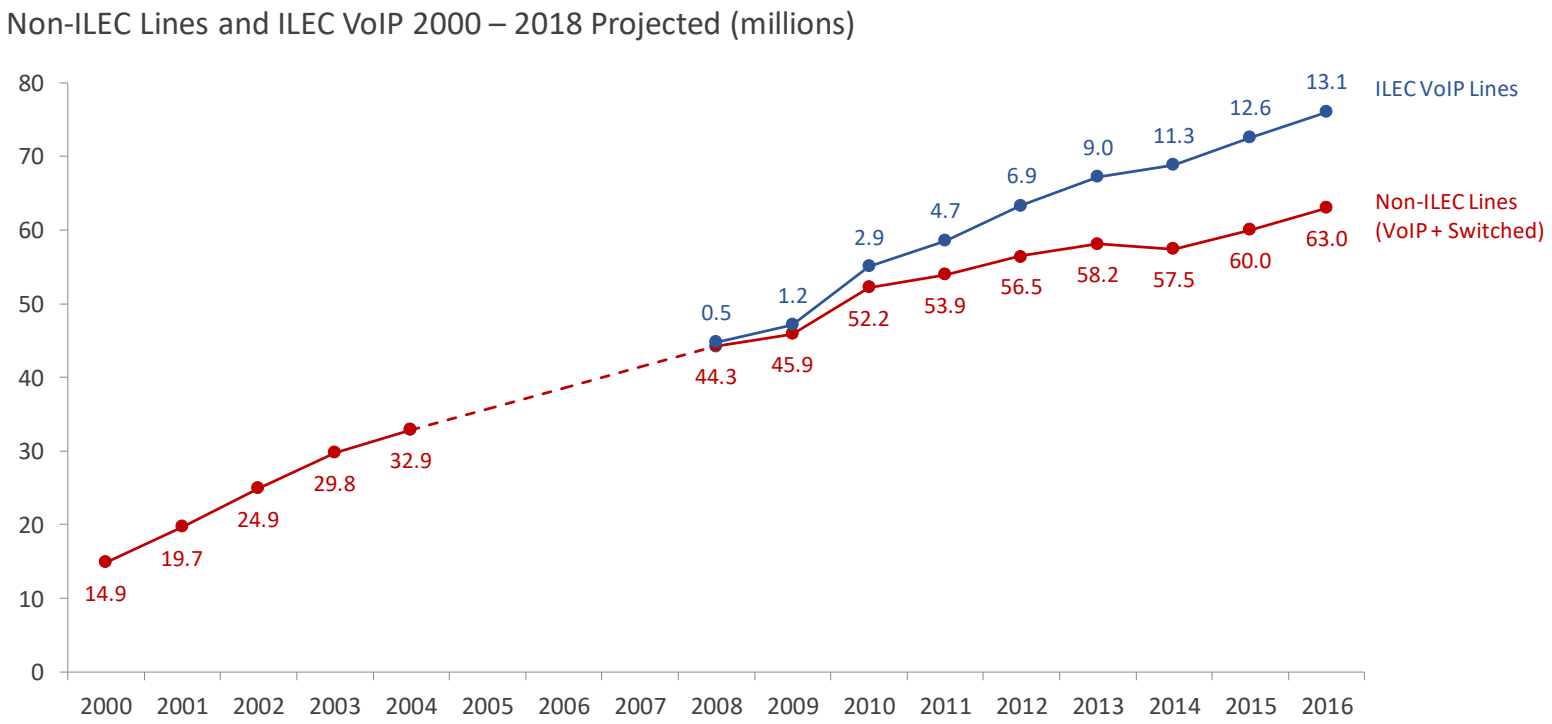
The Transition from Legacy Voice Networks to Mobile and Internet Communications

Dramatic Decline in Traditional Wired Voice Connections Continues



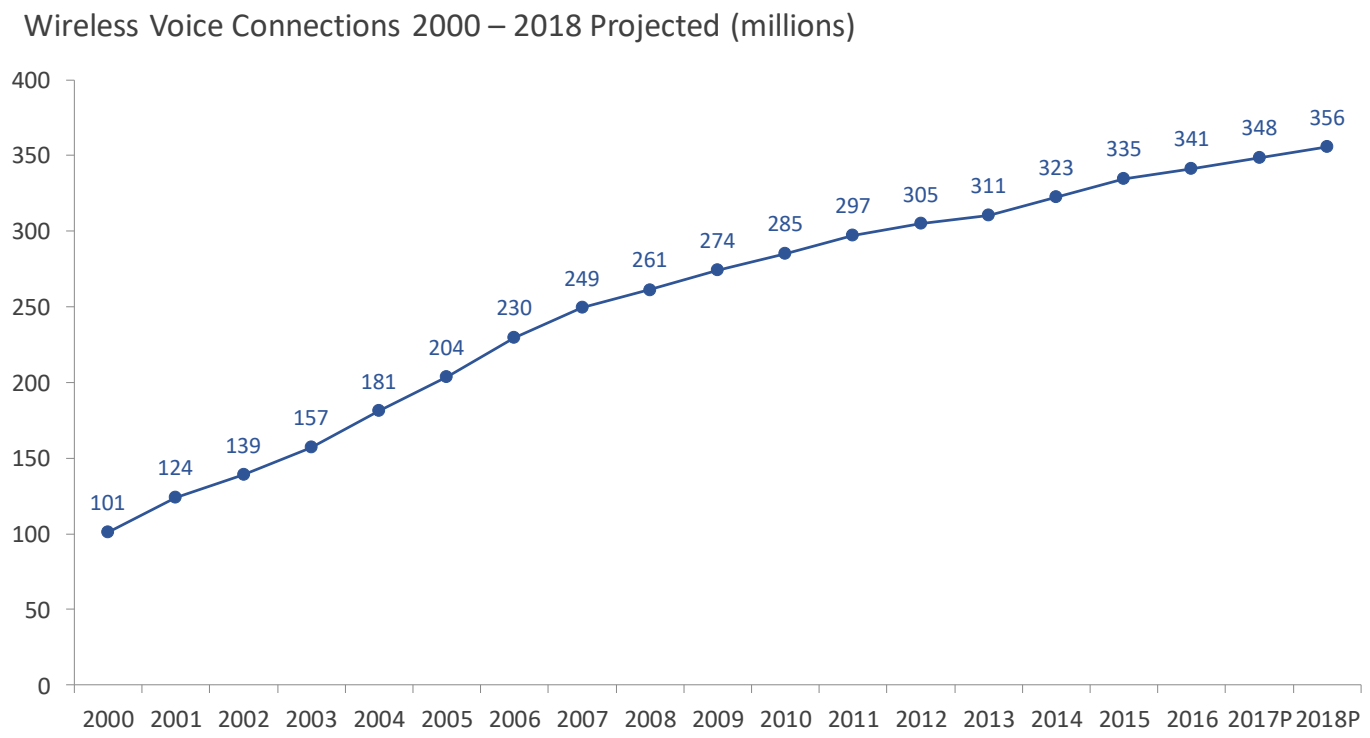
Source: FCC and USTelecom analysis. Includes primary and non-primary lines. Excludes ILEC VoIP and UNE-L (unbundled loops). Projections based on most recent 6-month straight-line run rates. Pre-2005, carriers with <10,000 lines did not report and FCC did not report residential lines.

Wired Voice Alternatives Are Growing



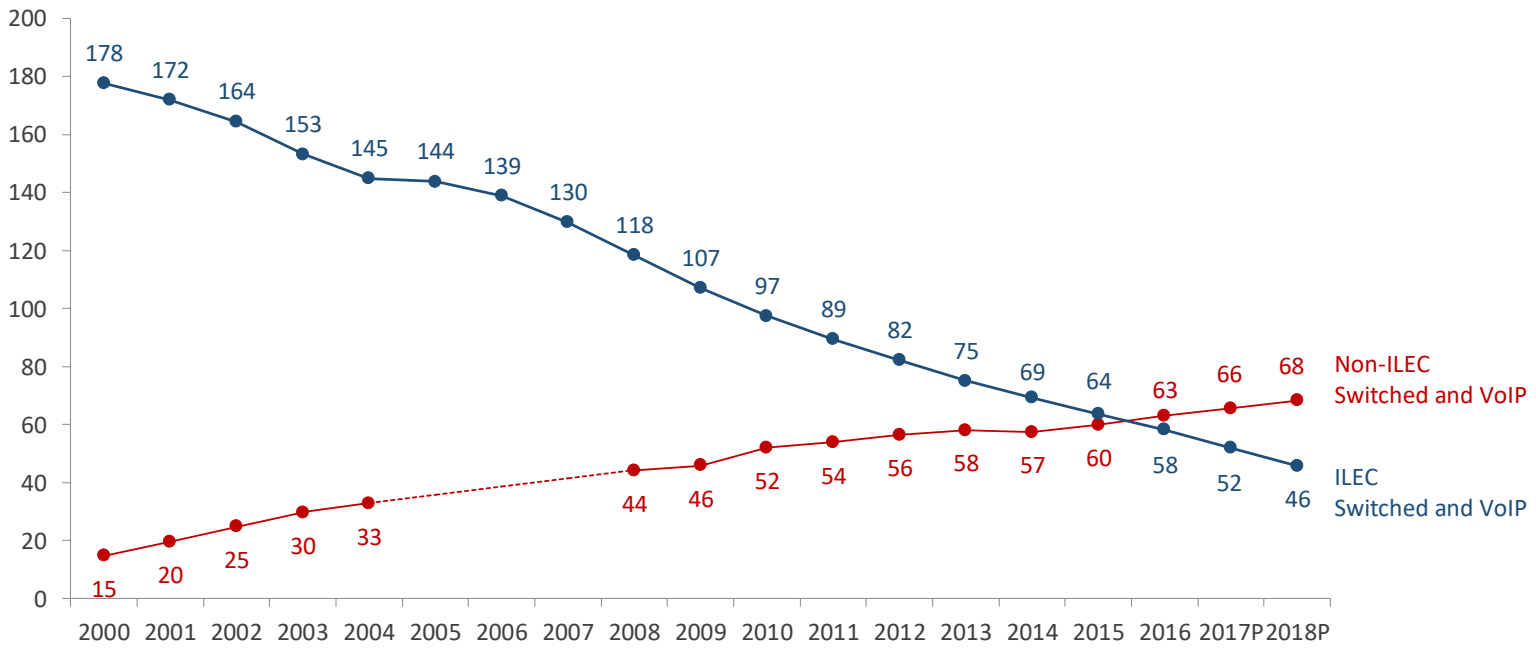
Source: FCC and USTelecom analysis. Includes primary and non-primary lines. Includes non-ILEC lines using ILEC wholelsale lines. Pre-2005, carriers with <10,000 lines did not report and FCC did not report residential lines. 2005-7 Non-ILEC data excluded due to data reliability issues. Projections based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

Wireless Voice Connections Are Growing Rapidly



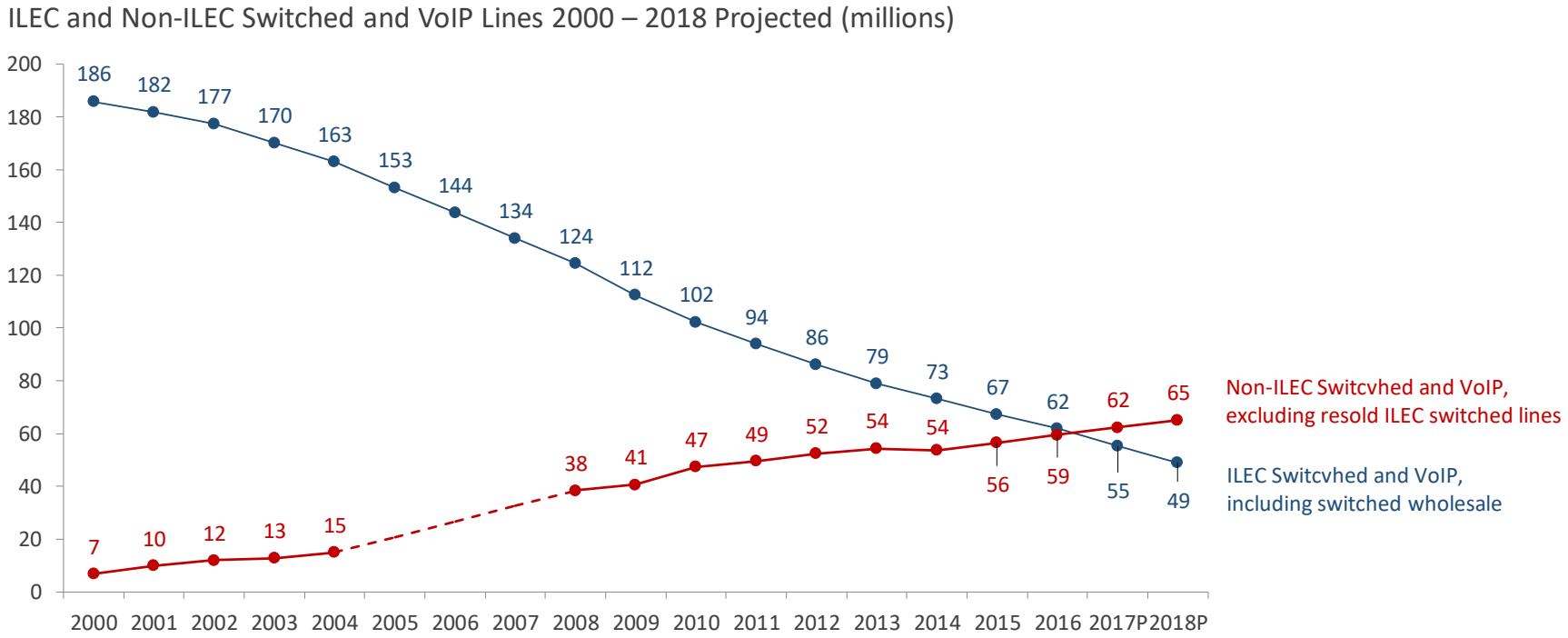
Source: FCC and USTelecom analysis. Projections based on most recent 6-month straight-line run rates.

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



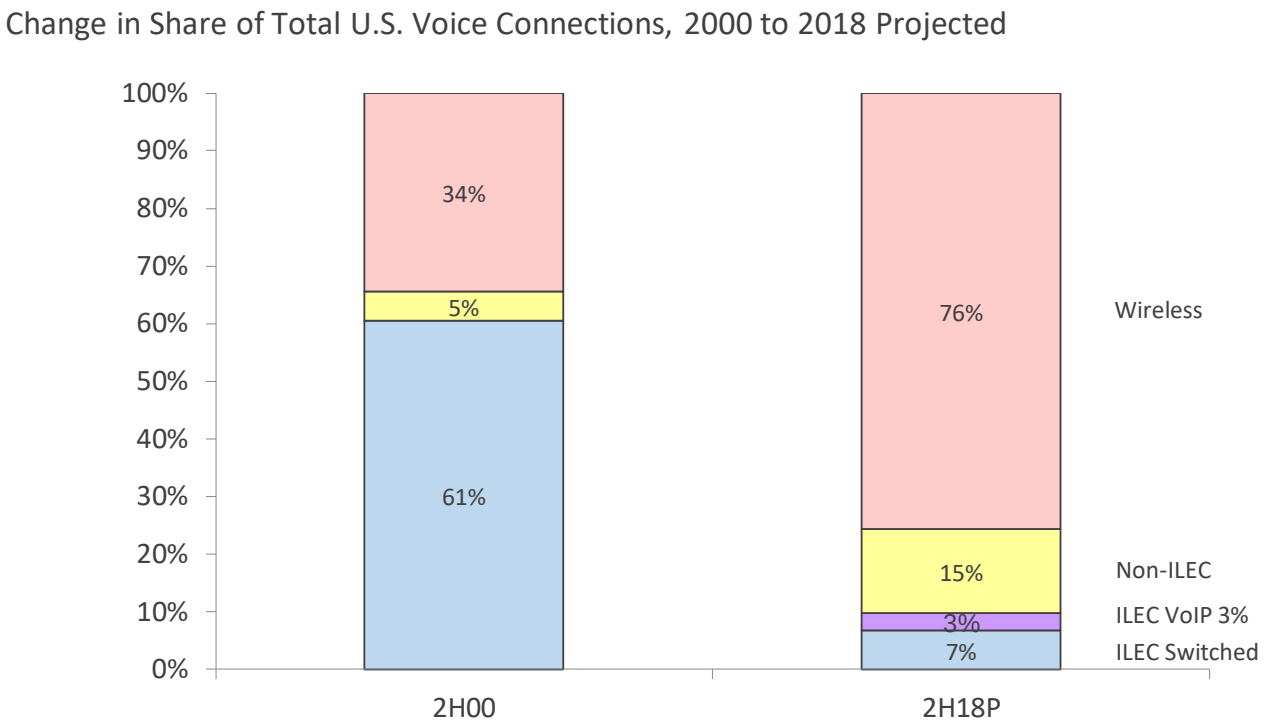
Source: FCC and USTelecom analysis. Pre-2005, carriers with <10,000 lines did not report. Pre-2008 data exclude VoIP. ILEC lines exclude wholesale. 2005-7 Non-ILEC data excluded due to data reliability issues. Projections are straight-line based on most recent 6-mnth trend.

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.

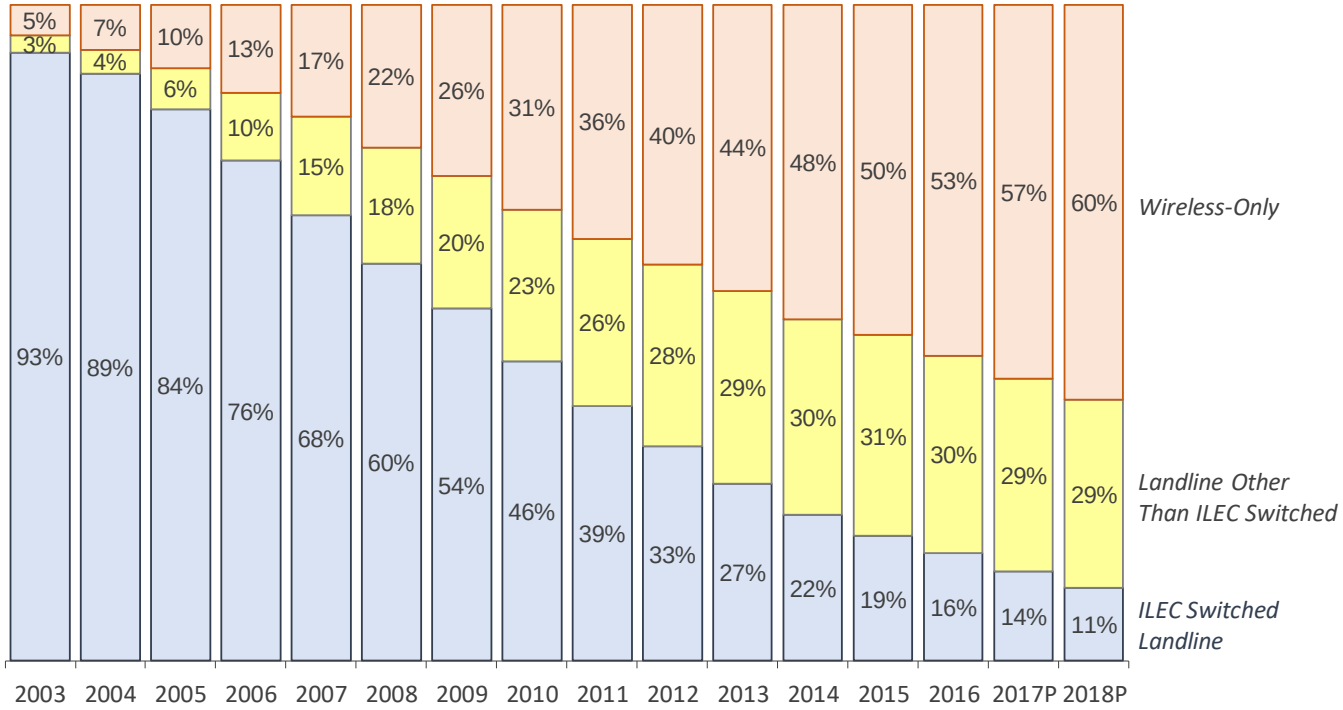
There Are Three Times as Many Wireless as Wired Voice Connections in the U.S.



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

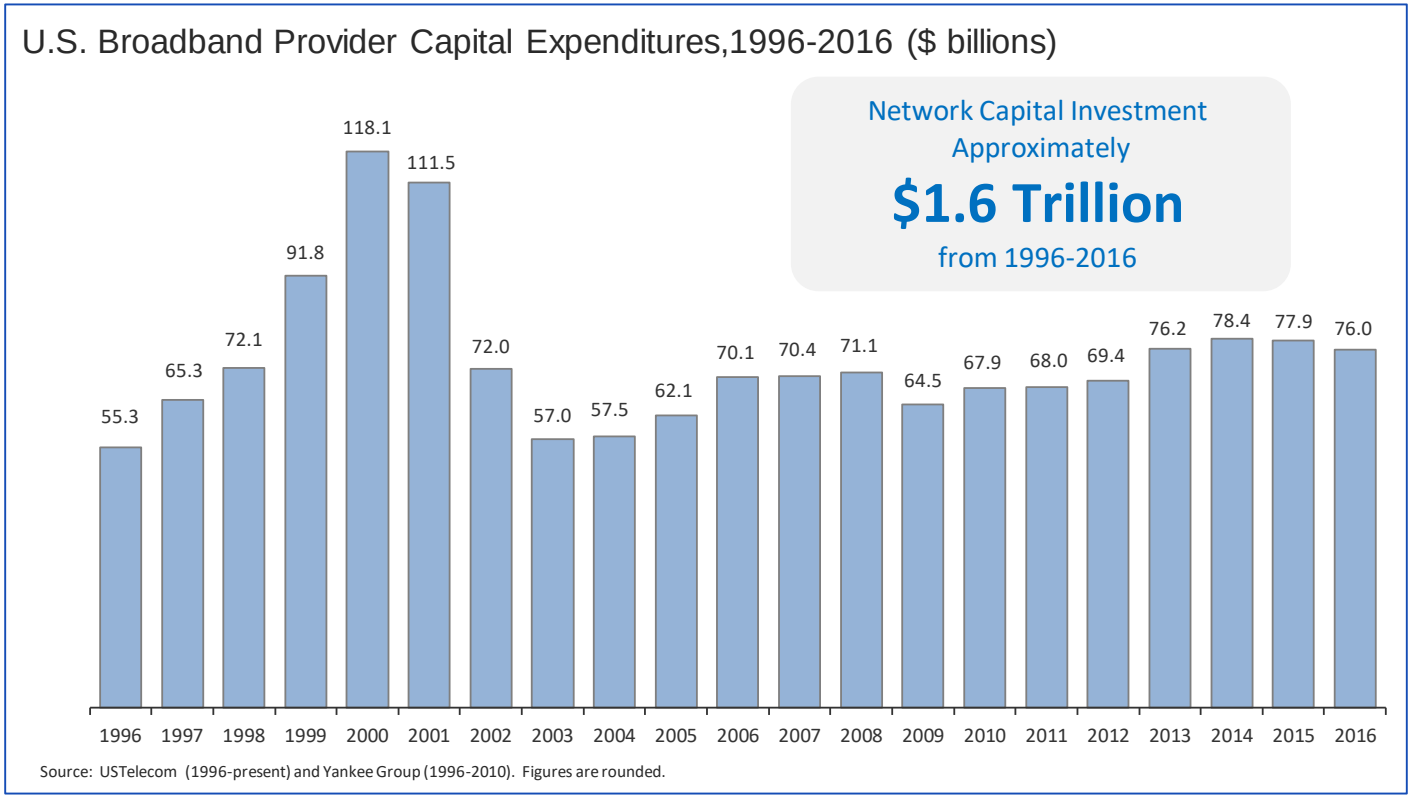
U.S. Household Voice Service Penetration and Projections
(Percent of Telephone Households)



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

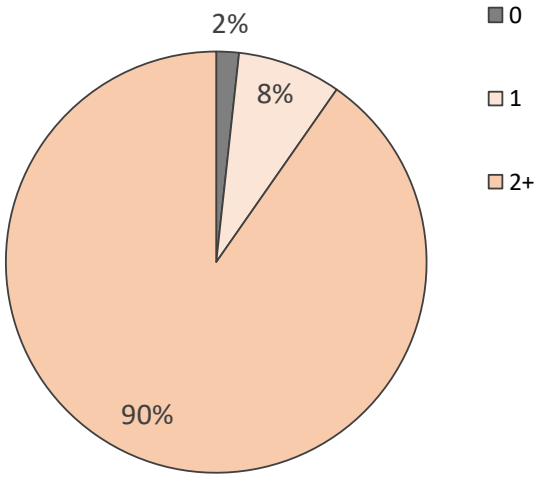
Competing Broadband Providers Have Invested $1.6 Trillion in Capital since 1996



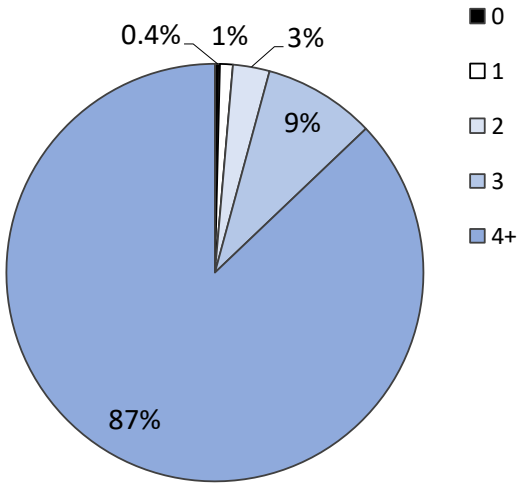
Data includes wireline, wireless, and cable providers.

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)

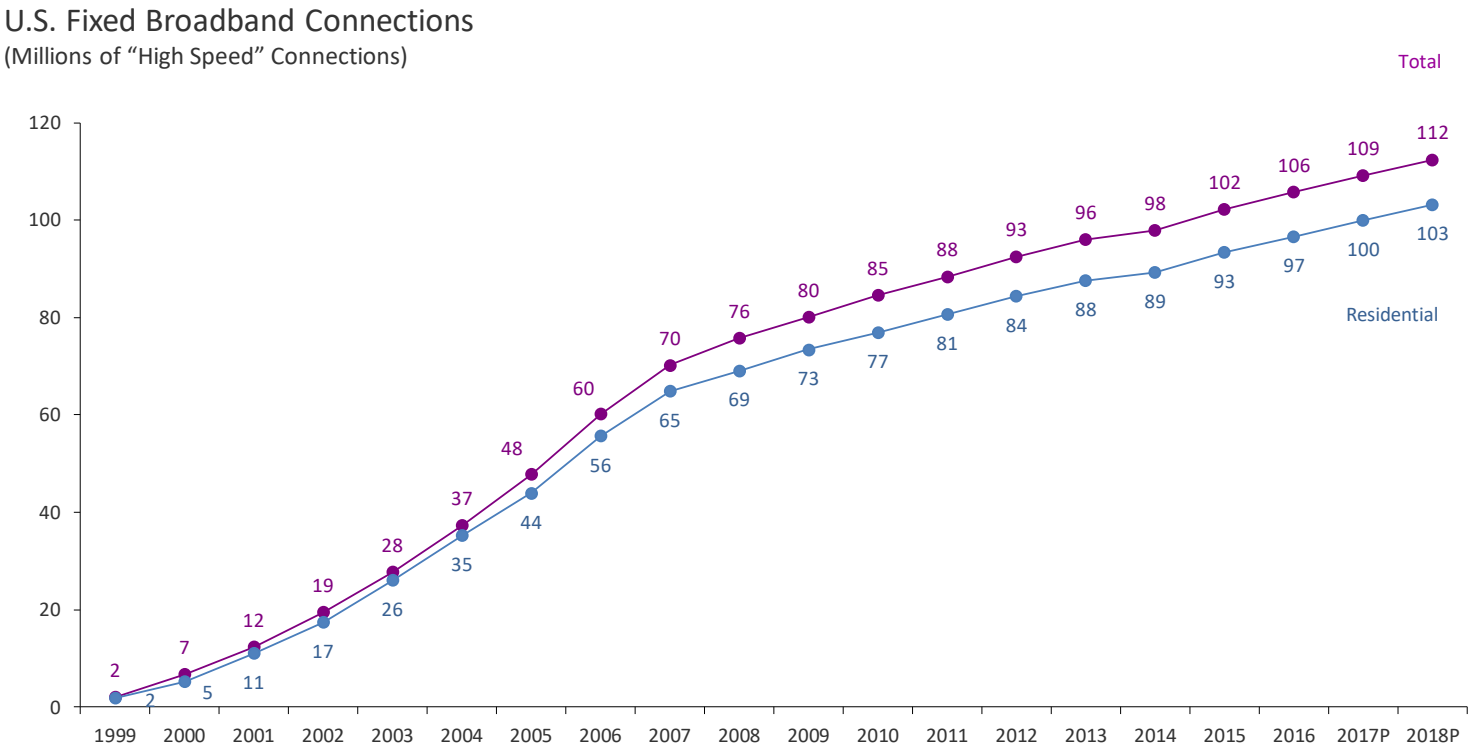


U.S. Wireless LTE Broadband Choices Available
(% of Housing Units, Year-End 2016)



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

Investment Has Enabled Widespread and Ongoing Broadband Adoption



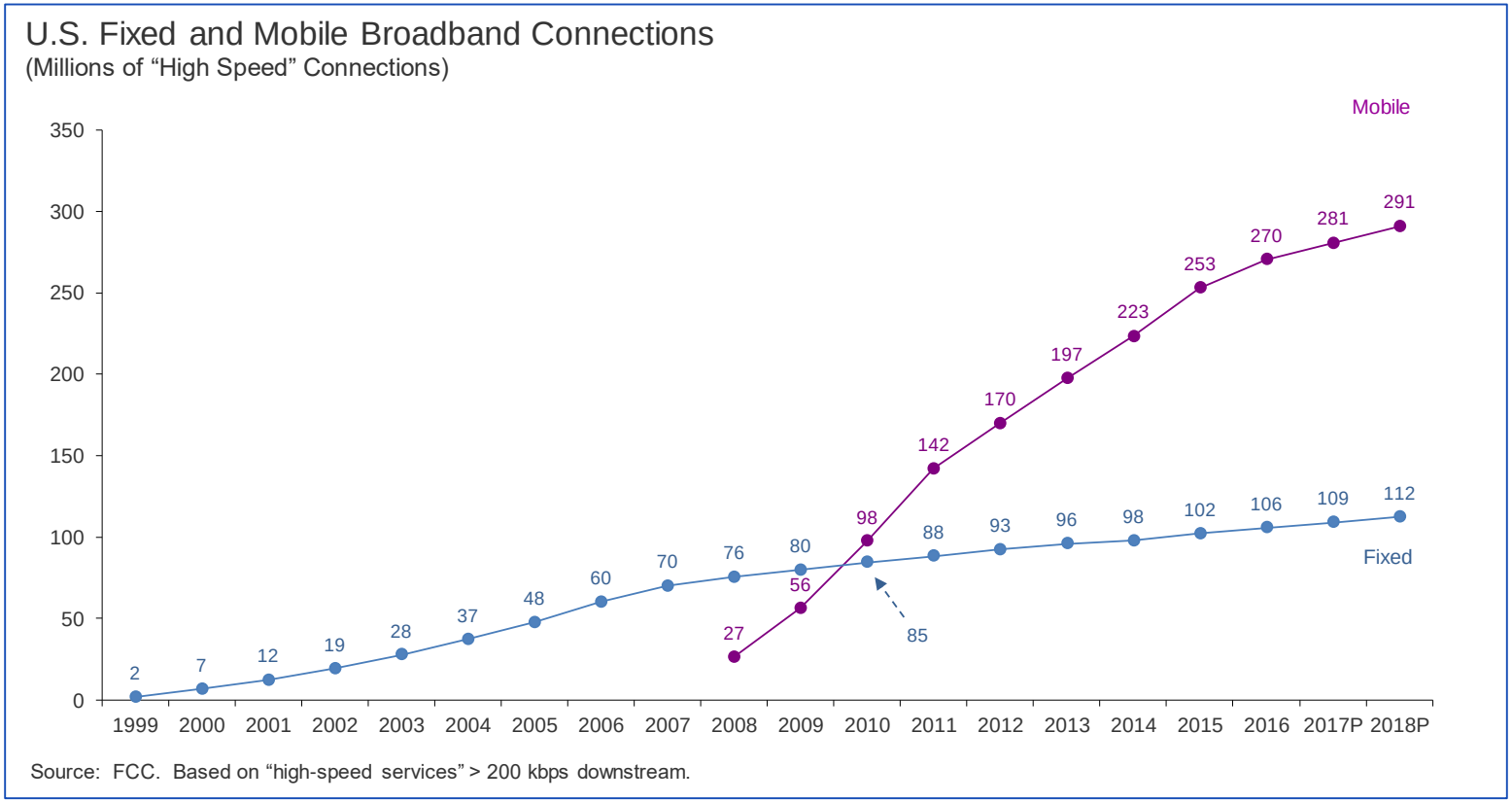
Source: FCC. Based on "high-speed services" > 200 kbps downstream. Projections are staright-line based on most recent 6-month trend.

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.

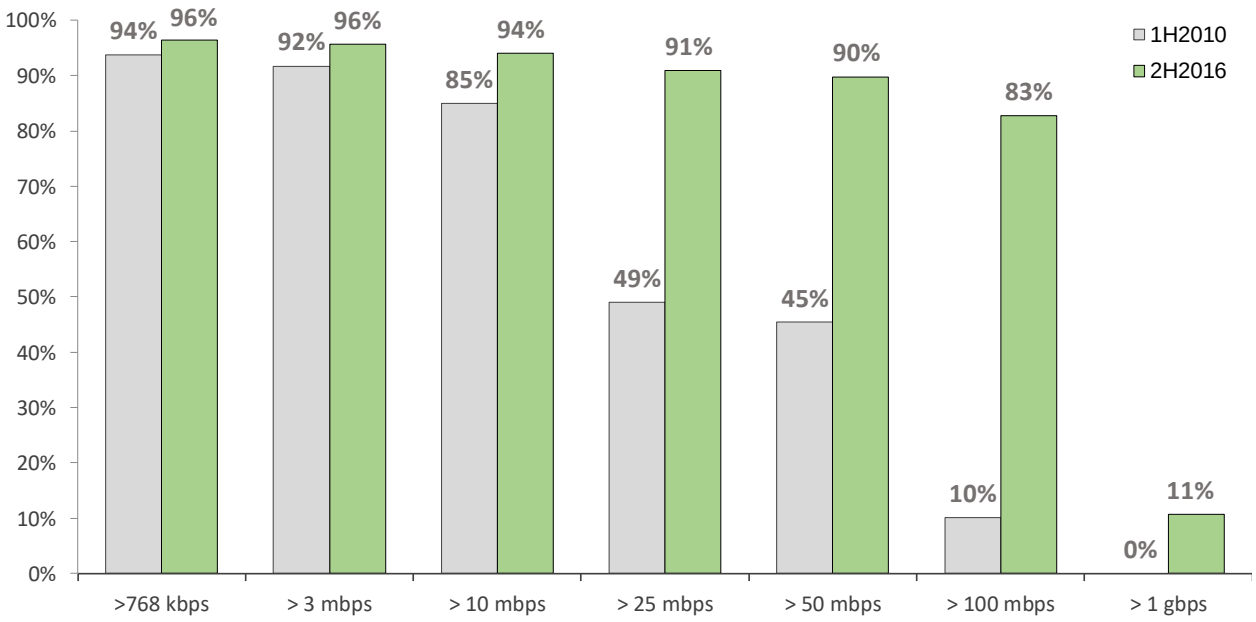
Mobile Broadband is Growing Rapidly



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

Broadband Availability by Download Speed for Wired Technologies , 2010-2016 (Percent of Housing Units)

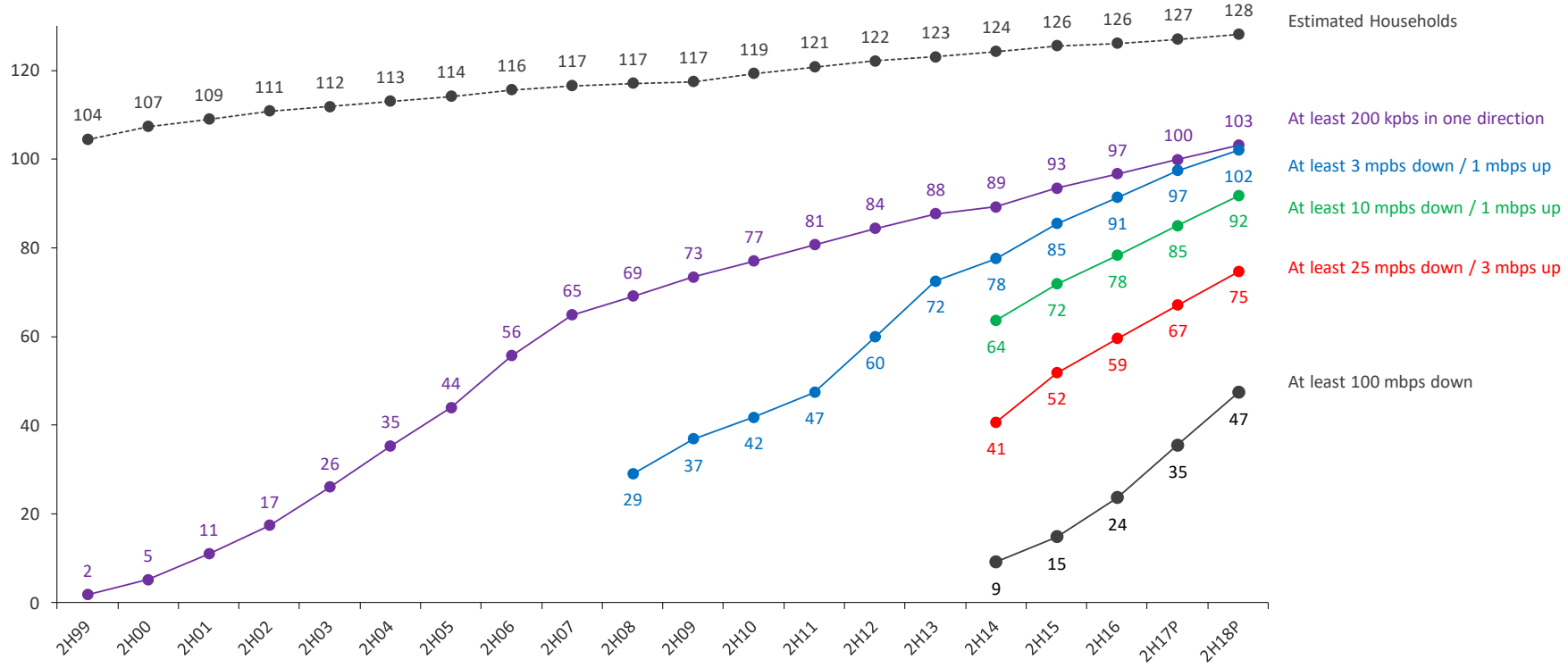


Source: NTIA National Broadband Map, USTelecom, and Telcodata CensusNBM.com. Percentages in bar chart are cumuliatve.

Fourth generation mobile broadband was available to less than 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

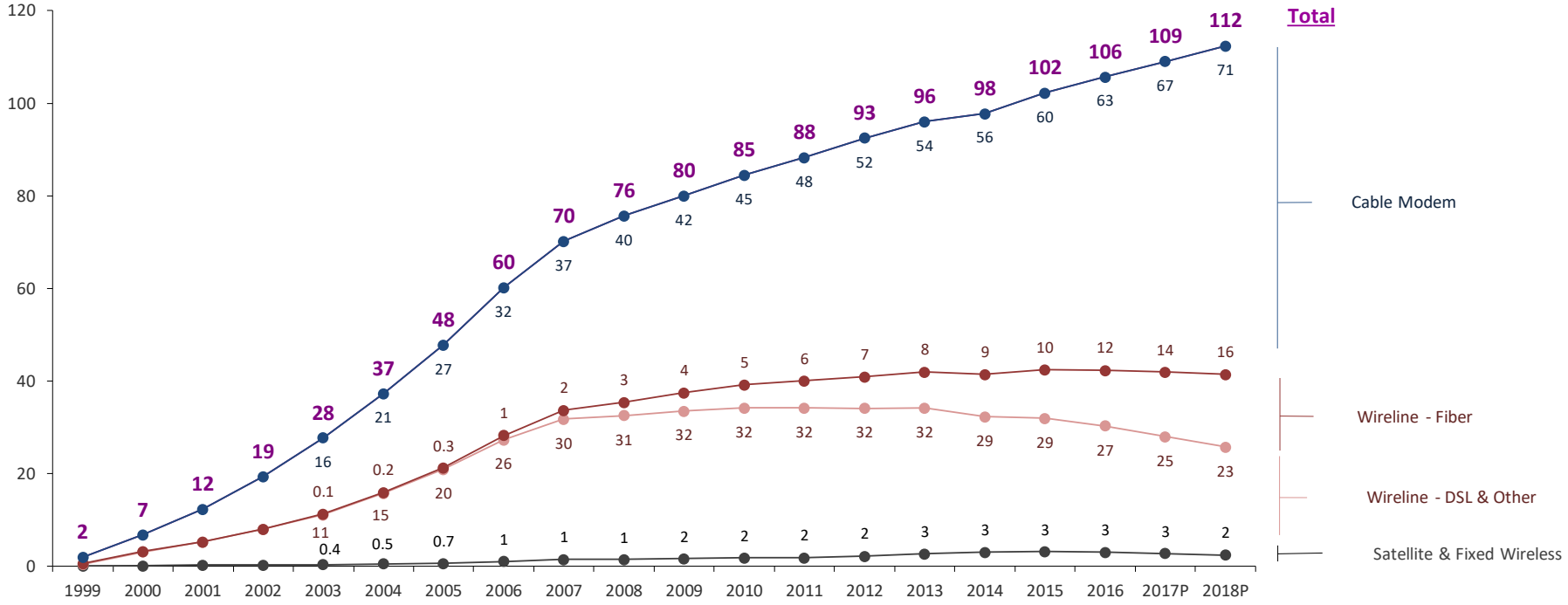
U.S. Residential Fixed Broadband Connections by Speed and Households
(Millions of Connections)



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

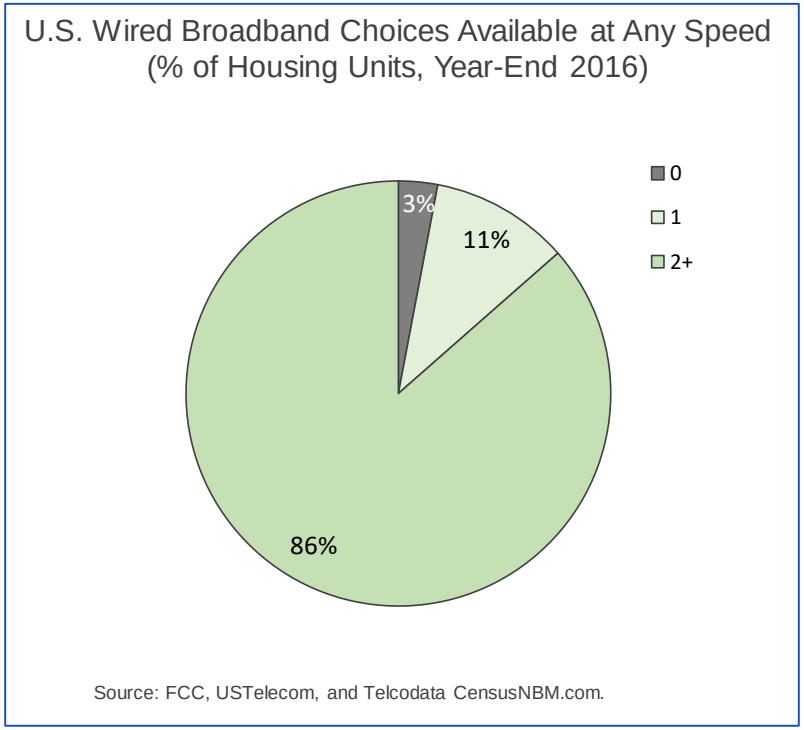
Broadband Has Been a Competitive Industry from Its Inception

U.S. Fixed Broadband Connections by Technology
(Millions of "High Speed" Connections)



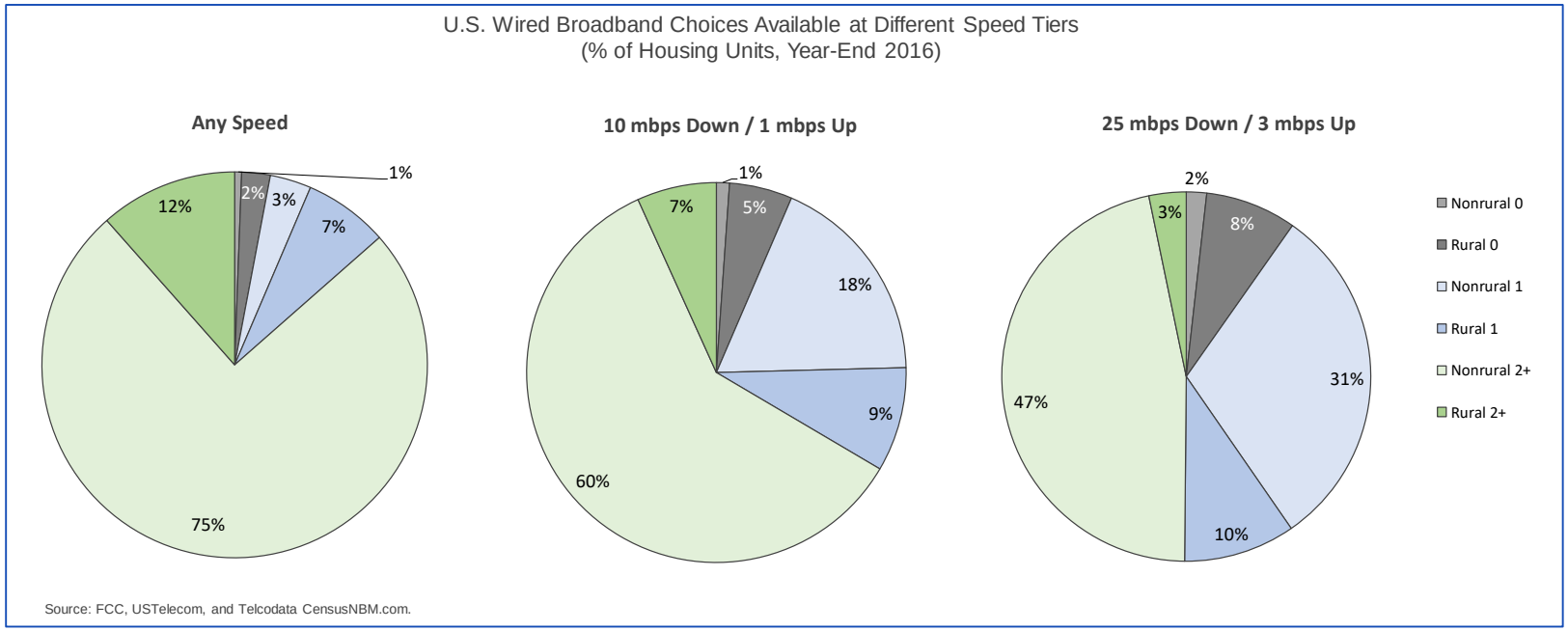
Source: FCC. Based on "high-speed services" > 200 kbps downstream

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

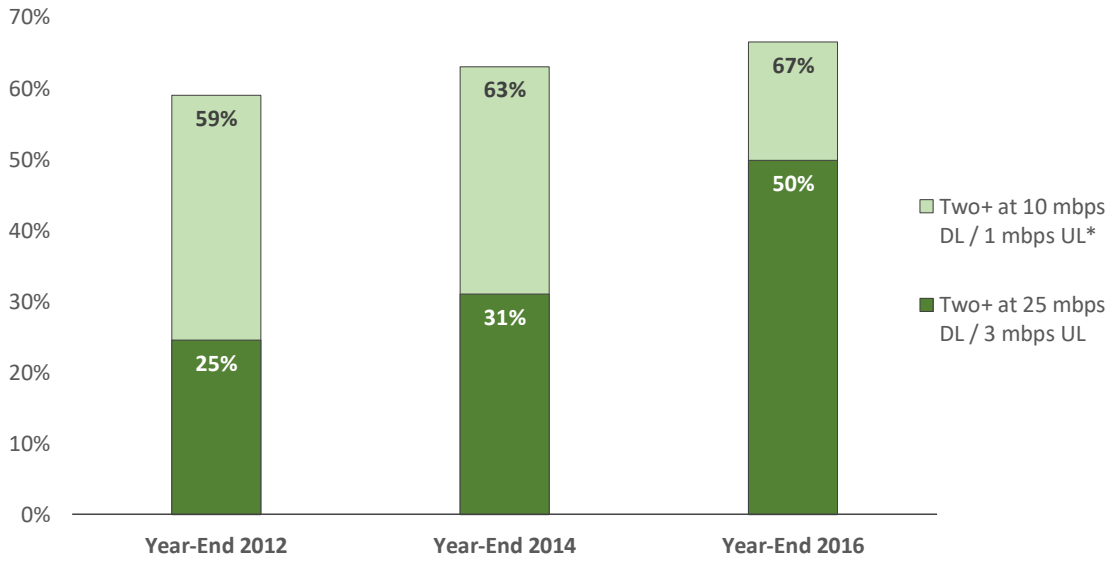


In a continual process of competitive leap-frog, wired broadband providers are at different stages of ongoing network upgrades

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.

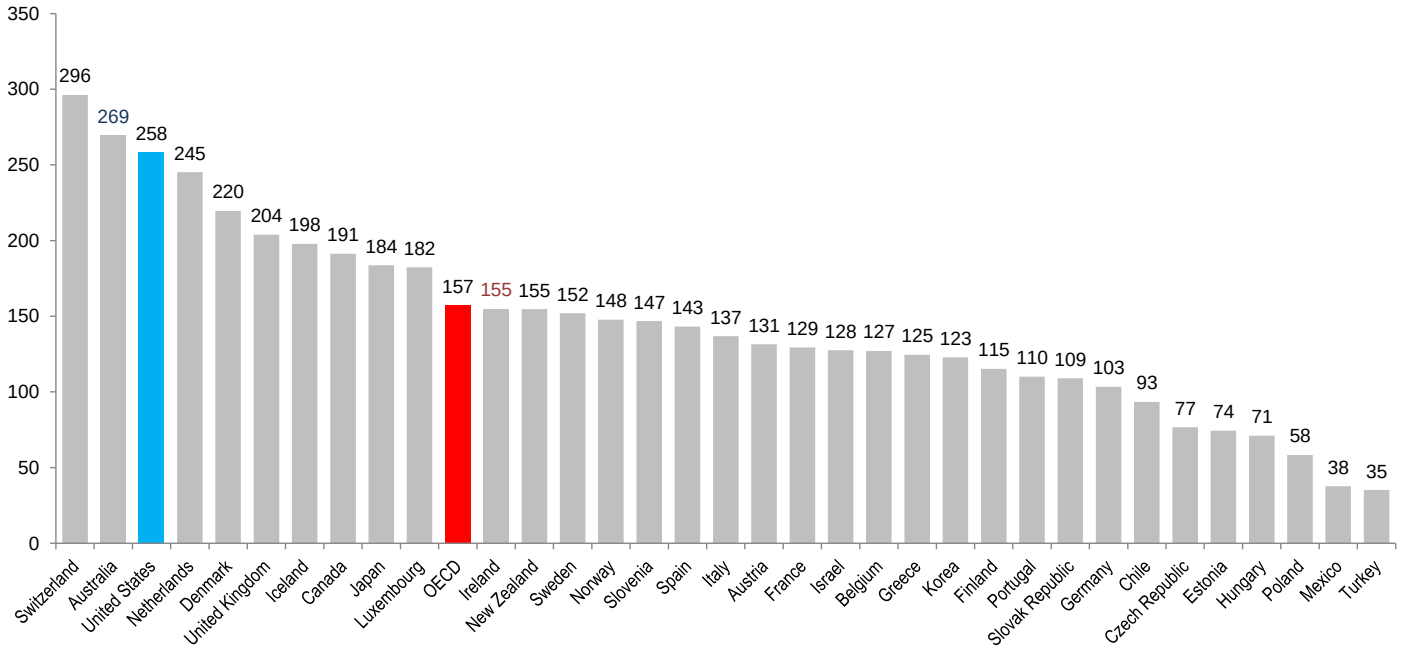


Sources: FCC, NTIA, USTelecom, and Telcodata CensusNBM.com.

*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

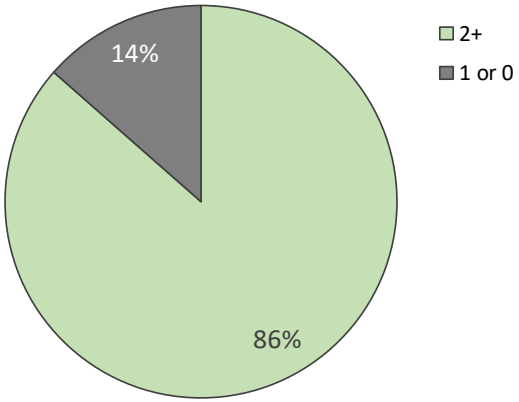
Average Annual Telecommunications Capital Investment Per Capita 1997-2013 (US Dollars)



Source: OECD and USTelecom Analysis.

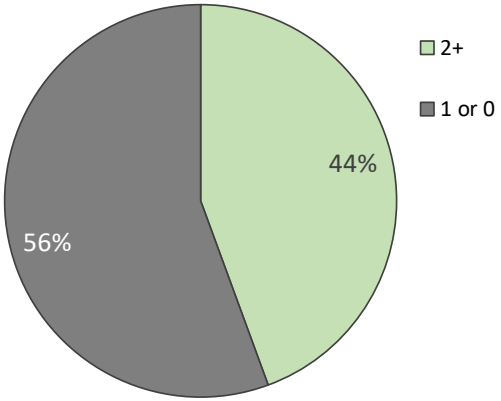
U.S. Investment Has Yielded More Competitive Choice than Europe

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



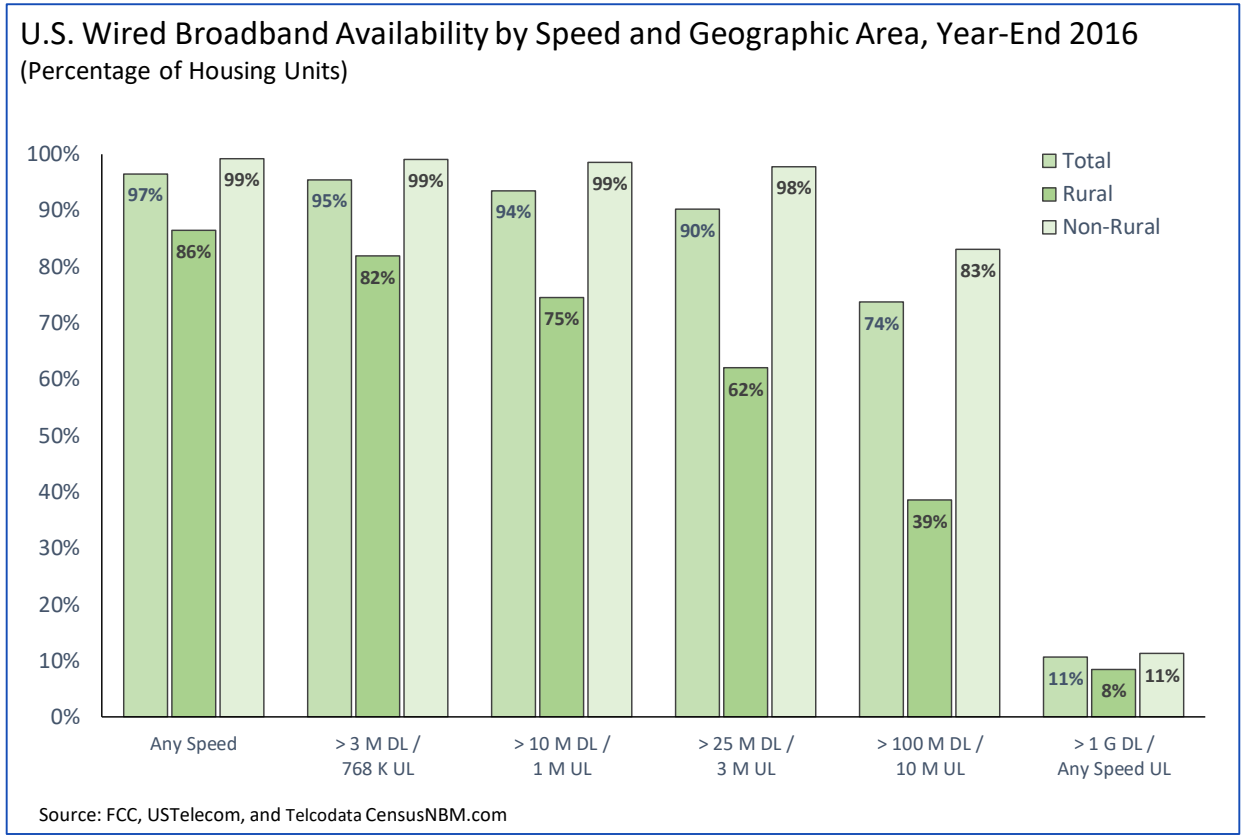
Source: FCC, USTelecom, and Telcodata CensusNBM.com.

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



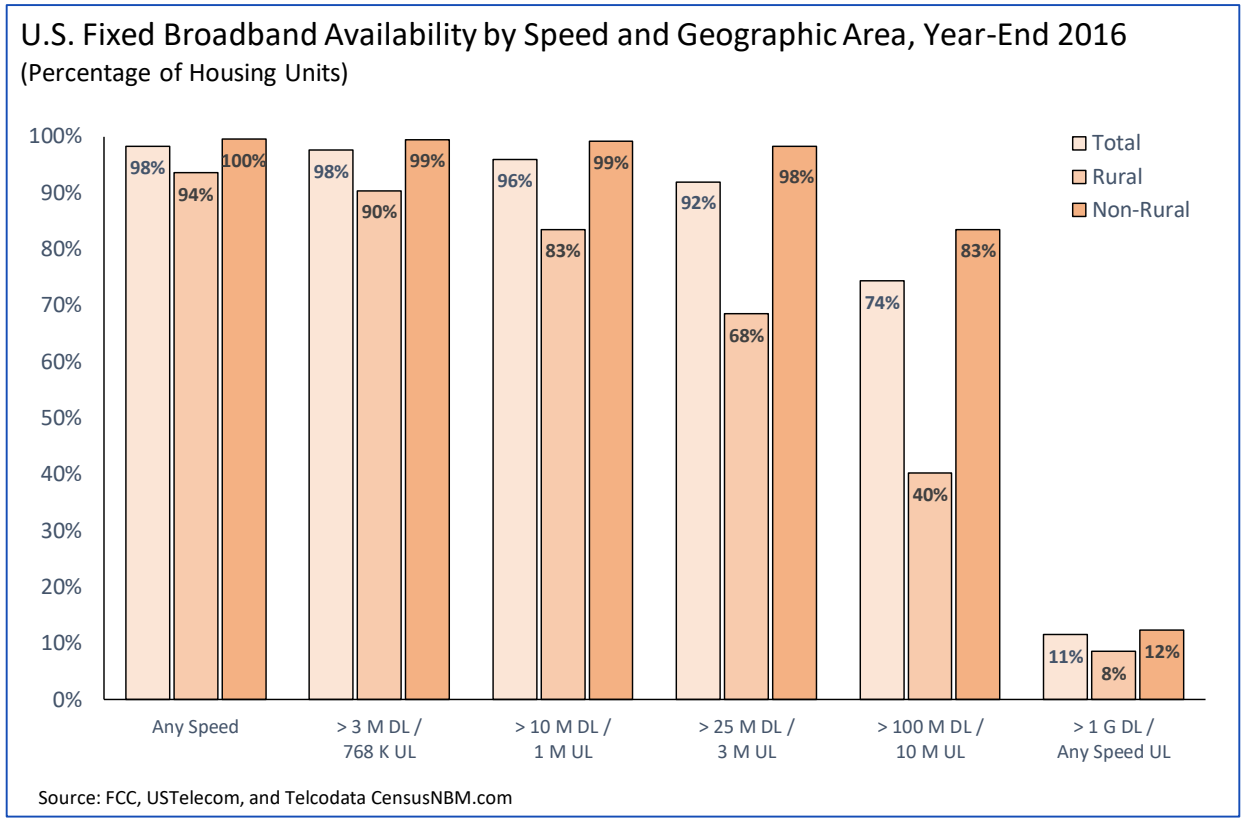
Source: European Union, USTelecom, and IHS Markit.

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

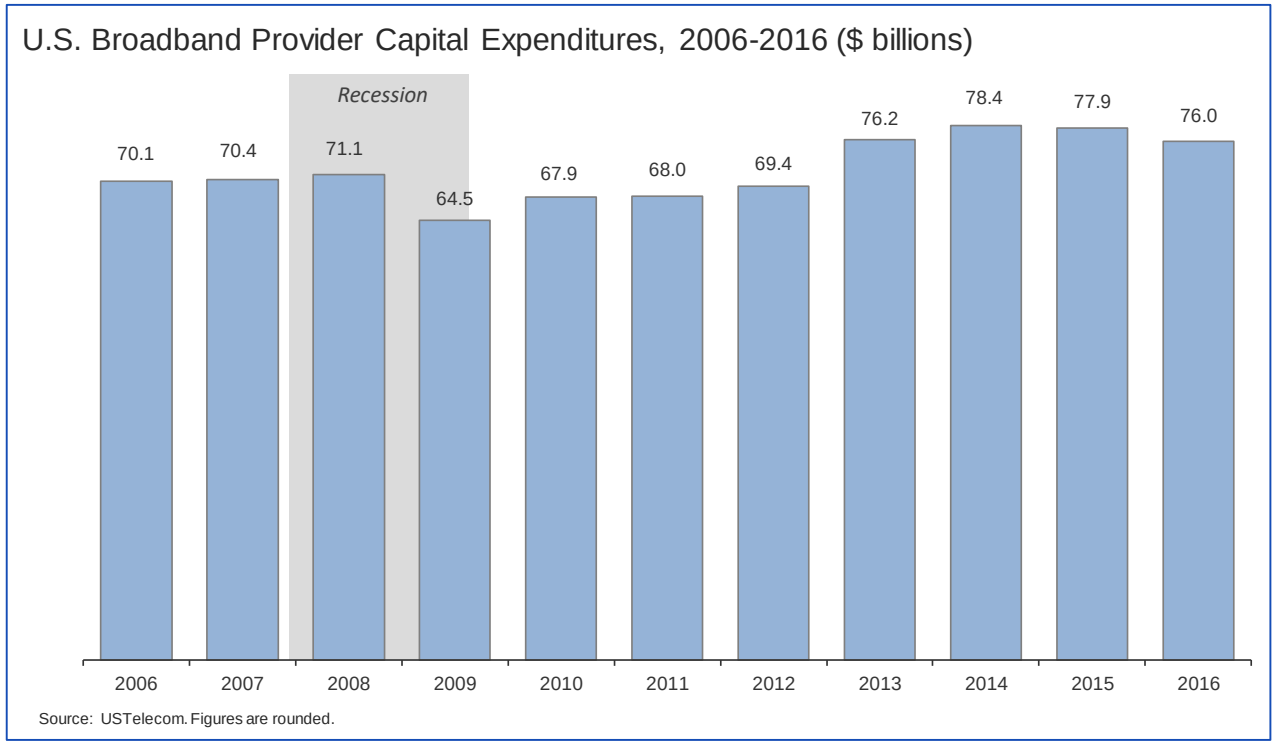
Fixed Wireless Eliminates Some Rural Coverage Gaps



These data include fixed terrestrial wireless

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

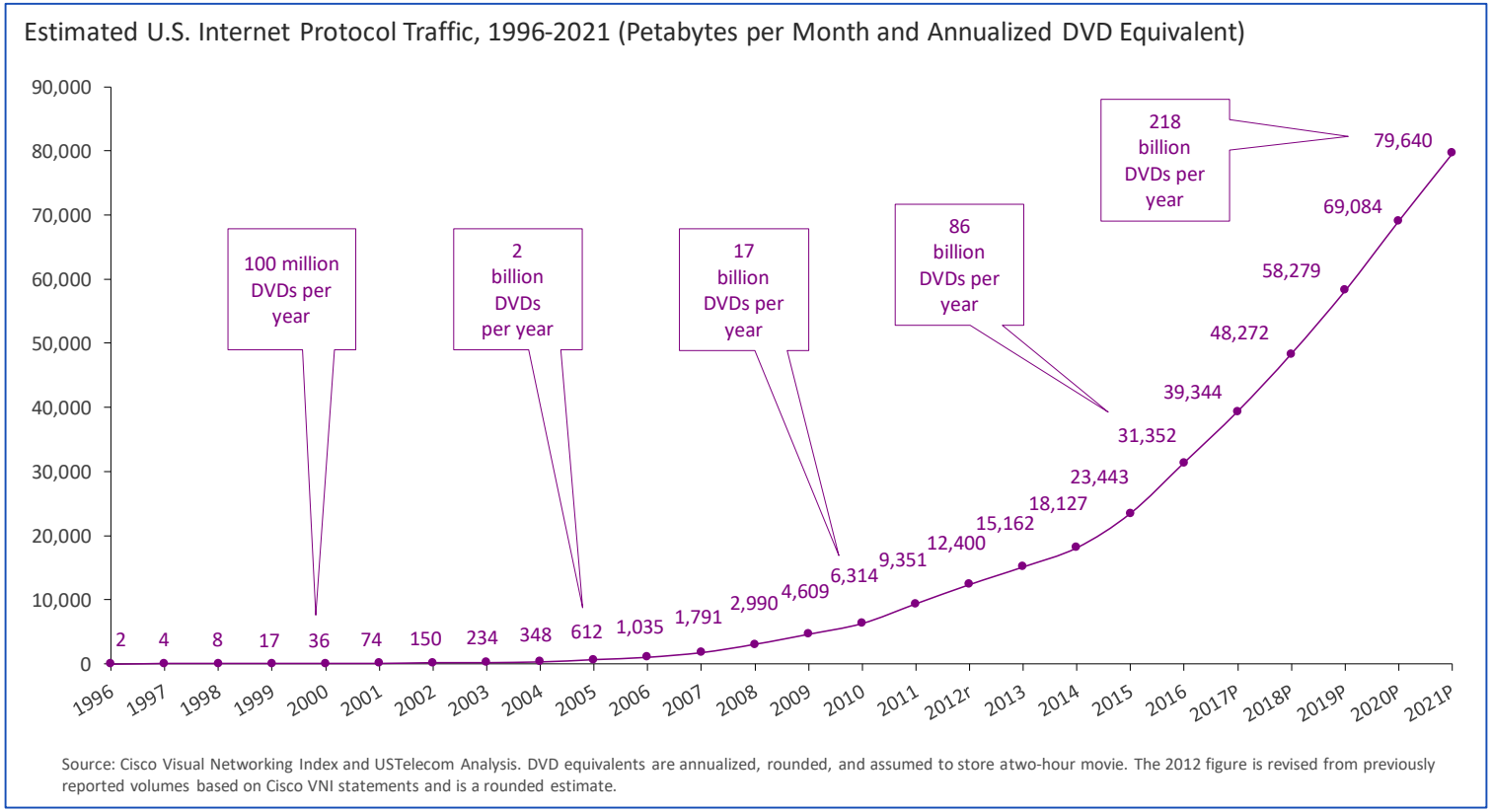
Broadband Capital Expenditures Declined in 2015 Coinciding with Heavy Title II Regulation



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

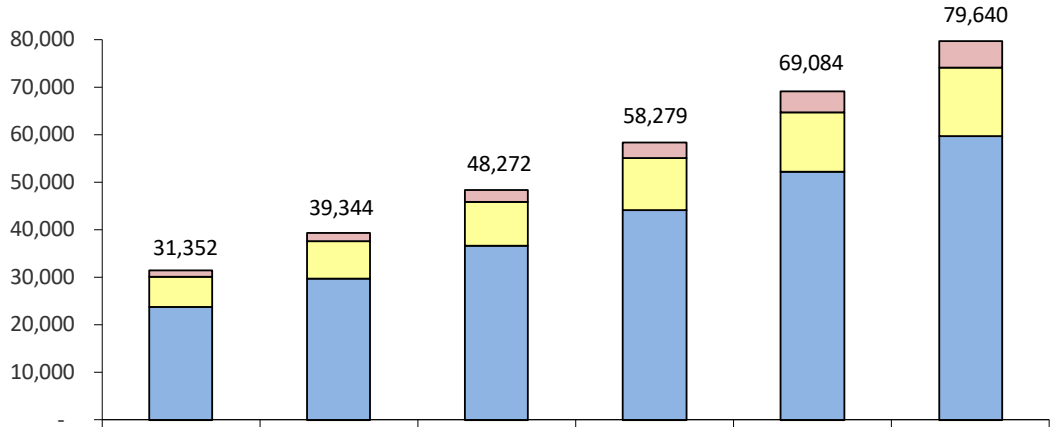


Source: Cisco Visual Networking Index and USTelecom Analysis. DVD equivalents are annualized, rounded, and assumed to store atwo-hour movie. The 2012 figure is revised from previously reported volumes based on Cisco VNI statements and is a rounded estimate.

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

Video is the Biggest Driver of IP Traffic

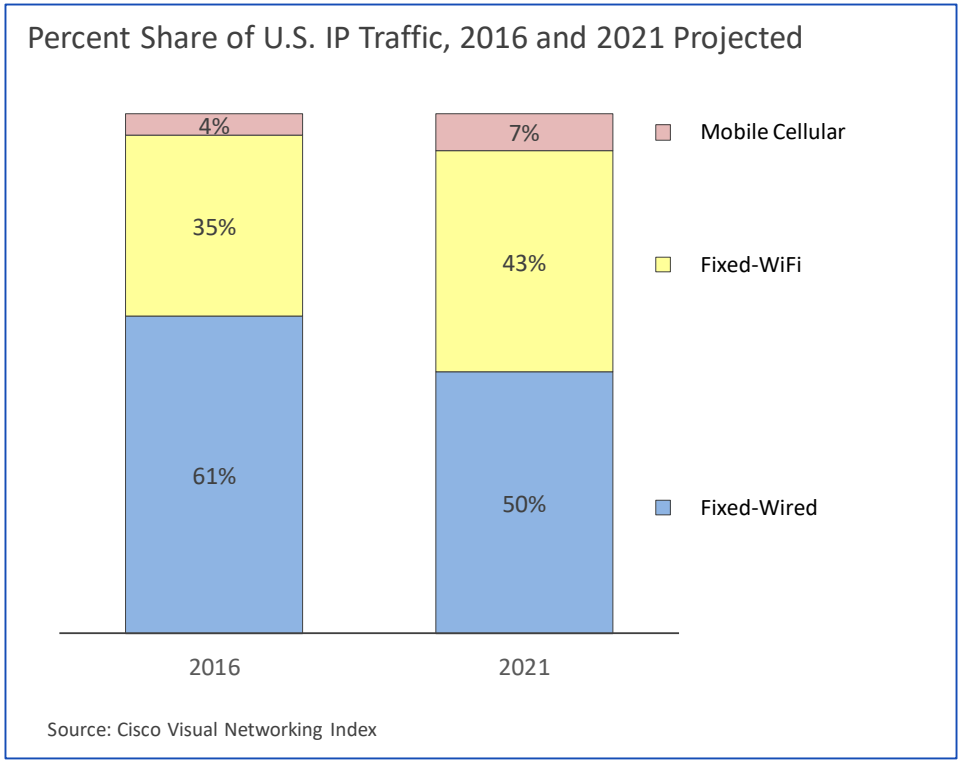
U.S. Internet Protocol Traffic, 2016-2021 (Petabytes per Month)



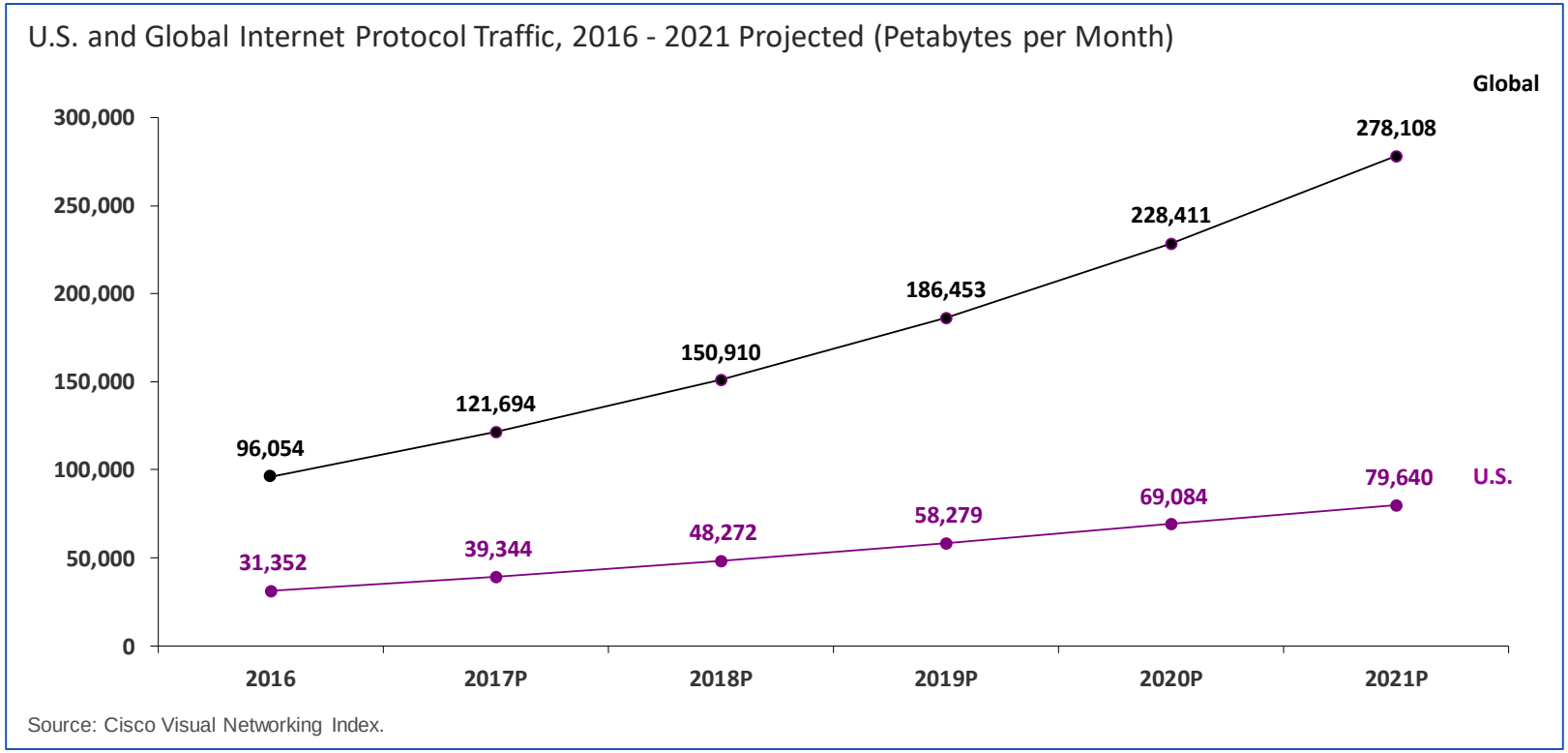
	2016	2017	2018	2019	2020	2021
Mobile	1,322	1,819	2,475	3,306	4,346	5,644
Fixed Consumer Data and Business	6,315	7,809	9,260	10,870	12,582	14,362
Fixed Consumer Video	23,715	29,716	36,537	44,104	52,157	59,634
Total	31,352	39,344	48,272	58,279	69,084	79,640

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

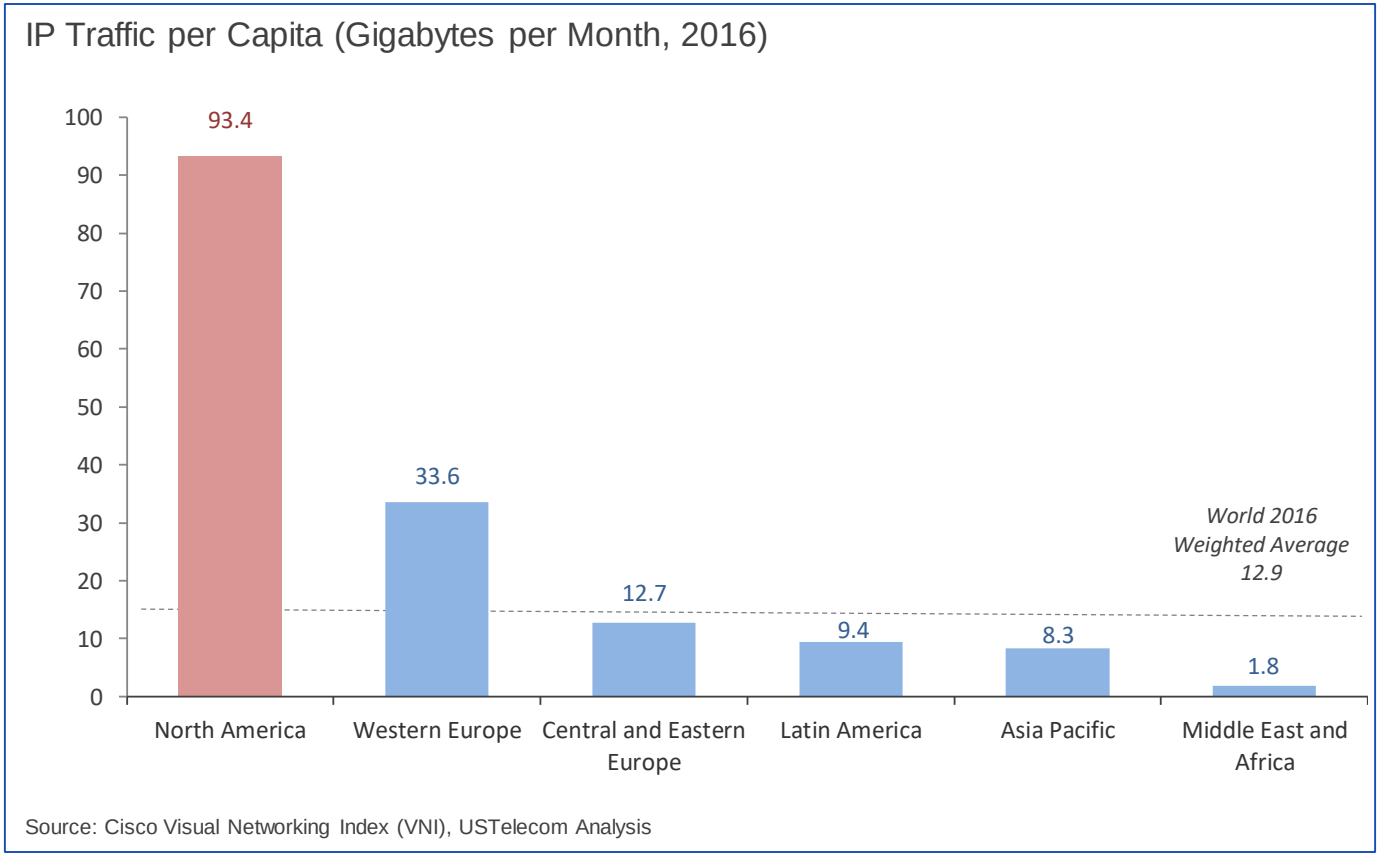


The U.S. Is a Global Leader in IP Traffic

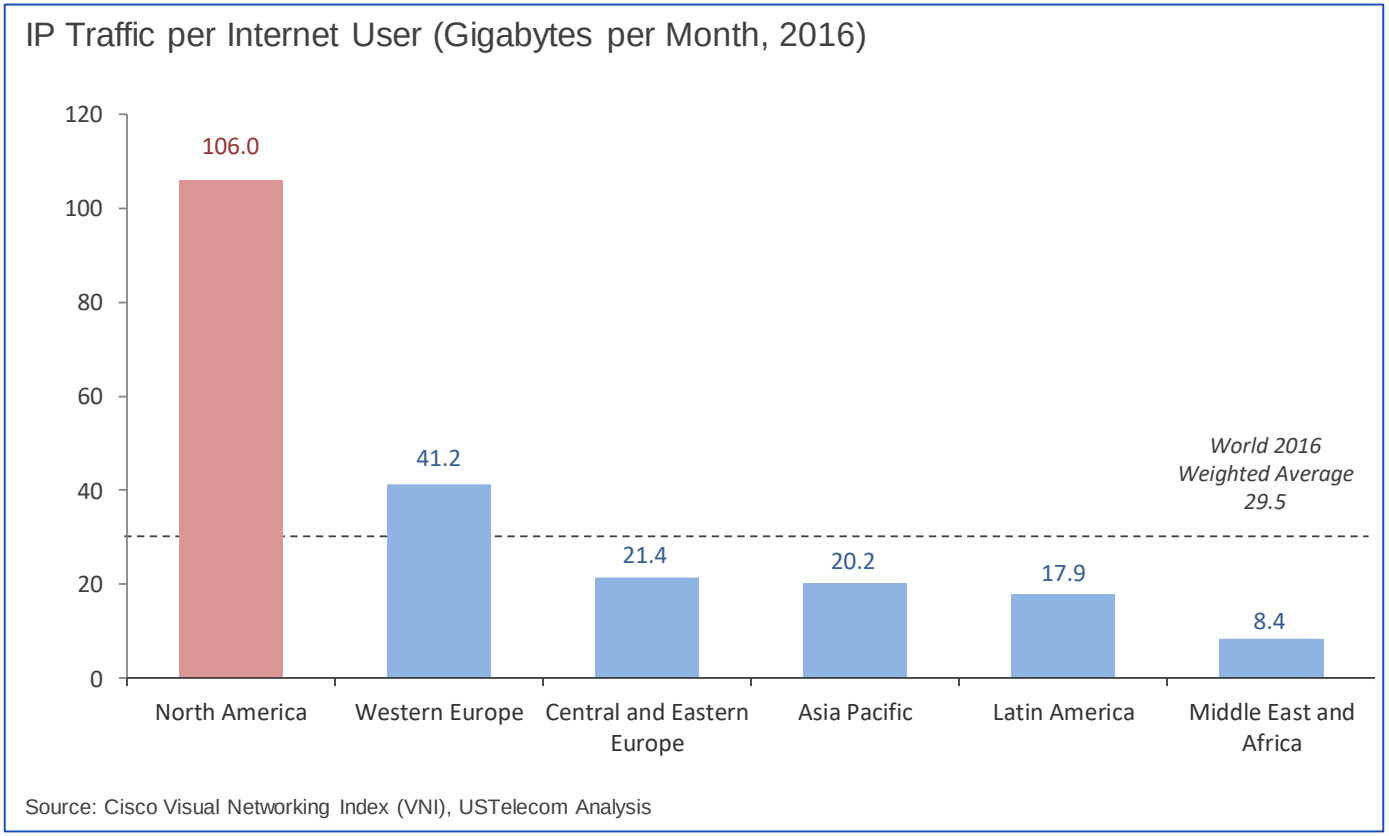


The U.S. is home to 4.4% of the world's population, but it generates nearly one-third of global IP traffic

North America Leads in IP Traffic per Capita

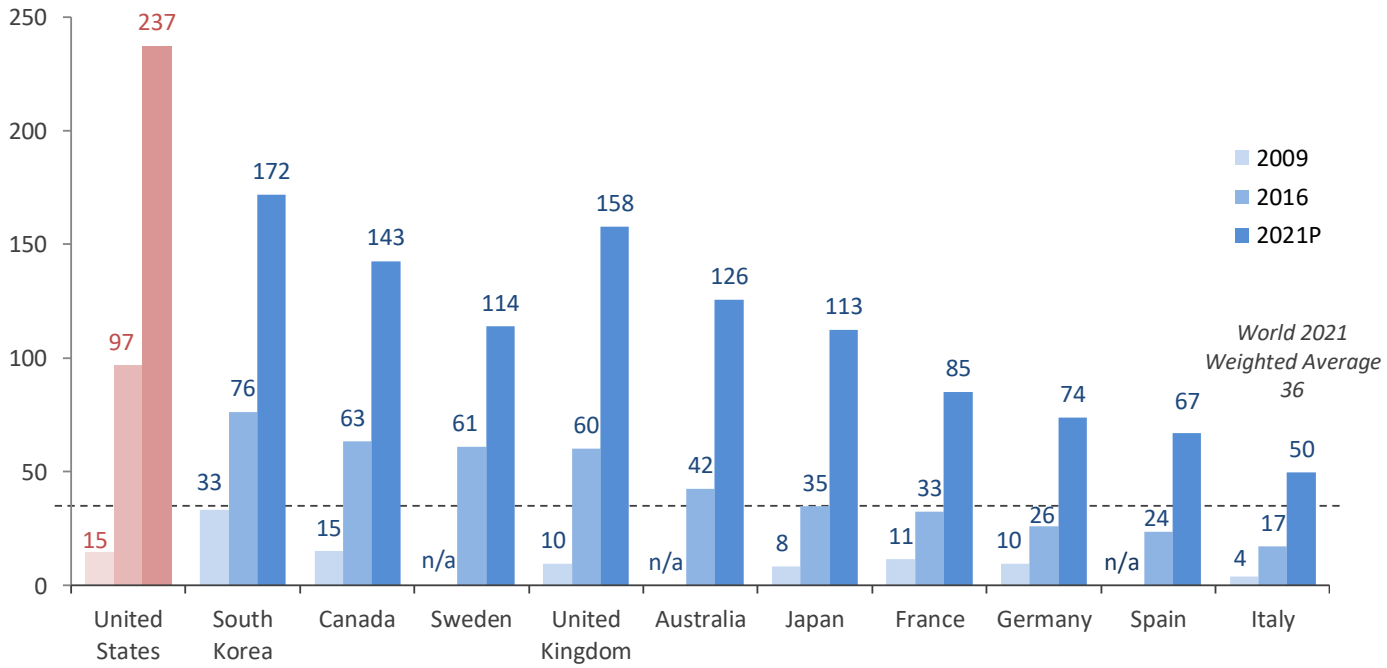


North America Leads in IP Traffic per User



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

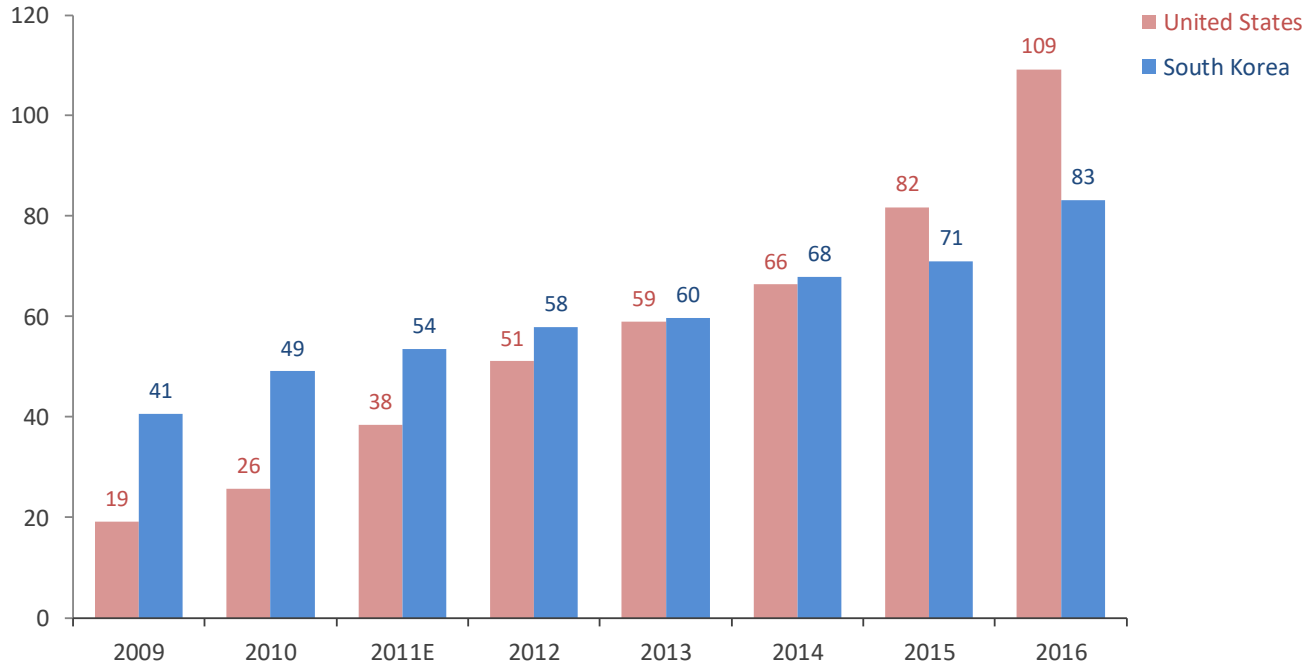
IP Traffic per Capita (Gigabytes per Month, 2009, 2016, and 2021 Projected)



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

U.S. and South Korea IP Traffic per Internet User 2009-2016 (Gigabytes per Month)



Source: Cisco Visual Networking Index, USTelecom Analysis. USTelecom did not collect data for 2011. The 2011 estimatre is the 2010-2012 midpoint.

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)

Exhibit B

RESEARCH BRIEF
FEBRUARY 22, 2018

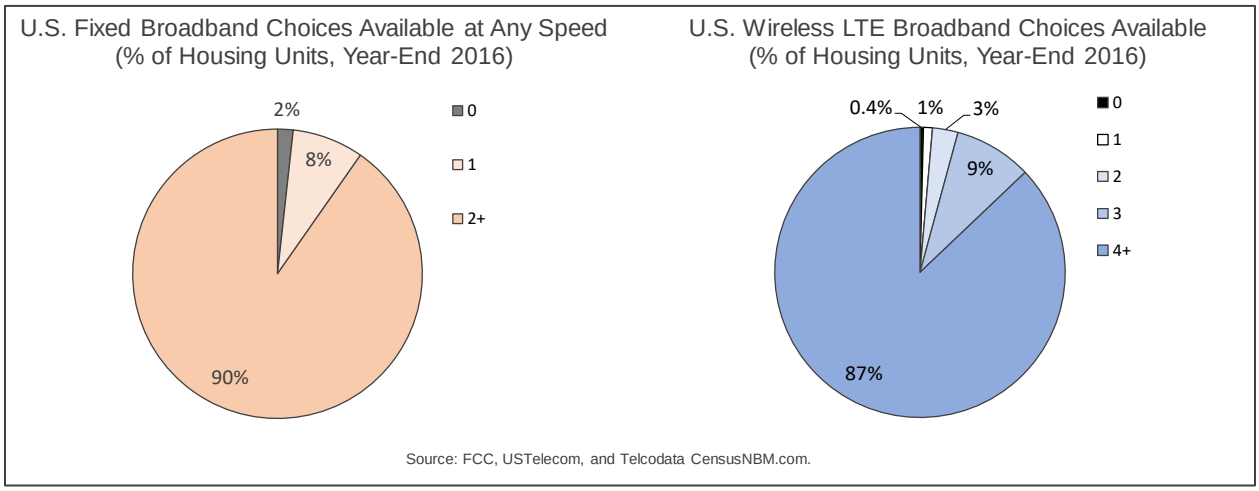
U.S. BROADBAND AVAILABILITY YEAR-END 2016

By Patrick Brogan, Vice President of Industry Analysis

U.S. broadband providers continued deploying and upgrading networks to bring consumers across the nation ever-faster service and competitive choice, according to a USTelecom and CensusNBM analysis of the most current Federal Communications Commission (FCC) broadband availability data for year-end 2016. Ongoing, widespread deployment of competitive broadband networks is the result of substantial capital investment in a dynamic, evolving market. Wireline, wireless, and cable providers invest more than $75 billion annually and have spent more than $1.6 trillion since 1996 to build competitive networks. The data indicate that deployment is widespread, but challenges remain to boosting coverage in rural areas.

USTelecom reiterates its view that any assessment of broadband availability and competition must start with an examination of broadband at any speed using any technology and must account for the dynamics of deployment and technological advancement over time. As of year-end 2016, 98 percent of Americans had at least one fixed broadband network platform available at any speed and 90 percent had at least two fixed platforms at any speed. As of year-end 2016, 99.6 percent of Americans had at least one mobile broadband network available; and nearly all Americans had a choice among LTE providers. See Chart 1. In addition, satellite providers offer national coverage and have recently launched next generation satellites that meet FCC broadband speed standards.

Chart 1



The FCC categorizes broadband as either fixed or mobile. The most current available data from the FCC are for year-end 2016 for fixed broadband and mobile wireless broadband. Fixed broadband consists of wired broadband and fixed wireless broadband. Wireless Internet Services Providers (WISPs) use terrestrial fixed wireless technology to deliver broadband services. For the purposes of the analysis below, USTelecom uses the term fixed broadband to refer to

terrestrial fixed broadband, which excludes satellite broadband. Wired broadband is a subset of fixed broadband, and it predominantly consists of broadband over fiber, digital subscriber line, and cable modem technologies. Mobile wireless broadband is separate from fixed wireless and fixed broadband.

The figures in Chart 1 reflect the foundational deployment of competitive broadband facilities. U.S. providers have been deploying broadband infrastructure using a range of technologies for more than two decades. As a result, basic underlying competitive infrastructure from multiple providers is available in the vast majority of the country. Moreover, broadband technologies are constantly evolving, with successive generations becoming increasingly powerful. Thus, upon the foundational infrastructure of underlying facilities, broadband providers invest tens of billions of dollars annually to extend and upgrade networks. As any provider or group of providers deploys advanced technologies, competing providers respond by deploying differentiated technologies of their own, driving a competitive process of ever-expanding network capabilities.

Against the backdrop of this competitive dynamic, it is important to keep in mind that broadband remains one of the most capital-intensive industries in the economy and the geographic reach of the U.S. is vast. In such an environment, providers simply cannot deploy the latest technology upgrades instantaneously across their entire network footprints. Wide-scale deployment is expensive and time consuming. Deployment and upgrades typically occur first in dense, low-cost areas and progress to more rural, high-cost areas over time. Snapshot analyses at a single point in time based on selective speed thresholds and technologies miss this dynamic: they understate both the availability and competitiveness of broadband. Worse, arbitrary speed thresholds can lead to misdiagnoses of market failure and calls for regulatory intervention. Therefore, it is imperative to look at both current and historical trends across technologies.

Competitive availability at higher speeds is growing rapidly as providers upgrade their widely deployed broadband networks. For example, available data allow us to look at wired broadband deployment, typically from wireline telecommunications and cable operators, at different speeds over time. The data indicate that competitive deployment is strong and growing. As of year-end 2016, 97 percent of Americans had at least one wired broadband network platform available to them and 86 percent had at least two wired options. See Chart 2. Competitive availability – defined narrowly as at least two wired providers – at 25 megabits per second (mbps) download (DL) and 3 mbps upload (UL) was 50 percent at year-end 2016, up from 31 percent at year-end 2014 and 25 percent at year-end 2012. Wired broadband at 10 mbps DL and 1 mbps UL was available to 67 percent of households from at least two providers at year-end 2016, up from 63 percent at year-end 2014 and an estimated 59 percent at year-end 2012. See Chart 3.

Chart 2

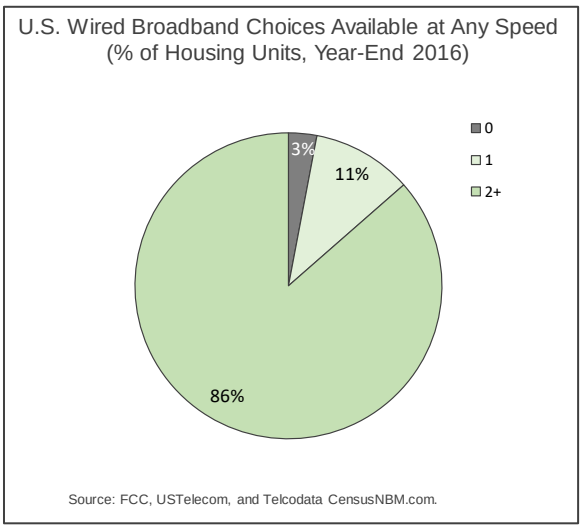
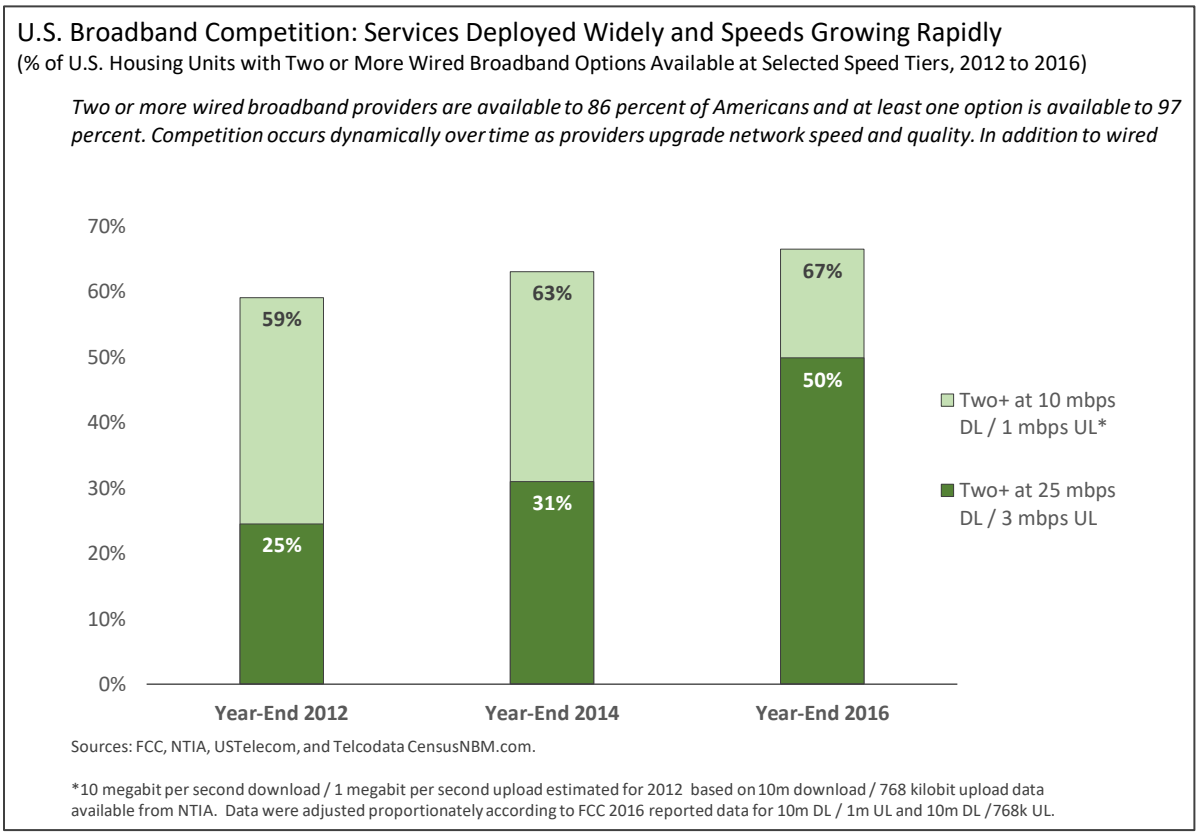


Chart 3



The FCC data also indicate that some portion of U.S. households can choose from three or more providers. For wired broadband, it is unclear the extent to which all of this is fully facilities-based competition. Of the 86 percent of Americans that had a choice of two or more wired broadband providers, 23 percent of Americans had a choice of three or more, according to the FCC data. We can identify at least one-fourth as full facilities-based providers: former cable over-builders, such as Wide Open West and RCN, covered at least 5.6 million housing units;

identifiable municipal network operators covered at least 1.6 million housing units; and Google Fiber covered approximately 884,000 housing units. Together these account for availability to 8.1 million housing units, or approximately six percent of Americans. The remaining three-fourths may include providers using their own facilities, providers who partially resell others' facilities, or some combination of these.

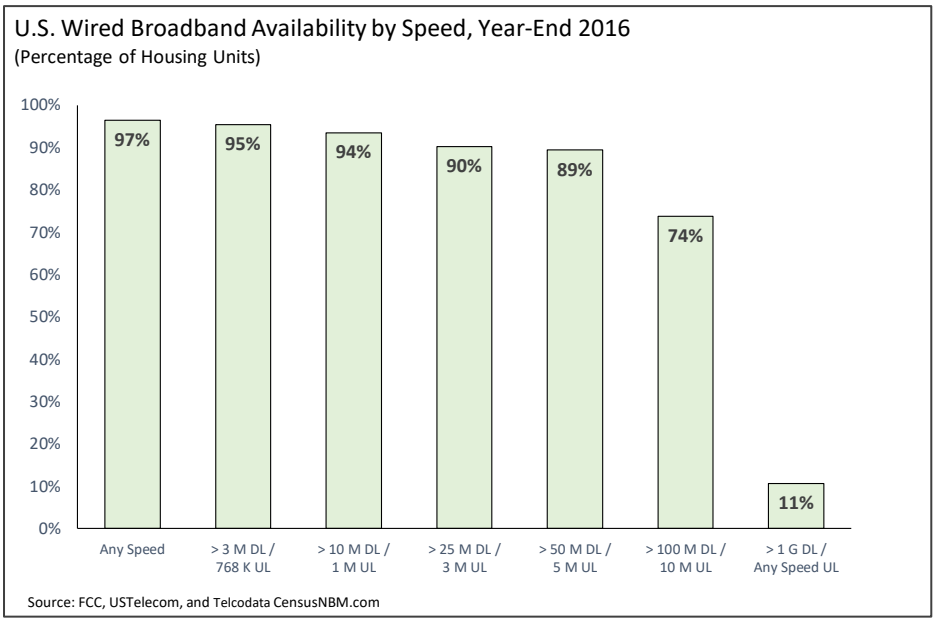
As of year-end 2016, fixed wireless service at any speed was available to 37 percent of Americans. The reported portion of Americans with three or more fixed broadband providers, which includes both wired and fixed wireless, available to them is significantly greater than for wired broadband, due to the inclusion of fixed wireless. Three or more fixed broadband options at any speed were available to 42 percent of Americans as of year-end 2016, compared to 23 percent for wired broadband only, according to the FCC data.

Mobile broadband from multiple providers is also widely available throughout the U.S. As shown above in Chart 1 above, as of year-end 2016, mobile broadband using 4G LTE wireless technology was available to 99.6 percent of Americans. Ninety-nine percent had a choice of two or more providers and 96 percent could choose among three or more. Four or more LTE mobile broadband options were available to 87 percent of Americans.

Broadband Availability and Deployment at Different Speeds over Time

Unsurprisingly, given the deployment dynamic discussed above, the FCC data for year-end 2016 show that the broadband availability rates are higher speeds at lower speeds. This is the case whether looking at wired broadband or the broader category of fixed broadband. See Chart 4 and Chart 5, respectively. However, consistent with the competitive deployment dynamic, the *overall* availability of higher speed services has been growing over time (see Chart 6); and the *competitive* availability of higher-speed services has been growing over time (see Chart 3).

Chart 4



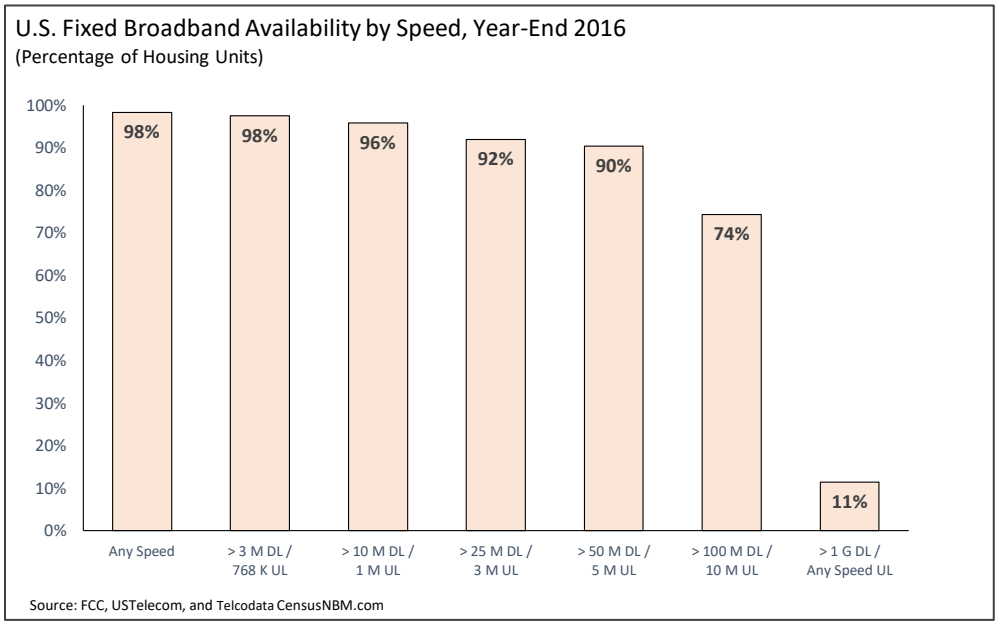
For wired broadband as of year-end 2016 (Chart 4):

- 97 percent of Americans could get broadband at any speed, up from 96 percent at mid-2016;
- 95 percent at 3 mbps DL and 768 kilobits per second (kbps) UL, up slightly from mid-2016 but unchanged at 95 percent after rounding;
- 94 percent at 10 mbps DL and 1 mbps UL, up from 93 percent at mid-2016;
- 90 percent at 25 mbps DL and 3 mbps UL, up from 89 percent at mid-2016;
- 89 percent at 50 mbps DL and 5 mbps UL, up from 88 percent at mid-2016;
- 74 percent at 100 mbps DL and 10 mbps UL, up from 68 percent at mid-2016; and
- 11 percent at 1 gigabit per second (gbps) DL and any speed UL, up from 9 percent at mid-2016.

For fixed broadband as of year-end 2016 (Chart 5):

- 98 percent of Americans could get broadband at any speed, up slightly from mid-2016 but unchanged from 98 percent after rounding;
- 98 percent at 3 mbps DL and 768 kbps UL, up from 97 percent at mid-2016;
- 96 percent at 10 mbps DL and 1 mbps UL, up from 95 percent at mid-2016;
- 92 percent at 25 mbps DL and 3 mbps UL, up from 90 percent at mid-2016;
- 90 percent at 50 mbps DL and 5 mbps UL, up from 89 percent at mid-2016;
- 74 percent at 100 mbps DL and 10 mbps UL, up from 68 percent at mid-2016; and
- 11 percent at 1 gbps DL and any speed UL, up from 10 percent at mid-2016.

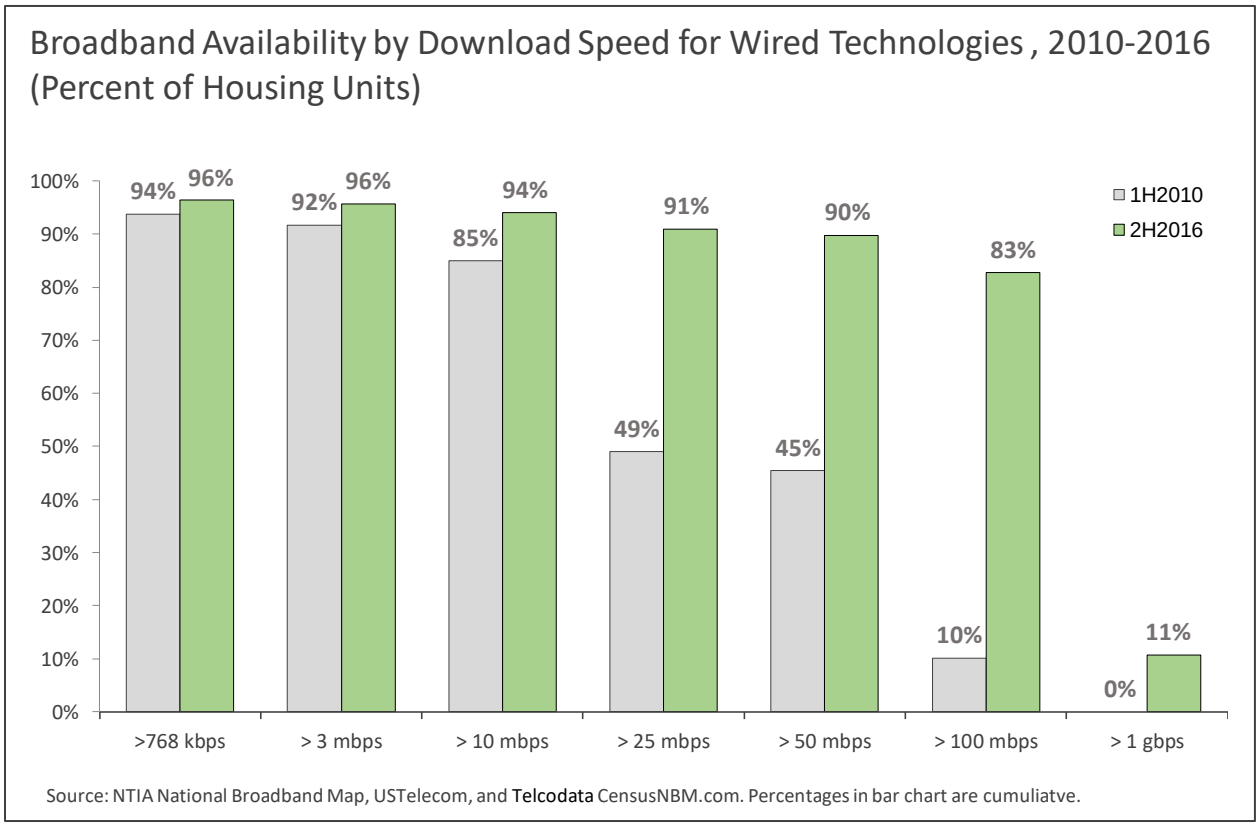
Chart 5



These data show that as of year-end 2016, fixed broadband at any speed was available to 98 percent of Americans and wired broadband was available to 96 percent of Americans. The FCC currently defines advanced services over fixed broadband based on a speed threshold of 25 mbps DL and 3 mbps UL. Approximately 92 percent of Americans had fixed broadband available and 90 percent had wired broadband available at the FCC's current speed threshold.

Broadband availability has been growing across all speed categories over time. Chart 6 compares availability of wired broadband from 2010 to 2016. Availability of broadband at 10 mbps DL grew from 85 percent to 94 percent. Availability of broadband at 25 mbps DL grew from 49 percent in 2010 to 91 percent at year-end 2016 while broadband at 50 mbps DL grew from 45 percent in 2010 to 90 percent at year-end 2016. Availability of broadband at 100 mbps DL grew from 10 percent in 2010 to 83 percent at year-end 2016. Gigabit consumer broadband, which did not exist in 2010, was available to 11 percent of households at year-end 2016.

Chart 6



Please note the following regarding the analysis shown in Chart 6: Corresponding data for fixed broadband are not readily available for 2010; and historical 2010 data were only available for download speeds. Therefore, the analysis in Chart 6 is limited to wired broadband. Nonetheless, it is likely that the broader fixed broadband category would show similar historical trends; and the discussions following Charts 4 and 5 comparing broadband availability at year-end 2016 and mid-2016 indicate that availability is currently growing for both fixed and wired options. Additionally, in order to make accurate comparisons to 2010, the analysis in Chart 6 contains only download speeds for 2016. As a result, the availability figures in Chart 6 are higher than for the corresponding download-upload combinations in Chart 4. Finally, since the 25 mbps DL /3 mbps UL and 50 mbps DL / 5 mbps UL are so similar, throughout the remainder of this research brief, USTelecom will not report the 50 mbps DL and 5 mbps UL figures.

An analysis of mobile broadband availability tells a similar story of competitive investment and growth. Data challenges make direct comparisons from 2010 to the present difficult. With 4G LTE technology, mobile carriers first began to report service at 10 mbps or greater DL. According to National Broadband Map (NMB), as of mid-2010, mobile broadband at 10 mbps DL or greater was available to less than one percent of Americans; by mid-2014 it was available to 98 percent. The FCC, which was responsible for the broadband deployment data collection as of year-end 2014, measures mobile wireless broadband speeds differently than the NBM; so, direct speed-based comparisons across the NBM and FCC data are not feasible. However, the FCC does report mobile broadband availability by technology. By year-end 2015, mobile broadband over LTE – a good proxy for 10 mbps or greater service – was available to 99.5 percent of Americans. By year-end 2016, LTE was available to 99.6 percent of Americans. In other words, mobile broadband at 10 mbps DL or greater grew from near zero to 98 percent availability in four years and approached 100 percent availability within six years. As of 2016, nearly all Americans had multiple choices for 4G mobile broadband, as shown above in Chart 1 above.

Broadband Availability in Rural and Non-Rural Areas

Broadband deployment across the diverse and expansive geography of the United States presents many challenges. In rural areas, costs are high and population densities low, so the cost per user can be extremely high. The economics of providing broadband at affordable and nationally comparable rates in many rural areas is difficult and in some cases prohibitive for wired providers who must deploy facilities all the way to end user locations. As a result, broadband is not surprisingly more widely available in non-rural areas than in rural areas and, due to the timing of upgrade cycles, typically at higher speeds. The analysis of rural broadband availability that follows updates USTelecom's previous analysis of mid-2016 data released in August 2017.

Rural Broadband Availability Overall

Broadband availability varies between rural and non-rural areas, but also within rural areas. In the calculations that follow, USTelecom reports availability as a percentage of housing units. Approximately 79 percent of housing units are non-rural and 21 percent are rural according to the 2010 Census.

As of year-end 2016, wired broadband at any speed was available to 99 percent of Americans in non-rural areas and 86 percent of Americans in rural areas at year-end 2016. See Chart 7. Wired broadband at 10 mbps DL and 1 mbps UL was available to 99 percent of Americans in non-rural areas and 75 percent in rural areas at year-end 2016, up from 98 percent and 72 percent, respectively, at mid-2016. Wired broadband at 25 mbps DL and 3 mbps UL was available to 98 percent of Americans in non-rural areas and 62 percent of Americans in rural areas at year-end 2016, up from 97 percent and 59 percent, respectively, at mid-2016. Wired broadband at 100 mbps DL and 10 mbps UL was available to 83 percent of Americans in non-rural areas and 39 percent of Americans in rural areas at year-end 2016, up from 79 percent and 34 percent, respectively, at mid-2016.

Chart 7

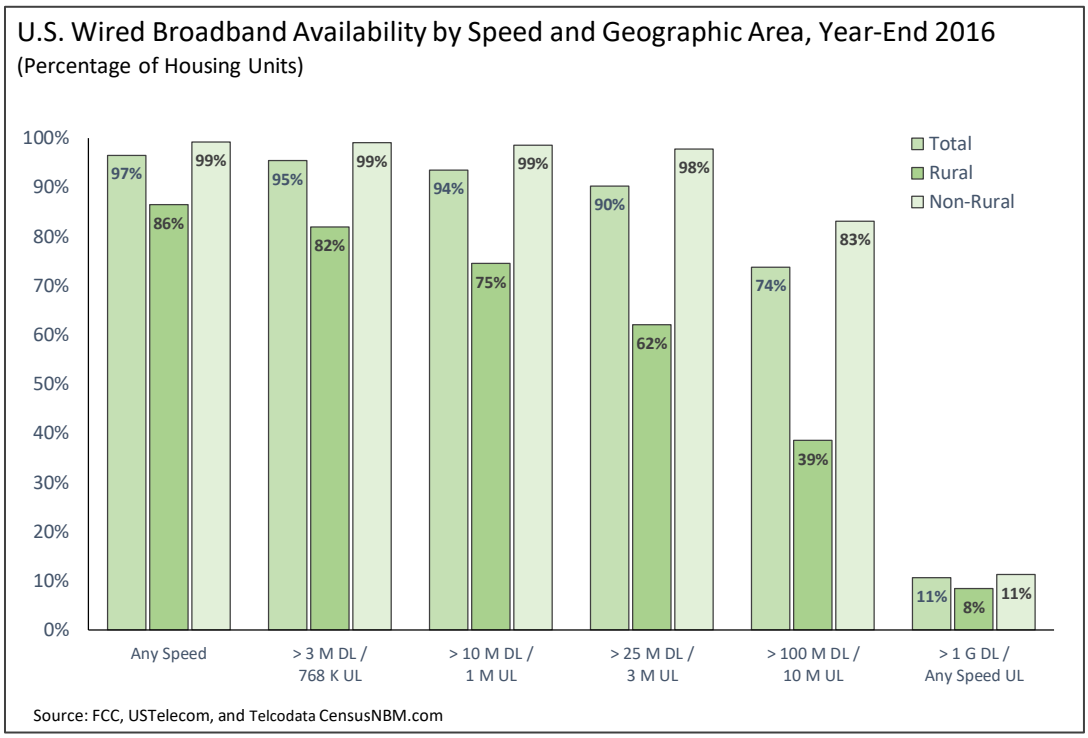
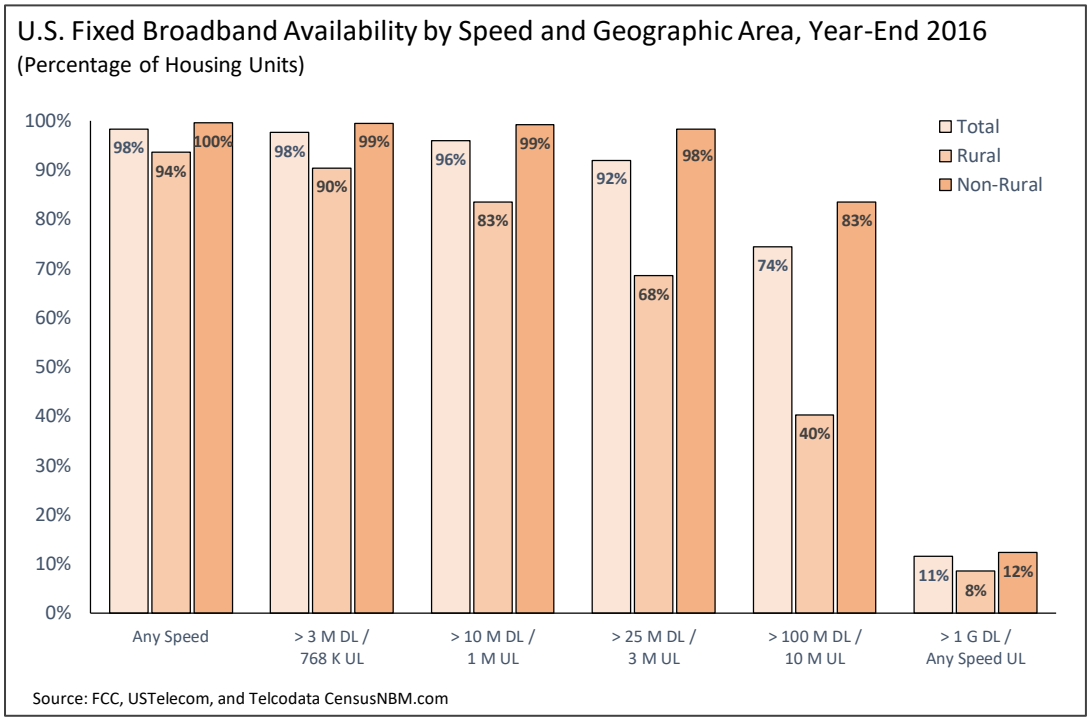


Chart 8



When including fixed wireless in the analysis, there is slightly greater availability in rural areas than there is when analyzing wired broadband alone. Fixed broadband at any speed was available to nearly 100 percent of Americans in non-rural areas and 94 percent of Americans in rural areas.

See Chart 8. Fixed broadband at 10 mbps DL and 1 mbps UL was available to 99 percent of Americans in non-rural areas and 83 percent in rural areas at year-end 2016, versus 99 percent and 80 percent, respectively, at mid-2016. Fixed broadband at 25 mbps DL and 3 mbps UL was available to 98 percent of Americans in non-rural areas and 68 percent of Americans in rural areas at year-end 2016, up from 97 percent and 64 percent, respectively, at mid-2016. Fixed broadband at 100 mbps DL and 10 mbps UL was available to 83 percent of Americans in non-rural areas and 40 percent of Americans in rural areas at year-end 2016, up from 77 percent and 35 percent, respectively, at mid-2016.

USTelecom does not provide a separate analysis for rural and non-rural deployment of mobile wireless broadband or satellite broadband. As shown in Chart 1 above, as of year-end 2016, 4G LTE mobile wireless broadband was available to 99.6 percent of Americans, and the vast majority of Americans, including those in rural areas, had 4G mobile broadband available to them from multiple competitive providers.

Competitive Availability: Rural and Non-Rural Components

At year-end 2016, wired broadband at any speed was available to 86 percent of Americans from two or more providers, with 11 percent having one option and three percent having no wired broadband option. See Chart 2. The 86 percent with two or more wired broadband options consisted of 75 percent in non-rural areas and 11 percent in rural areas. The 11 percent with one option consisted of nearly four percent in non-rural areas and seven percent in rural areas. The three percent that did not have a wired broadband provider consisted of less than one percent in non-rural areas and slighter greater than two percent in rural areas. See Chart 9.

At any point in time, competitive availability appears lower at higher speeds since they reflect more recent upgrade cycles. See Chart 10. This result is expected; and it reflects a dynamic, competitive marketplace. While core wired infrastructure is competitively available to 86 percent of Americans, networks are at different stages of upgrading to higher-speeds. As of year-end 2016, 67 percent of Americans could get 10 mbps DL and 1 mbps UL from at least two providers, while 50 percent could get 25 mbps DL and 3 mbps UL from at least two providers. As Chart 3 demonstrates, deployment at higher speeds by multiple providers is growing rapidly as competition drives upgrades.

Please note that Chart 9 shows the percentages with one decimal place because otherwise rounding would yield different figures than discussed above. Chart 10 uses the rounded figures because the individual charts are too small to accommodate decimals.

Chart 9

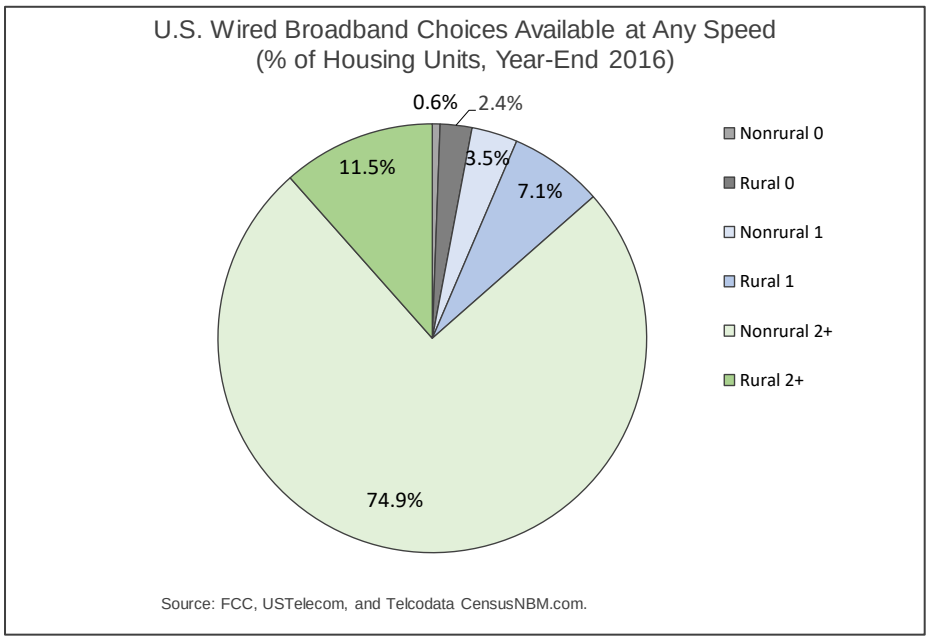
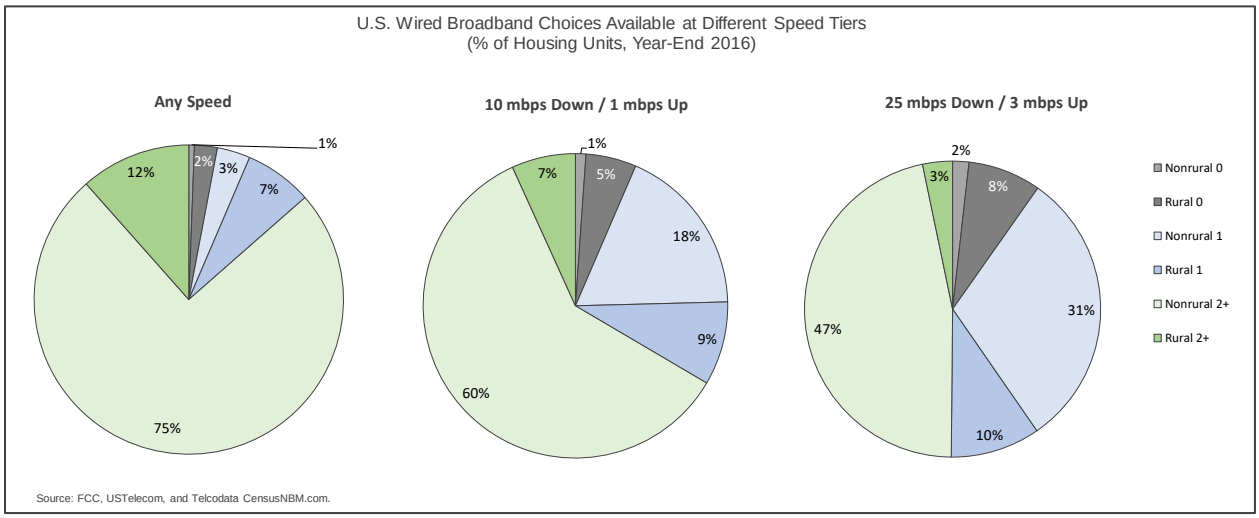


Chart 10



As of year-end 2016, fixed broadband – including wired and fixed wireless – at any speed was available to 90 percent of Americans from two or more providers, with eight percent having one option and two percent having no fixed broadband option. See Chart 1. The 90 percent with two or more fixed broadband options consisted of 76 percent in non-rural areas and 14 percent in rural areas. The eight percent with one fixed broadband option consisted of five percent in non-rural areas and three percent in rural areas. The two percent that did not have a fixed broadband provider consisted of less than one percent in non-rural areas and just under one and a half percent in rural areas. See Chart 11.

As with wired broadband, competitive availability estimates for fixed broadband are lower at higher speeds due to competitive dynamics and upgrade cycles. See Chart 12. Including fixed

wireless yields slightly higher estimates than wired broadband, especially at the 10 mbps DL and 1 mbps UL speed tier, where an additional 9 percent of Americans – 6 percent in non-rural areas and three percent in rural areas – had two or more fixed broadband offerings available as of year-end 2016.

Chart 11

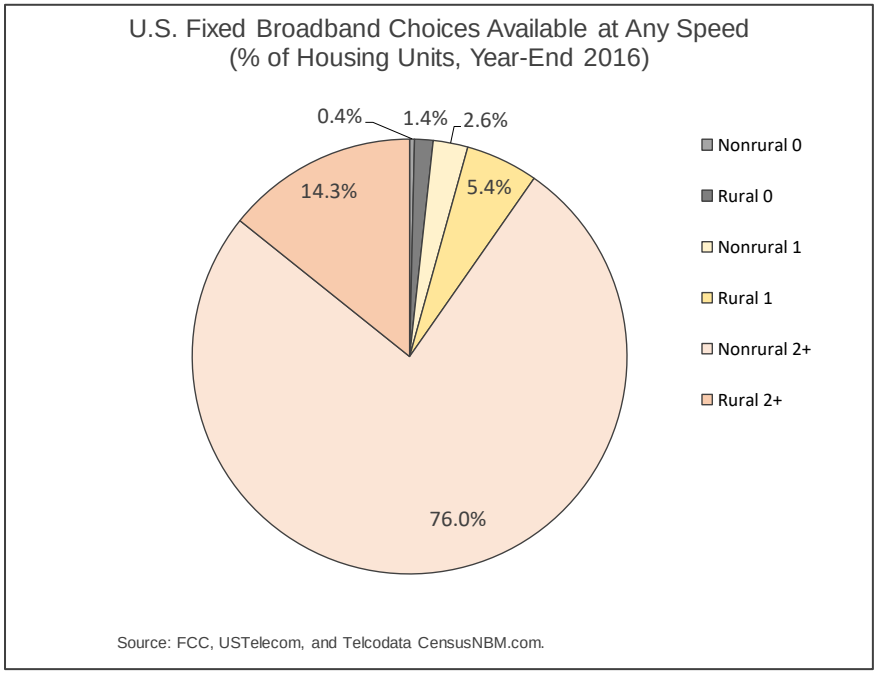
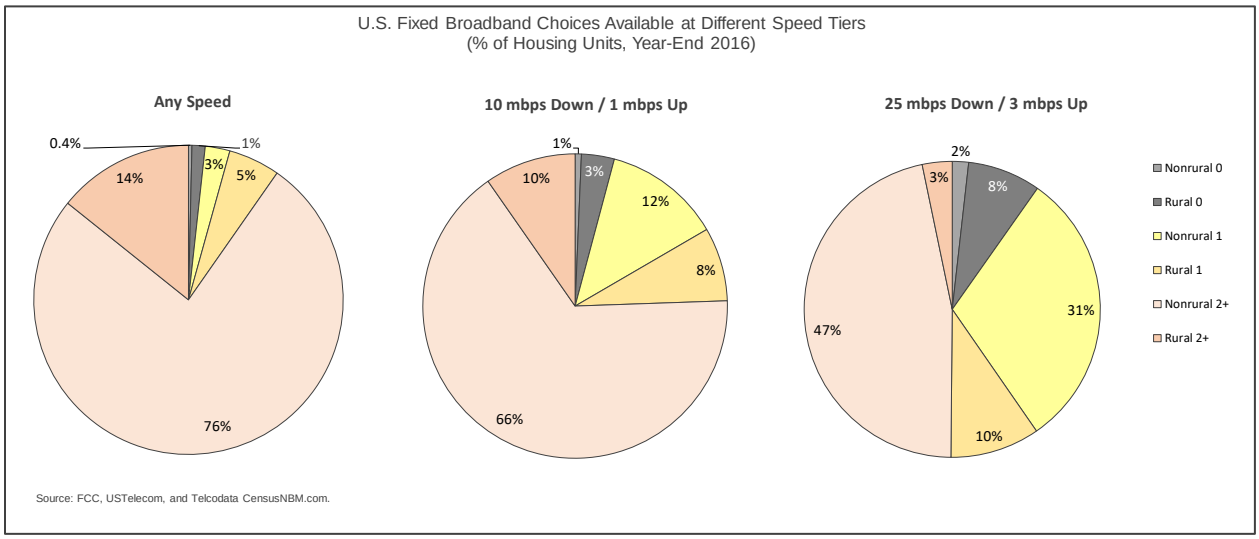


Chart 12



"The" Rural Broadband Gap?

Rural broadband is not monolithic. The data show that there is variation across rural areas in terms of deployment, speeds, and competition. While there are gaps in rural broadband, there is no single "rural broadband gap." Rather, gaps exist in specific rural areas either where broadband

is not available due to challenging economics or areas where there is only one provider and either demand, industry technology trends, or subsidies are not driving sufficient upgrades.

Nearly 55 percent of rural areas, where 11 percent of Americans reside, had two or more wired networks deployed, as of year-end 2016. Almost 34 percent of rural areas, where 7 percent of Americans reside, had just one wired provider. Combined with those areas that had two or more providers, almost 89 percent of rural Americans had at least one wired provider available to them. Of these, 75 percent could get services at 10 mbps DL and 1 mbps UL; 62 percent could get service at 25 mbps DL and 3 mbps UL; and 39 percent could get service at 100 mbps DL and 10 mbps UL. See Chart 6. Including fixed wireless and relaxing the upload requirement, these figures rise to 85 percent for 10 mbps DL; 71 percent for 25 mbps DL; and 51 percent for 100 mbps DL. See Appendix B.

The remainder may be unserved, depending on technology assumptions. Almost 14 percent of rural areas where three percent of Americans reside did not have a wired broadband option as of year-end 2016. This falls to less than 7 percent of rural areas, or less than 2 percent of all Americans, if fixed wireless is included in the analysis. The unserved portion falls to about two percent of rural areas and 0.4 percent of all Americans if 4G mobile wireless is included in the analysis, conservatively assuming nearly all uncovered areas for 4G mobile wireless are in rural America. Satellite eliminates the gap for all but the most extremely remote areas of the country if it is included in the analysis. The FCC has noted that latency – delays in data transmission arising from the distances between users and satellites – may affect perceived quality of real time interactive applications. However, satellite providers have recently deployed next generation satellites offering services that meet the FCC's current speed thresholds, and they may be able to accommodate real-time two-way communications. At minimum, in the very highest cost areas, satellite may be the most economical option for fixed broadband.

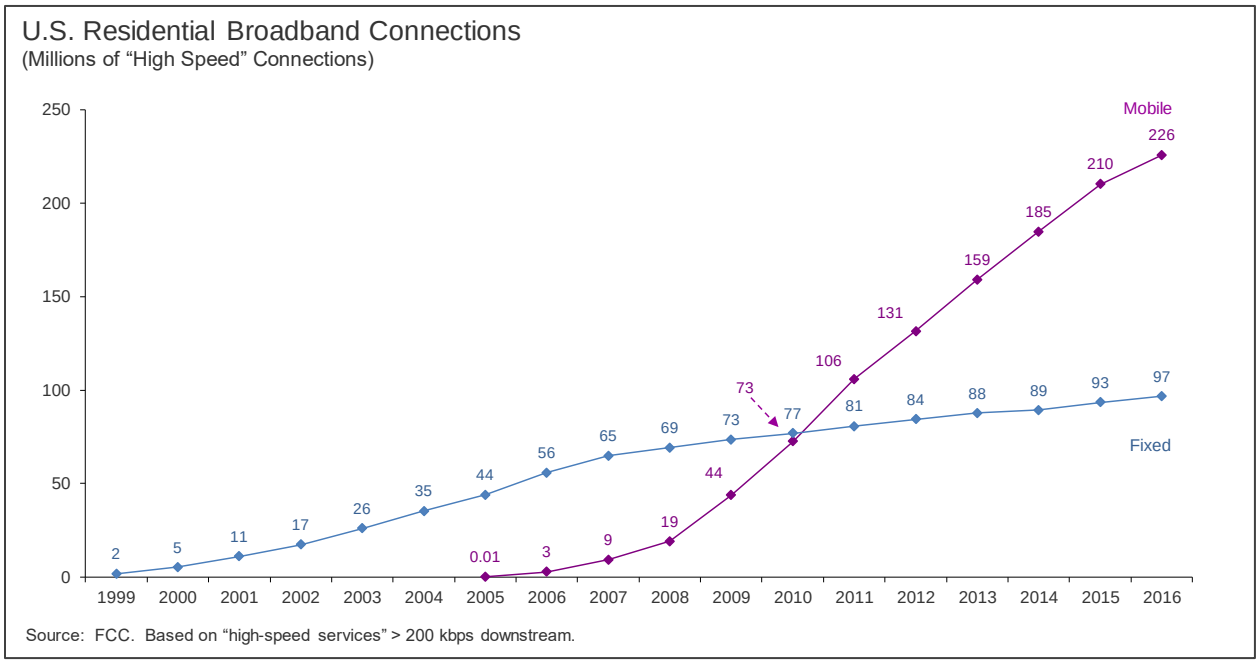
USTelecom believes that every American should have the opportunity to connect to the internet through sufficiently robust broadband service. For some areas, this requires government support. The FCC's Connect America Fund provides a good starting point. Further progress will require additional funding. Policies must be targeted, flexible, and efficient. Policies should target support to specific areas where the economics do not support deployment or upgrades; and governments must not fund wasteful, duplicative overbuilding of existing facilities. Policies must also be sufficiently flexible to allow for the most cost effective solutions rather than adhering to rigid technology or speed requirements. Finally, it is essential that funding be dedicated and direct, using a mechanism like the Connect America Fund, for the most economically and administratively efficient distribution of funds.

Mobile-Fixed Broadband Substitution

It is early in the evolution of wireless broadband to draw hard conclusions about substitution between fixed and mobile broadband services. Mobile broadband adoption is growing faster than fixed broadband adoption. See Chart 13. Fourth generation wireless services offer speeds on par with many wired broadband services, and fifth generation (5G) wireless promises significantly greater speeds. Americans are consuming more high-bandwidth services, especially video, on mobile devices and the major wireless providers are investing in fixed wireless services as a

potential fixed line alternative. There is also evidence that at least some consumers are choosing mobile broadband only, and that a portion of those consumer have a choice of fixed broadband provider. This cohort may grow significantly with the deployment of 5G wireless in the coming years, including both mobile and fixed wireless services. It will be critical for government to monitor such developments and to adjust policy should the trend toward substitution of wireless for wireline broadband gain momentum. As with voice telephony, broadband wireless-only users have started out slowly. Yet, the portion of U.S. households who rely on wireless-only telephone service has grown from 3 percent in 2003 to 53 percent as of 2016.

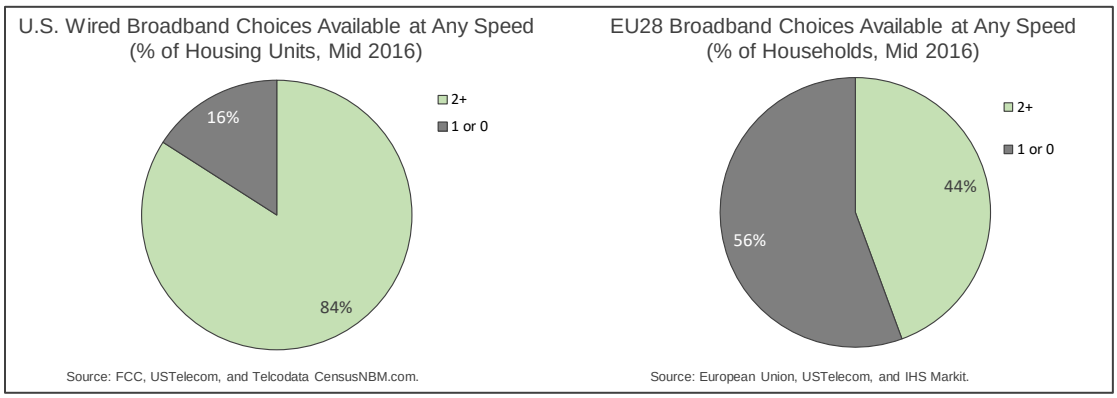
Chart 13



U.S. and European Broadband Availability

According to European Union data, U.S. consumers enjoy greater competitive choice among facilities-based wired broadband providers than their counterparts in Europe. As detailed above, as of year-end 2016, wired broadband from two or more providers was available to 86 percent of Americans. Data for Europe are available for mid-2016 only. Therefore, Chart 14 compares U.S. and European competitive availability for the same period. As of mid-2016, wired broadband from two or more providers was available to 84 percent of housing units in the U.S. By contrast, as of mid-2016, wired broadband from two or more providers was available to an estimated 44 percent of households in the EU's 28 member states (EU28), assuming that telecom providers cover most of Union and the cable footprint largely overlaps these providers.

Chart 14



Conclusion

As of year-end 2016, 97 percent of Americans had at least one wired broadband infrastructure available to them – 98 percent, if fixed wireless is included in the analysis. Moreover, there are competing wired broadband infrastructures in 86 percent of the country – 90 percent, if fixed wireless is included in the analysis. Nearly all Americans could get broadband service via mobile wireless and satellite.

While the FCC 477 data are not perfect, they are the best available and the risk of overstatement is minimal at broad geographic levels of aggregation. These broadband availability data highlight that U.S. broadband providers continue to deploy and upgrade networks rapidly, bringing the vast majority of consumers across the nation ever-faster service and choice in a reasonable and timely fashion. There is no paucity of competition, and there is no systemic market failure when it comes to deploying broadband in the U.S.

The presence of facilities-based competition is spurring ongoing investment in network upgrades across the nation, and as a result, both fixed and mobile broadband speeds are growing. Statistical market snapshots that arbitrarily understate the extent of broadband availability and competition are analytically deficient and can generate bad policy decisions. With respect to rural areas, there is not a monolithic broadband gap, but a range of areas that do not have sufficient broadband available to them. Policies must be targeted, addressing specific problem areas, and must be flexible to allow for economically efficient solutions. Moreover, to ensure both economic and administrative efficiency, governments must distribute any public funds for rural broadband deployment directly to providers through mechanisms such as the FCC's Connect America Fund.

Methodology

Data and Analysis

USTelecom worked with its consultant, Telecodata, to produce this research. Telcodata's broadband research service, CensusNBM (CensusNBM.com), compiled the data for this analysis by combining the Federal Communications Commission's (FCC) broadband availability and US Census housing unit data that is filed at the granular census block detail level and then consistently aggregated by Telcodata analysts to produce statistics for all 50 states plus DC. CensusNBM uses the 2010 Census, the last period that the Bureau produced a full tabulation of housing units, households, and population. For mapping and compatibility purposes, CensusNBM computed the broadband availability and Census information at the census block level in order to produce consistent broadband availability ratios. Census housing units and households track very closely, but housing units is a broader measure: it includes occupied homes, vacant homes and vacation homes; the household measure would include only occupied housing units.

The FCC has reported broadband availability data semi-annually using data collected using its Form 477 since year-end 2014. The most current FCC data available – and the data in this analysis – are for year-end 2016. The FCC reports broadband availability at the census block level by provider and by technology type, with maximum download/upload speeds.

The FCC reports the following fixed technology categories based on its Form 477 data collection:

- Asymmetric xDSL
- ADSL2
- VDSL
- Symmetric xDSL
- Copper
- Fiber
- Cable DOCSIS 3.1
- Cable DOCSIS 3.0
- Cable DOCSIS 1 - 1.1 - 2.0
- Cable Other
- Terrestrial Fixed Wireless
- Satellite

To enable certain analyses at higher levels than possible with the FCC-reported technology categories, CensusNBM created several broader groupings using. For example, CensusNBM created categories for all Cable technologies and all DSL technologies. It also created categories for Any Wired Technology except Cable – a category intended in include all wireline telecommunications provers; Any Wired Technology, which includes wireline telecommunications and cable providers; and Any Fixed Technology except Satellite, which combined Any Wired Technology and Terrestrial Fixed Wireless categories.

The following list represents the hierarchy of fixed broadband groupings and sub-groupings (see Appendices):

- Any Fixed Technology except Satellite
  - Any Wired Technology
    - Any Wired Technology except Cable
      - DSL
        - Asymmetric xDSL
        - ADSL2
        - VDSL
        - Symmetric xDSL
      - Copper
      - Fiber
    - Cable
      - DOCSIS 3.1
      - DOCSIS 3.0
      - DOCSIS 1 - 1.1 - 2.0
      - Cable Other
  - Terrestrial Fixed Wireless
- Satellite

The process for creating the broader categories eliminates duplication when appropriate, such as instances where a single provider reported multiple technologies in the same area, or where multiple types of providers in a broader category reported facilities in the same area. For example, since the FCC's Form 477 requires ISPs to record each broadband technology in a census block and its associated download/upload speeds, there can be duplicate records for a single provider. Therefore, when calculating the number of housing units with “Any Wired Technology except Cable” as a category, CensusNMB counts the number of housing units in census blocks where a single ISP reports both DSL and Fiber just one time – not once for fiber and once for DSL. Similarly, when calculating the number of housing units with “Any Wired Technology” as a category, CensusNBM counts the number of housing units in census blocks where both wireline telecommunications and cable operators report facilities just one time.

History

The National Telecommunications and Information Administration (NTIA) collected broadband availability data semi-annually for the “national broadband map” from mid-2010 to mid-2014. Those data are similar to, but not the same as, the broadband availability data the FCC collects using its Form 477. As a result, it is not possible to produce precise consistent time series between the NTIA data and the FCC data; but it is possible to create some rough comparisons over time using high-level data.

As part of the national broadband map, NTIA produced several reports detailing results by discrete technology and speed categories. Thus far, the FCC has released a great deal of raw data, and has used selected data in its Section 706 broadband deployment reports, but has not provided reports similar to those NTIA previously provided. USTelecom worked with

CensusNBM to develop several reports similar to, though not identical, to the NTIA technology and speed reports. See Appendixes.

With the FCC data, CensusNBM has flexibility to create speed tiers, technology aggregates, and other reports. It does not have as much flexibility with the NTIA data. Below is a discussion of some of the relevant differences between the NTIA and the FCC data.

- The NTIA only provided speed data in ranges, such as "1.5 mbps to 3.0 mbps." Certain speed thresholds that have become standards, like upload speeds "greater than 1.0 mbps" are not possible to ascertain with the NTIA data. In contrast, the current FCC 477 data specifies unique maximum advertised speeds, such as "1.0 Mbps." With such data points, as opposed to pre-defined ranges, it is possible for CensusNBM to create its own ranges or thresholds.
- The FCC 477 report identifies residential and business census blocks and further differentiates residential maximum advertised speeds from business/government maximum contracted speeds. Since the NTIA filings did not distinguish residential from business advertised speeds any comparison over time between the NTIA and FCC are not precisely compatible. Since the NTIA data also include business broadband deployment, earlier data will show relatively higher broadband availability results than the FCC 477 at comparable maximum advertised speeds.
- The NTIA data has only seven categories of fixed technologies, while the FCC data has 11.
- Unlike NTIA, the FCC data treats mobile wireless broadband differently than fixed broadband, so it is now not possible to report mobile data in the same manner as fixed broadband.

Geography

These data are national (50 states plus DC) with breakouts for rural and non-rural areas based on Census classification of census blocks. In terms of housing units, approximately 79 percent are in non-rural areas and 21 percent are in rural areas.

Appendix A – Year-End 2016 Broadband Availability by Housing Units, Download and Upload

US Broadaband Availability by Technology and Speed, Year-End 2016, Selected Download and Upload Speeds (Percentage of Housing Units)

All Areas

Technology	Total HU Any Speed	Total HU > 768 K DL / 200 K UL	Total HU > 3 M DL / 768 K UL	Total HU > 10 M DL / 1 M UL	Total HU > 25 M DL / 3 M UL	Total HU > 50 M DL / 5 M UL	Total HU > 100 M DL / 10 M UL	Total HU >1 gbps DL
Any Fixed Technology Except Satellite	98.3%	98.2%	97.6%	95.9%	92.0%	90.4%	74.4%	11.5%
Any Wired Technology	96.5%	96.3%	95.4%	93.5%	90.2%	89.4%	73.7%	10.7%
Any Wired Technology Except Cable	92.3%	91.8%	85.2%	70.9%	51.1%	42.3%	23.6%	7.3%
DSL	86.9%	86.4%	77.7%	57.2%	31.3%	23.2%	4.6%	0.1%
Asymmetric xDSL	64.9%	63.9%	50.8%	14.9%	3.8%	1.6%	0.2%	0.1%
ADSL2	34.2%	33.6%	28.5%	20.0%	1.8%	0.1%	0.0%	0.0%
VDSL	35.7%	35.7%	33.3%	31.6%	27.5%	21.5%	4.3%	0.0%
Symmetric xDSL	0.8%	0.8%	0.3%	0.3%	0.1%	0.1%	0.1%	0.0%
Copper	2.2%	2.2%	2.2%	2.1%	0.5%	0.3%	0.3%	0.0%
Fiber	26.4%	26.4%	26.0%	25.6%	24.7%	21.3%	19.6%	7.3%
Cable	88.0%	87.9%	87.9%	87.8%	87.2%	86.7%	70.0%	3.5%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	86.9%	86.9%	86.9%	86.9%	86.5%	86.2%	69.6%	3.2%
DOCSIS 1 - 1.1 - 2.0	1.8%	1.8%	1.7%	1.6%	1.2%	0.4%	0.3%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.0%	0.8%	0.6%	0.2%
Terrestrial Fixed Wireless	37.5%	37.1%	34.9%	30.9%	19.5%	11.8%	6.0%	0.9%
Satellite	100.0%	100.0%	100.0%	100.0%	56.8%	0.0%	0.0%	0.0%

Rural Areas

Technology	Rural HU Any Speed	Rural HU > 768 K DL / 200 K UL	Rural HU > 3 M DL / 768 K UL	Rural HU > 10 M DL / 1 M UL	Rural HU > 25 M DL / 3 M UL	Rural HU > 50 M DL / 5 M UL	Rural HU > 100 M DL / 10 M UL	Rural HU >1 gbps DL
Any Fixed Technology Except Satellite	93.5%	93.1%	90.4%	83.5%	68.5%	63.3%	40.2%	8.5%
Any Wired Technology	86.5%	85.5%	81.9%	74.5%	62.0%	59.9%	38.5%	8.4%
Any Wired Technology Except Cable	79.1%	77.5%	69.1%	52.0%	25.2%	22.2%	12.2%	6.3%
DSL	74.2%	72.5%	63.2%	44.0%	14.3%	11.6%	2.3%	0.0%
Asymmetric xDSL	48.4%	46.4%	36.5%	12.7%	4.3%	3.8%	0.4%	0.0%
ADSL2	43.3%	41.5%	35.9%	25.3%	0.9%	0.2%	0.0%	0.0%
VDSL	17.4%	17.4%	15.7%	14.4%	9.4%	7.6%	1.7%	0.0%
Symmetric xDSL	0.9%	0.9%	0.7%	0.5%	0.3%	0.2%	0.2%	0.0%
Copper	1.1%	1.1%	1.1%	0.9%	0.4%	0.4%	0.4%	0.0%
Fiber	14.5%	14.5%	14.3%	14.2%	13.1%	12.2%	10.6%	6.2%
Cable	53.3%	53.1%	53.0%	52.7%	51.1%	50.1%	31.0%	2.3%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	51.3%	51.3%	51.3%	51.1%	50.1%	49.4%	30.5%	2.2%
DOCSIS 1 - 1.1 - 2.0	2.0%	2.0%	1.8%	1.6%	0.8%	0.7%	0.4%	0.0%
Cable Other	1.3%	1.3%	1.2%	1.2%	1.0%	0.8%	0.6%	0.2%
Terrestrial Fixed Wireless	41.3%	40.9%	35.3%	28.1%	15.1%	7.4%	3.6%	0.0%
Satellite	100.0%	100.0%	100.0%	100.0%	43.8%	0.0%	0.0%	0.0%

Nonrural Areas

Technology	Nonrural HU Any Speed	Nonrural HU > 768 K DL / 200 K UL	Nonrural HU > 3 M DL / 768 K UL	Nonrural HU > 10 M DL / 1 M UL	Nonrural HU > 25 M DL / 3 M UL	Nonrural HU > 50 M DL / 5 M UL	Nonrural HU > 100 M DL / 10 M UL	Nonrural HU >1 gbps DL
Any Fixed Technology Except Satellite	99.6%	99.6%	99.5%	99.2%	98.2%	97.6%	83.5%	12.3%
Any Wired Technology	99.2%	99.2%	99.0%	98.6%	97.8%	97.3%	83.1%	11.2%
Any Wired Technology Except Cable	95.9%	95.6%	89.5%	75.9%	58.0%	47.7%	26.6%	7.6%
DSL	90.3%	90.1%	81.6%	60.7%	35.9%	26.2%	5.2%	0.1%
Asymmetric xDSL	69.2%	68.6%	54.7%	15.5%	3.7%	1.0%	0.1%	0.1%
ADSL2	31.7%	31.5%	26.5%	18.6%	2.0%	0.0%	0.0%	0.0%
VDSL	40.6%	40.6%	37.9%	36.2%	32.3%	25.2%	5.1%	0.0%
Symmetric xDSL	0.7%	0.7%	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%
Copper	2.6%	2.6%	2.5%	2.5%	0.5%	0.3%	0.2%	0.1%
Fiber	29.6%	29.6%	29.1%	28.7%	27.7%	23.7%	22.0%	7.6%
Cable	97.3%	97.2%	97.2%	97.2%	96.8%	96.5%	80.4%	3.9%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	96.4%	96.4%	96.4%	96.4%	96.2%	96.0%	80.0%	3.4%
DOCSIS 1 - 1.1 - 2.0	1.7%	1.7%	1.6%	1.6%	1.3%	0.3%	0.2%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.0%	0.8%	0.6%	0.2%
Terrestrial Fixed Wireless	36.4%	36.1%	34.8%	31.6%	20.7%	13.0%	6.6%	1.2%
Satellite	100.0%	100.0%	100.0%	100.0%	60.3%	0.0%	0.0%	0.0%

Source: FCC, USTelecom, and Telcodata CensusNBM.com

Appendix B – Year-End 2016 Broadband Availability by Housing Units, Download Only

US Broadaband Availability by Technology and Speed, Year-End 2016, Download Speeds Only (Percentage of Housing Units)

All Areas

Technology	Total HU Any Speed	Total HU >768 kbps DL	Total HU >1.5 mbps DL	Total HU >3 mbps DL	Total HU >6 mbps DL	Total HU >10 mbps DL	Total HU >25 mbps DL	Total HU >50 mbps DL	Total HU >100 mbps DL	Total HU >1 gbps DL
Any Fixed Technology Except Satellite	98.3%	98.3%	97.9%	97.7%	97.1%	96.2%	92.6%	90.7%	83.2%	11.5%
Any Wired Technology	96.5%	96.5%	96.0%	95.7%	95.1%	94.0%	91.0%	89.8%	82.7%	10.7%
Any Wired Technology Except Cable	92.3%	92.3%	87.0%	85.6%	82.4%	72.2%	54.6%	43.0%	24.3%	7.3%
DSL	86.9%	86.9%	80.9%	78.3%	72.3%	58.8%	35.3%	23.9%	5.2%	0.1%
Asymmetric xDSL	64.9%	64.5%	54.7%	51.6%	44.8%	15.2%	4.5%	1.7%	0.8%	0.1%
ADSL2	34.2%	34.1%	29.7%	28.9%	26.7%	21.7%	6.9%	0.1%	0.0%	0.0%
VDSL	35.7%	35.7%	33.3%	33.3%	33.3%	31.7%	29.0%	22.2%	4.3%	0.0%
Symmetric xDSL	0.8%	0.8%	0.7%	0.3%	0.3%	0.3%	0.1%	0.1%	0.1%	0.0%
Copper	2.2%	2.2%	2.2%	2.2%	2.2%	2.1%	0.5%	0.3%	0.3%	0.0%
Fiber	26.4%	26.4%	26.0%	26.0%	25.9%	25.6%	24.7%	21.4%	19.8%	7.3%
Cable	88.0%	88.0%	88.0%	88.0%	87.9%	87.8%	87.4%	87.0%	79.9%	3.5%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	86.9%	86.9%	86.9%	86.9%	86.9%	86.9%	86.6%	86.4%	79.5%	3.2%
DOCSIS 1 - 1.1 - 2.0	1.8%	1.8%	1.7%	1.7%	1.6%	1.6%	1.2%	0.4%	0.3%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	0.9%	0.7%	0.2%
Terrestrial Fixed Wireless	37.5%	37.1%	35.3%	35.1%	33.2%	30.9%	19.5%	11.8%	6.1%	0.9%
Satellite	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	56.8%	0.0%	0.0%	0.0%

Rural Areas

Technology	Any Speed	>768 kbps DL	>1.5 mbps DL	>3 mbps DL	>6 mbps DL	>10 mbps DL	>25 mbps DL	>50 mbps DL	>100 mbps DL	>1 gbps DL
Any Fixed Technology Except Satellite	93.5%	93.4%	91.9%	91.1%	88.6%	85.0%	70.9%	64.1%	50.8%	8.5%
Any Wired Technology	86.5%	86.4%	84.2%	82.9%	80.7%	76.6%	64.7%	60.8%	49.2%	8.4%
Any Wired Technology Except Cable	79.1%	79.0%	73.0%	70.6%	65.8%	56.0%	30.9%	22.7%	14.0%	6.3%
DSL	74.2%	74.1%	67.7%	64.9%	59.2%	48.4%	20.5%	12.0%	4.0%	0.0%
Asymmetric xDSL	48.4%	48.0%	41.3%	38.0%	31.9%	13.3%	5.3%	3.9%	2.1%	0.0%
ADSL2	43.3%	43.2%	37.9%	37.0%	35.0%	29.9%	7.7%	0.2%	0.0%	0.0%
VDSL	17.4%	17.4%	16.0%	15.9%	15.8%	14.6%	11.1%	7.9%	1.7%	0.0%
Symmetric xDSL	0.9%	0.9%	0.8%	0.7%	0.5%	0.5%	0.3%	0.2%	0.2%	0.0%
Copper	1.1%	1.1%	1.1%	1.1%	1.0%	0.9%	0.4%	0.4%	0.4%	0.0%
Fiber	14.5%	14.5%	14.3%	14.3%	14.3%	14.2%	13.2%	12.4%	11.0%	6.2%
Cable	53.3%	53.3%	53.3%	53.2%	52.9%	52.7%	51.6%	50.8%	42.0%	2.3%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	51.3%	51.3%	51.3%	51.3%	51.2%	51.1%	50.6%	49.9%	41.5%	2.2%
DOCSIS 1 - 1.1 - 2.0	2.0%	2.0%	2.0%	2.0%	1.7%	1.6%	0.8%	0.7%	0.4%	0.0%
Cable Other	1.3%	1.3%	1.3%	1.2%	1.2%	1.2%	1.0%	0.9%	0.7%	0.2%
Terrestrial Fixed Wireless	41.3%	40.9%	36.3%	35.9%	31.5%	28.2%	15.1%	7.4%	3.7%	0.0%
Satellite	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	43.8%	0.0%	0.0%	0.0%

Nonrural Areas

Technology	Any Speed	>768 kbps DL	>1.5 mbps DL	>3 mbps DL	>6 mbps DL	>10 mbps DL	>25 mbps DL	>50 mbps DL	>100 mbps DL	>1 gbps DL
Any Fixed Technology Except Satellite	99.6%	99.6%	99.5%	99.5%	99.4%	99.2%	98.4%	97.8%	91.8%	12.3%
Any Wired Technology	99.2%	99.2%	99.1%	99.1%	99.0%	98.6%	97.9%	97.5%	91.6%	11.2%
Any Wired Technology Except Cable	95.9%	95.8%	90.7%	89.7%	86.8%	76.5%	60.8%	48.4%	27.0%	7.6%
DSL	90.3%	90.3%	84.4%	81.9%	75.8%	61.6%	39.3%	27.0%	5.6%	0.1%
Asymmetric xDSL	69.2%	68.8%	58.3%	55.2%	48.3%	15.7%	4.3%	1.1%	0.5%	0.1%
ADSL2	31.7%	31.7%	27.6%	26.7%	24.5%	19.6%	6.6%	0.1%	0.0%	0.0%
VDSL	40.6%	40.6%	38.0%	38.0%	37.9%	36.2%	33.7%	26.0%	5.1%	0.0%
Symmetric xDSL	0.7%	0.7%	0.7%	0.2%	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%
Copper	2.6%	2.6%	2.5%	2.5%	2.5%	2.5%	0.5%	0.3%	0.2%	0.1%
Fiber	29.6%	29.6%	29.1%	29.1%	29.0%	28.7%	27.8%	23.8%	22.1%	7.6%
Cable	97.3%	97.3%	97.2%	97.2%	97.2%	97.2%	96.9%	96.7%	90.0%	3.9%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	96.4%	96.4%	96.4%	96.4%	96.4%	96.4%	96.2%	96.1%	89.6%	3.4%
DOCSIS 1 - 1.1 - 2.0	1.7%	1.7%	1.7%	1.7%	1.6%	1.6%	1.3%	0.3%	0.2%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%	0.7%	0.2%
Terrestrial Fixed Wireless	36.4%	36.1%	35.0%	34.9%	33.7%	31.7%	20.7%	13.0%	6.8%	1.2%
Satellite	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	60.3%	0.0%	0.0%	0.0%

Source: FCC, USTelecom, and Telcodata CensusNBM.com

Appendix C – Year-End 2016 Broadband Availability by Population, Download and Upload

US Broadaband Availability by Technology and Speed, Year-End 2016, Selected Download and Upload Speeds (Percentage of Population)

All Areas

Technology	Total Pop Any Speed	Total Pop > 768 K DL / 200 K UL	Total Pop > 3 M DL / 768 K UL	Total Pop > 10 M DL / 1 M UL	Total Pop > 25 M DL / 3 M UL	Total Pop > 50 M DL / 5 M UL	Total Pop > 100 M DL / 10 M UL	Total Pop >1 gbps DL
Any Fixed Technology Except Satellite	98.5%	98.4%	97.8%	96.3%	92.6%	91.1%	75.6%	11.3%
Any Wired Technology	96.8%	96.5%	95.7%	93.9%	90.9%	90.1%	75.0%	10.5%
Any Wired Technology Except Cable	92.6%	92.1%	85.5%	73.7%	52.3%	43.0%	23.8%	7.2%
DSL	87.0%	86.5%	77.7%	57.1%	32.2%	23.5%	4.5%	0.1%
Asymmetric xDSL	65.3%	64.4%	51.7%	14.8%	4.1%	1.6%	0.2%	0.1%
ADSL2	33.2%	32.7%	27.9%	19.2%	1.9%	0.1%	0.0%	0.0%
VDSL	36.4%	36.4%	34.0%	32.2%	28.1%	21.9%	4.3%	0.0%
Symmetric xDSL	0.8%	0.8%	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%
Copper	2.1%	2.1%	2.1%	2.0%	0.4%	0.2%	0.2%	0.0%
Fiber	27.0%	27.0%	26.6%	26.2%	25.3%	21.7%	20.0%	7.2%
Cable	88.8%	88.8%	88.8%	88.7%	88.1%	87.7%	71.5%	3.5%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	87.8%	87.8%	87.8%	87.8%	87.4%	87.1%	71.1%	3.1%
DOCSIS 1 - 1.1 - 2.0	1.5%	1.5%	1.5%	1.4%	1.0%	0.3%	0.2%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.0%	0.8%	0.6%	0.2%
Terrestrial Fixed Wireless	37.8%	37.5%	35.7%	31.6%	19.9%	12.1%	5.9%	0.9%
Satellite	100.0%	100.0%	100.0%	100.0%	57.3%	0.0%	0.0%	0.0%

Rural Areas

Technology	Rural Pop Any Speed	Rural Pop > 768 K DL / 200 K UL	Rural Pop > 3 M DL / 768 K UL	Rural Pop > 10 M DL / 1 M UL	Rural Pop > 25 M DL / 3 M UL	Rural Pop > 50 M DL / 5 M UL	Rural Pop > 100 M DL / 10 M UL	Rural Pop >1 gbps DL
Any Fixed Technology Except Satellite	94.1%	93.7%	91.2%	84.5%	69.8%	64.6%	41.5%	8.5%
Any Wired Technology	86.9%	86.0%	82.4%	75.0%	63.0%	61.0%	39.7%	8.5%
Any Wired Technology Except Cable	79.5%	77.8%	69.2%	51.9%	25.4%	22.4%	12.2%	6.2%
DSL	74.6%	72.8%	63.3%	43.8%	14.4%	11.7%	2.2%	0.0%
Asymmetric xDSL	48.9%	46.9%	38.2%	12.7%	4.3%	3.8%	0.4%	0.0%
ADSL2	43.0%	41.2%	36.4%	24.7%	0.9%	0.2%	0.0%	0.0%
VDSL	17.7%	17.7%	16.1%	14.4%	9.5%	7.7%	1.7%	0.0%
Symmetric xDSL	0.9%	0.8%	0.6%	0.5%	0.2%	0.2%	0.2%	0.0%
Copper	1.0%	1.0%	1.0%	0.9%	0.4%	0.4%	0.4%	0.0%
Fiber	14.6%	14.6%	14.4%	14.2%	13.1%	12.2%	10.6%	6.1%
Cable	54.6%	54.6%	54.4%	54.0%	52.5%	51.6%	32.5%	2.5%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	52.6%	52.6%	52.6%	52.5%	51.5%	50.8%	32.0%	2.3%
DOCSIS 1 - 1.1 - 2.0	2.0%	2.0%	1.9%	1.5%	0.8%	0.7%	0.4%	0.0%
Cable Other	1.3%	1.3%	1.3%	1.2%	1.0%	0.8%	0.6%	0.2%
Terrestrial Fixed Wireless	42.4%	42.0%	37.3%	29.4%	15.9%	7.9%	3.7%	0.0%
Satellite	100.0%	100.0%	100.0%	100.0%	43.5%	0.0%	0.0%	0.0%

Nonrural Areas

Technology	Nonrural Pop Any Speed	Nonrural Pop > 768 K DL / 200 K UL	Nonrural Pop > 3 M DL / 768 K UL	Nonrural Pop > 10 M DL / 1 M UL	Nonrural Pop > 25 M DL / 3 M UL	Nonrural Pop > 50 M DL / 5 M UL	Nonrural Pop > 100 M DL / 10 M UL	Nonrural Pop >1 gbps DL
Any Fixed Technology Except Satellite	99.5%	99.5%	99.4%	99.1%	98.0%	97.4%	83.7%	12.0%
Any Wired Technology	99.1%	99.1%	98.9%	98.4%	97.5%	97.1%	83.4%	11.0%
Any Wired Technology Except Cable	95.7%	95.5%	89.3%	78.9%	58.8%	47.9%	26.6%	7.5%
DSL	90.0%	89.7%	81.1%	60.3%	36.5%	26.3%	5.0%	0.1%
Asymmetric xDSL	69.2%	68.5%	55.0%	15.3%	4.1%	1.0%	0.1%	0.1%
ADSL2	30.9%	30.6%	25.9%	17.9%	2.2%	0.0%	0.0%	0.0%
VDSL	40.9%	40.9%	38.3%	36.5%	32.5%	25.3%	4.9%	0.0%
Symmetric xDSL	0.8%	0.8%	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%
Copper	2.3%	2.3%	2.3%	2.3%	0.4%	0.2%	0.2%	0.0%
Fiber	29.9%	29.9%	29.5%	29.1%	28.2%	23.9%	22.2%	7.4%
Cable	97.0%	97.0%	97.0%	96.9%	96.6%	96.3%	80.8%	3.7%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	96.2%	96.2%	96.2%	96.2%	96.0%	95.8%	80.4%	3.3%
DOCSIS 1 - 1.1 - 2.0	1.4%	1.4%	1.4%	1.4%	1.1%	0.3%	0.2%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.0%	0.9%	0.6%	0.2%
Terrestrial Fixed Wireless	36.7%	36.5%	35.3%	32.1%	20.9%	13.1%	6.4%	1.1%
Satellite	100.0%	100.0%	100.0%	100.0%	60.6%	0.0%	0.0%	0.0%

Source: FCC, USTelecom, and Telcodata CensusNBM.com

Appendix D – Year-End 2016 Broadband Availability by Population, Download Only

US Broadaband Availability by Technology and Speed, Year-End 2016, Download Speeds Only (Percentage of Population)

All Areas

Technology	Total Pop Any Speed	Total Pop >768 kbps DL	Total Pop >1.5 mbps DL	Total Pop >3 mbps DL	Total Pop >6 mbps DL	Total Pop >10 mbps DL	Total Pop >25 mbps DL	Total Pop >50 mbps DL	Total Pop >100 mbps DL	Total Pop >1 gbps DL
Any Fixed Technology Except Satellite	98.5%	98.4%	98.1%	98.0%	97.4%	96.6%	93.2%	91.4%	84.3%	11.3%
Any Wired Technology	96.8%	96.7%	96.2%	95.9%	95.4%	94.3%	91.5%	90.4%	83.8%	10.5%
Any Wired Technology Except Cable	92.6%	92.6%	87.2%	85.9%	82.7%	72.5%	69.6%	43.6%	24.5%	7.2%
DSL	87.0%	87.0%	80.9%	78.3%	72.2%	58.6%	36.0%	24.1%	5.1%	0.1%
Asymmetric xDSL	65.3%	64.9%	54.9%	51.7%	44.8%	15.1%	4.8%	1.6%	0.8%	0.1%
ADSL2	33.2%	33.2%	28.8%	27.9%	25.8%	20.9%	6.6%	0.1%	0.0%	0.0%
VDSL	36.4%	36.4%	34.0%	34.0%	34.0%	32.3%	29.6%	22.5%	4.3%	0.0%
Symmetric xDSL	0.8%	0.8%	0.7%	0.3%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Copper	2.1%	2.1%	2.1%	2.1%	2.0%	2.0%	0.4%	0.2%	0.2%	0.0%
Fiber	27.0%	27.0%	26.6%	26.6%	26.5%	26.2%	25.3%	21.7%	20.1%	7.2%
Cable	88.8%	88.8%	88.8%	88.8%	88.7%	88.7%	88.2%	87.9%	81.3%	3.5%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	87.8%	87.8%	87.8%	87.8%	87.8%	87.8%	87.5%	87.3%	80.8%	3.1%
DOCSIS 1 - 1.1 - 2.0	1.5%	1.5%	1.5%	1.5%	1.4%	1.4%	1.0%	0.4%	0.2%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%	0.7%	0.2%
Terrestrial Fixed Wireless	37.8%	37.5%	35.8%	35.7%	33.9%	31.6%	19.9%	12.1%	6.1%	0.9%
Satellite	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	57.3%	0.0%	0.0%	0.0%

Rural Areas

Technology	Any Speed	>768 kbps DL	>1.5 mbps DL	>3 mbps DL	>6 mbps DL	>10 mbps DL	>25 mbps DL	>50 mbps DL	>100 mbps DL	>1 gbps DL
Any Fixed Technology Except Satellite	94.1%	94.0%	92.5%	91.9%	89.4%	85.9%	72.0%	65.4%	52.0%	8.5%
Any Wired Technology	86.9%	86.8%	84.5%	83.3%	81.1%	77.1%	65.6%	61.8%	50.3%	8.5%
Any Wired Technology Except Cable	79.5%	79.3%	73.1%	70.6%	65.8%	55.8%	30.9%	22.9%	14.1%	6.2%
DSL	74.6%	74.4%	67.8%	64.9%	59.1%	48.1%	20.3%	12.1%	4.0%	0.0%
Asymmetric xDSL	48.9%	48.5%	41.5%	38.2%	32.1%	13.3%	5.4%	3.9%	2.1%	0.0%
ADSL2	43.0%	42.8%	37.4%	36.4%	34.4%	29.3%	7.4%	0.2%	0.0%	0.0%
VDSL	17.7%	17.7%	16.1%	16.1%	15.9%	14.6%	11.2%	8.0%	1.7%	0.0%
Symmetric xDSL	0.9%	0.8%	0.7%	0.6%	0.5%	0.5%	0.2%	0.2%	0.2%	0.0%
Copper	1.0%	1.0%	1.0%	1.0%	1.0%	0.9%	0.4%	0.4%	0.4%	0.0%
Fiber	14.6%	14.6%	14.4%	14.4%	14.3%	14.2%	13.2%	12.4%	11.0%	6.1%
Cable	54.6%	54.6%	54.6%	54.5%	54.2%	54.1%	53.0%	52.2%	43.4%	2.5%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	52.6%	52.6%	52.6%	52.6%	52.5%	52.5%	52.0%	51.3%	42.8%	2.3%
DOCSIS 1 - 1.1 - 2.0	2.0%	2.0%	1.9%	1.9%	1.6%	1.5%	0.8%	0.7%	0.4%	0.0%
Cable Other	1.3%	1.3%	1.3%	1.3%	1.3%	1.2%	1.1%	1.0%	0.7%	0.2%
Terrestrial Fixed Wireless	42.4%	42.0%	37.8%	37.3%	32.9%	29.5%	15.9%	7.9%	3.9%	0.0%
Satellite	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	43.5%	0.0%	0.0%	0.0%

Nonrural Areas

Technology	Any Speed	>768 kbps DL	>1.5 mbps DL	>3 mbps DL	>6 mbps DL	>10 mbps DL	>25 mbps DL	>50 mbps DL	>100 mbps DL	>1 gbps DL
Any Fixed Technology Except Satellite	99.5%	99.5%	99.4%	99.4%	99.3%	99.1%	98.2%	97.6%	92.0%	12.0%
Any Wired Technology	99.1%	99.1%	99.0%	98.9%	98.8%	98.4%	97.7%	97.3%	91.8%	11.0%
Any Wired Technology Except Cable	95.7%	95.7%	90.6%	89.5%	86.7%	76.5%	78.9%	48.6%	27.0%	7.5%
DSL	90.0%	89.9%	84.0%	81.4%	75.3%	61.1%	39.7%	27.0%	5.4%	0.1%
Asymmetric xDSL	69.2%	68.8%	58.0%	55.0%	47.9%	15.5%	4.6%	1.0%	0.5%	0.1%
ADSL2	30.9%	30.9%	26.7%	25.9%	23.7%	18.9%	6.5%	0.1%	0.0%	0.0%
VDSL	40.9%	40.9%	38.3%	38.3%	38.3%	36.5%	33.9%	25.9%	4.9%	0.0%
Symmetric xDSL	0.8%	0.8%	0.7%	0.2%	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%
Copper	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	0.4%	0.2%	0.2%	0.0%
Fiber	29.9%	29.9%	29.5%	29.5%	29.4%	29.1%	28.2%	23.9%	22.3%	7.4%
Cable	97.0%	97.0%	97.0%	97.0%	97.0%	96.9%	96.7%	96.5%	90.3%	3.7%
DOCSIS 3.1	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DOCSIS 3.0	96.2%	96.2%	96.2%	96.2%	96.2%	96.2%	96.0%	95.9%	89.9%	3.3%
DOCSIS 1 - 1.1 - 2.0	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.1%	0.3%	0.2%	0.0%
Cable Other	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%	0.7%	0.2%
Terrestrial Fixed Wireless	36.7%	36.5%	35.4%	35.3%	34.1%	32.1%	20.9%	13.1%	6.6%	1.1%
Satellite	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	60.6%	0.0%	0.0%	0.0%

Source: FCC, USTelecom, and Telcodata CensusNBM.com