Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act	)	GN Docket No. 15-191

2016 BROADBAND PROGRESS REPORT

Adopted: January 28, 2016 **Released: January 29, 2016**

By the Commission: Chairman Wheeler and Commissioners Clyburn and Rosenworcel issuing separate statements; Commissioner Pai concurring and issuing a statement; Commissioner O'Rielly dissenting and issuing a statement.

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I. INTRODUCTION

1. We issue this Report pursuant to section 706 of the Telecommunications Act of 1996, as amended, on our annual inquiry regarding the availability of "advanced telecommunications capability" to all Americans and the Congressional directive to determine whether such capability is being deployed to all Americans in a reasonable and timely fashion.[1] We find that advanced telecommunications capability is not being deployed to all Americans in a reasonable and timely fashion. As discussed in detail below, while our efforts have helped increase deployment, many Americans still lack access to advanced telecommunications capability, especially in rural areas and on Tribal lands. The disparity between advanced telecommunications capabilities available to rural and urban Americans persists. We

[1] 47 U.S.C. § 1302(b). For simplicity in past inquiries, the Commission has sometimes used the term "broadband" to refer to "advanced telecommunications capability." However, "advanced telecommunications capability" is a statutory term with a definition that differs from the term "broadband" as it is used in other contexts. *See* 47 U.S.C. § 1302(d)(1) ("The term 'advanced telecommunications capability' is defined, without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology."). Thus, in this Inquiry, we do not equate the term "broadband" with the statutory term "advanced telecommunications capability," but we do necessarily consider the availability of various broadband services that contribute to advanced telecommunications capability in our analysis under the statute. *See Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191, Eleventh Broadband Progress Notice of Inquiry, 30 FCC Rcd 8823, 8824 n. 3 (2015) (*Notice* or *2015 Eleventh Broadband Progress Notice of Inquiry*).

also find that many schools, particularly those in rural areas, continue to lack access to advanced telecommunications capabilities, necessary to meet the shorter and long term goals we established for the E-rate program (more formally known as the Schools and Libraries universal service support program).

2. Americans continue to turn to advanced telecommunications capability for every facet of daily life, and use fixed and mobile services for distinct but equally important purposes. We find today that the availability of advanced telecommunications capability requires access to both fixed and mobile services. This understanding of advanced telecommunications capability more accurately reflects consumer needs in today's society. For example, consumers use *fixed* broadband service for high capacity home use, including streaming high definition (HD) video, uploading large files and certain web services, but also increasingly rely on *mobile* broadband services for activities like navigation, communicating with family and friends and on social media, and receiving timely news updates away from home. Fixed and mobile broadband services are both critical means by which Americans communicate, and both should be evaluated in our analysis. We recognize that fixed and mobile services can provide some similar functionalities in certain applications and circumstances. This does not, however, change the inherent differences in key capabilities provided by the two services. Thus, as part of this Inquiry, we take the common-sense step of including mobile broadband services in our assessment of advanced telecommunications capability.

3. We retain our existing speed benchmark of 25 Mbps download/3 Mbps upload (25 Mbps/3 Mbps) for fixed services, but find that the current record is insufficient to set an appropriate speed benchmark for mobile service. While we find that it is reasonable to apply the same speed benchmarks to all fixed services, including fixed terrestrial and fixed satellite broadband service, we continue to observe different technical capabilities and adoption patterns between fixed terrestrial and fixed satellite service. Because no fixed satellite broadband service meets the 25 Mbps/3Mbps speed threshold as of the reporting period, we do not address the question of whether fixed satellite broadband services meeting this speed threshold would be considered to provide advanced telecommunications capability. Thus, in this Report we update how we account for both mobile services and satellite services.

4. We conclude that advanced telecommunications capability is not being deployed to all Americans in a reasonable and timely fashion. We recognize and applaud the meaningful progress that has been made through continued public- and private-sector initiatives to advance deployment of 25 Mbps/3 Mbps broadband or higher service since the *2015 Broadband Progress Report*.[2] But there is still more work to do. Despite the increase in the number of Americans that are able to obtain advanced telecommunications capability, these advances are not occurring broadly enough or quickly enough to achieve our statutory objective. Nationwide, one in ten Americans lacks access to 25 Mbps/3 Mbps broadband. As importantly, there continues to be a significant disparity of access to advanced telecommunications capability across America with more than 39 percent of Americans living in rural areas lacking access to advanced telecommunications capability, as compared to 4 percent of Americans living in urban areas, and approximately 41 percent of Americans living on Tribal lands lacking access to advanced telecommunications capability.[3] We note that small businesses tend to subscribe to mass market broadband service. Thus, the rural-urban disparity in deployment of these broadband services also disproportionately impacts the ability of small businesses operating in rural areas to successfully compete in the 21st century economy.

[2] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 14-126, 2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment, 30 FCC Rcd 1375, 1418, para. 79, Table 4 (2015) (*2015 Broadband Progress Report*) (providing data on Americans without access to fixed 25Mbps/3Mbps broadband); *see also infra* para. 79, Table 1.

[3] *See infra* para. 79, Table 1.

5. Congress also requires the Commission to evaluate the availability of advanced telecommunications capability to schools and classrooms. Recent third-party analysis of data collected by the E-rate program shows that while 20 million more students have access to high-speed broadband than two years ago, 41 percent of schools have not yet met our short-term connectivity goal of 100 Mbps per 1,000 users, and an even higher percentage are struggling to meet our longer term goal of 1 Gbps per 1,000 users.[4] Moreover, a recent survey of school district leaders conducted by CoSN in partnership with the School Superintendents Association (AASA) and MDR reported that 68 percent of school district leaders do not think they have sufficient bandwidth for today and the coming 18 months.[5] For these reasons, we separately conclude that advanced telecommunications capability to schools and classrooms is not being deployed in a reasonable and timely fashion.

6. As a consequence of our conclusion that advanced telecommunications capability is not being deployed to all Americans in a reasonable and timely fashion, section 706 mandates that the Commission "take immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market."[6] Our analysis finds that rural areas and Tribal lands are being left behind, as well as certain schools and classrooms, from receiving the advanced services envisioned by Congress. Moreover, as outlined below, only 38 percent of Americans have more than one choice of providers for fixed advanced telecommunications capability.[7] The competitive options for advanced telecommunications capability are even more limited in rural areas with only 13 percent of Americans living in rural areas having more than one choice of providers of these services compared to 44 percent of Americans living in urban areas.[8] While actions of the Commission and the private sector have done much to accelerate the deployment of advanced telecommunications capability, more needs to be done. We will continue working to remove barriers to infrastructure investment, in part by direct subsidies, and in part by identifying and helping to reduce potential obstacles to deployment, competition, and adoption—concepts that we continue to recognize are tightly linked.

II. BACKGROUND

A. Statutory Requirements and Context

7. Section 706(b) requires the Commission to "initiate a notice of inquiry concerning the availability of advanced telecommunications capability to *all* Americans (including, in particular, elementary and secondary schools and classrooms)."[9] In conducting this inquiry, the Commission must "determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion."[10] If that determination is negative, the Commission "shall take

[4] EducationSuperHighway, Connecting America's Students: Opportunities for Action, at 12 (April 2014) http://www.educationsuperhighway.org/wp-content/uploads/2014/11/Connecting-Americas-Students-K12-E-rate-Spending-Report-April-2014.pdf (*EducationSuperHighway Report*) (EducationSuperHighway (ESH) reports on the number of schools and school districts with broadband access of 100 kbps or more of service per student, which approximates our short term goal of 100 Mbps per user).

[5] CoSN, 2014 Annual E-Rate and Infrastructure Survey, at 5 (2015), http://cosn.org/sites/default/files/pdf/CoSN%202nd%20Annual%20E-rate%20and%20Infrastructure%20Report,%2010-15-2014_2.pdf (CoSN Survey).

[6] 47 U.S.C. § 1302(b). The D.C. Circuit has upheld our interpretation of subsections (a) and (b) of section 706 as independent and overlapping grants of authority. *Verizon v. FCC*, 740 F.3d 623, 637-39 (D.C. Cir. 2014).

[7] *See infra* para. 86, Table 6.

[8] *Id*.

[9] 47 U.S.C. § 1302(b) (emphasis added).

[10] *Id*.

immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market."[11]

8. In 2008, Congress augmented the government's role in ensuring that effective broadband services reach all Americans by passing the Broadband Data Improvement Act (BDIA), which requires the Commission to issue its section 706(b) reports annually,[12] as well as provide specific demographic information[13] and international comparisons in its Report.[14] The revisions to our statutory directive under section 706 were based on Congress's finding that "[t]he deployment and adoption of broadband technology has resulted in enhanced economic development and public safety for communities across the Nation, improved health care and educational opportunities, and a better quality of life for all Americans."[15] Congress also recognized that continued efforts were necessary so that "our Nation remains competitive and continues to create business and job growth."[16] Congress took additional action in this area through the 2009 Recovery Act, which directed the National Telecommunications and Information Administration (NTIA) through the State Broadband Initiative (SBI) program to collect more robust data about broadband deployment and create "a comprehensive nationwide inventory map of existing broadband service capability and availability" through a National Broadband Map.[17] Subsequently, in the 2013 *Modernizing FCC Form 477 Order*, we held it is in the public interest for the Commission to collect data on deployment of fixed and mobile broadband networks. We held it should be the Commission that collects the deployment data in order to help meet our statutory obligations.[18]

B. Previous Broadband Progress Reports

9. In recent Broadband Progress Reports, the Commission found that advanced telecommunications capability was not being deployed to all Americans in a reasonable and timely fashion.[19] The Commission based its determination on the lack of availability of fixed broadband services and the Reports also included an assessment of factors indicative of fixed broadband availability, including physical deployment, broadband price, quality, and adoption by consumers.[20] In those Reports,

[11] *Id*. § 1302(b).

[12] BDIA § 103(a)(1); 47 U.S.C. § 1302(b).

[13] BDIA § 103(a)(3); 47 U.S.C. § 1302(c). The BDIA requires that the Commission "compile a list of geographical areas not served by any provider of advanced telecommunications capability." *Id.* To the extent that Census Bureau data are available, the Commission must then "determine, for each such unserved area—(1) the population; (2) the population density; and (3) the average per capita income." *Id*.

[14] BDIA § 103(b)(1); 47 U.S.C. § 1303(b).

[15] BDIA § 102(1); 47 U.S.C. § 1301(1).

[16] BDIA § 102(2); 47 U.S.C. § 1301(2).

[17] American Recovery and Reinvestment Act of 2009, § 6001(l), Pub. L. No. 111-5, 123 Stat. 115 (2009) (Recovery Act).

[18] *Modernizing the FCC Form 477 Data Program*, WC Docket No. 11-10, Report and Order, 28 FCC Rcd 9887, 9897, para. 22 (2013) (*Modernizing Form 477 Order).*

[19] *2015 Broadband Progress Report*, 30 FCC Rcd at 1378, para. 4; *see also Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 11-121, Eighth Broadband Progress Report, 27 FCC Rcd 10342*,* 10344, 10350, paras. 1, 9 & n.47 (2012) (*2012 Eighth Broadband Progress Report*) (also summarizing the findings in the first through seventh reports).

[20] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act,* GN Docket No. 10-159, Seventh Broadband Progress Report and Order on Reconsideration, 26 FCC Rcd 8008, 8020-21, paras. 18-20 (2011) (continued….)

the Commission did not include mobile and satellite services in its determination because it found that data regarding those services may overstate deployment to a significant degree and because of concerns about the latency and capacity of mobile broadband services.[21]

10. In the *2015 Broadband Progress Report*, the Commission increased the speed benchmark for advanced telecommunications capability to 25 Mbps/3 Mbps, up from the 4 Mbps/1 Mbps benchmark used in the previous three Reports.[22] In setting the benchmark, the Commission took into account the needs of multiple users in the average household, as well as the speeds required to use high-quality video, data, voice, and other broadband applications.[23] The Commission further held that "[t]rends in deployment and adoption, the speeds that providers are offering today, and the speeds required to use high-quality video, data, voice, and other broadband applications all point at a new benchmark."[24] The Commission then found that approximately 55 million Americans lacked access to broadband services that provided advanced telecommunications capability.[25]

11. On August 7, 2015, the Commission released the *2015 Broadband Progress Notice of Inquiry* soliciting new data and information to evaluate various factors that influence the availability of broadband to all Americans.[26] The Commission sought comment on whether advanced telecommunications capability should include consumer access to both fixed and mobile broadband service.[27] The Commission also sought comment on speed benchmarks.[28] The Commission noted its intention to explore use of the revised FCC Form 477 broadband deployment data in future reports, including whether and how the revised data could be used for a more comprehensive consideration of mobile broadband service and potentially satellite broadband.[29]

(Continued from previous page)
(*2011 Seventh Broadband Progress Report*); *see also 2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10363, para. 27.

[21] *2011 Seventh Broadband Progress Report*, 26 FCC Rcd at 8023-24, para. 26; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10365-68, paras. 31-43. On August 21, 2012, the Commission released the *2012 Ninth Broadband Progress Notice of Inquiry*. The Commission did not issue a Report on that inquiry. By separate Order, the Commission announced the conclusion of the inquiry begun by the *2012 Ninth Broadband Progress Notice of Inquiry*. *See Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps To Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket Nos. 12-228, 14-126, Order, 30 FCC Rcd 1567 (2015).

[22] *2015 Broadband Progress Report,* 30 FCC Rcd at 1377, para. 3 & n.4.

[23] *Id.* at 1377, para. 3.

[24] *Id*.

[25] *2015 Broadband Progress Report*, 30 FCC Rcd at 1378, para. 4 ("Although public- and private-sector initiatives continue to advance deployment, these advances are not occurring broadly enough or quickly enough. Recent data show that approximately 55 million Americans (17 percent) live in areas unserved by fixed 25 Mbps/3 Mbps broadband or higher service, and that gap closed only by three percentage points in the last year.").

[26] *See generally 2015 Eleventh Broadband Progress Notice of Inquiry*, 30 FCC Rcd 8823.

[27] *Id*. at 8824-25, para. 3.

[28] *Id*. at 8825, para. 3 ("…we propose to retain the speed benchmark of 25 Mbps download/3 Mbps upload (25 Mbps/3 Mbps) applied to fixed terrestrial services in the *2015 Broadband Progress Report*, and we seek comment on applying this speed benchmark to fixed satellite services. We also seek comment on a lower speed benchmark for mobile broadband service….").

[29] *2015 Eleventh Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8824-25, para. 3.

III. ANALYZING ADVANCED TELECOMMUNICATIONS CAPABILITY IN THE CONTEMPORARY BROADBAND ECOSYSTEM

12. In this section, we present our findings regarding the proper interpretation of the definition of advanced telecommunications capability in the contemporary broadband ecosystem. First, we discuss the incorporation of mobile broadband into our finding regarding the deployment of advanced telecommunications capability. In particular, we explain our finding that, today, fixed and mobile broadband are not functional substitutes, and that both services provide necessary components of advanced telecommunications capability. Next, we discuss fixed satellite service, and determine that all fixed services should meet the same speed benchmarks in the context of our section 706 advanced telecommunications capability determination. We then discuss the benchmarks by which the deployment of advanced telecommunications capability should be measured for broadband services, with separate consideration of speed benchmarks for fixed and mobile broadband. We also discuss the separate benchmarks for measuring deployment of advanced telecommunications capability to American schools and libraries.

13. *Background*. Through section 706, Congress has directed the Commission to review, on an annual basis, "the availability of advanced telecommunications capability to all Americans."[30] The statute broadly defines advanced telecommunications capability as "high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology."[31] Congress left to the Commission the task of interpreting the meaning of terms such as "advanced," "high-speed," and "high-quality."[32] However, as the Commission has noted in past Reports, it is most reasonable to conclude that Congress used the term "advanced" to refer to broadband services that "permit consumers to originate and receive highly developed or progressive services" rather than those merely providing "the most common or basic capabilities."[33] Further, Congress intended that our interpretation of "advanced" telecommunications capability evolve to keep pace with technological development and changing consumer needs.[34] This view is supported both by the technologically neutral language utilized by Congress to frame section 706,[35] and the legislative history of the 1996 Act.[36] Therefore, our survey of the deployment of "advanced" telecommunications capability centers on the functionality broadband services provide to end users, rather than the underlying technology being utilized.[37] Such an approach avoids undue focus on any subset of broadband services, while also ensuring that our interpretation of the definition of advanced telecommunications capability is consistent with current technological and market realities.

14. For these reasons, the Commission has developed a holistic approach to analyzing broadband services that considers consumer usage patterns and prevailing trends in the residential broadband market in deciding which broadband services satisfy the definition of advanced

[30] 47 U.S.C. 1302(b).

[31] 47 U.S.C. 1302(d).

[32] *2015 Broadband Progress Report*, 30 FCC Rcd at 1394, para. 27.

[33] *Id.* at 1391, para. 22.

[34] *Id.* at 1390-91, paras. 19-23.

[35] *See* 47 U.S.C. § 1302(d)(1) ("The term 'advanced telecommunications capability' is defined, *without regard to any transmission media or technology*, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications *using any technology*.") (emphasis added).

[36] *See e.g.*, 141 Cong. Rec. 15108 (1995) (Senator Pressler, then Chair of the Senate Commerce Committee and a sponsor of the 1996 Act, explained that the proposed legislation would promote access to existing capabilities "and a host of other services that soon will be available.").

[37] *See, e.g.*, *2015 Broadband Progress Report*, 30 FCC Rcd at 1395-1401, paras. 29-40.

telecommunications capability.[38] In the *2015 Broadband Progress Report*, for example, we pointed to several developments that, when taken together, compelled the Commission to reevaluate the then-existing 4 Mbps/1 Mbps speed benchmark, which had been in place since 2010, in favor of a 25 Mbps/3 Mbps standard.[39] In reaching this finding, the Commission relied in particular on the expanding demand for online video services,[40] increasing simultaneous usage of multiple devices in a single household,[41] and growing adoption of 25 Mbps/3 Mbps services by consumers in areas where such services were available, among other trends.[42]

15. Because section 706 requires the Commission to determine "geographical areas that are not served by any provider of advanced telecommunications capability,"[43] our interpretation of the definition of advanced telecommunications capability also necessarily reflects the quality and granularity of data available to the Commission.[44] The data also affect the scope of our finding. Notably, as we have explained in prior Reports, the Commission has previously had "significant concerns about the quality and reliability of the mobile and satellite service data."[45] Partly for this reason, prior Broadband Progress Reports have discussed mobile and satellite broadband, but have omitted these services from the Commission's ultimate finding under section 706(b).[46]

16. In the *2015 Broadband Progress Notice of Inquiry*, we sought comment on whether and precisely how to include mobile and satellite broadband into our interpretation of the definition of advanced telecommunications capability.[47] The *Notice* also sought comment on the use of additional, non-speed criteria to define advanced telecommunications capability,[48] and whether to raise or supplement the current speed benchmark of 25 Mbps/3 Mbps with a higher, forward-looking benchmark.[49]

17. *Overview*. After careful review of the record developed in response to the *Notice*, as well as other publicly available information, we find that consumers have advanced telecommunications capability only to the extent that they have access to both fixed and mobile broadband service. As they currently exist, fixed and mobile broadband services are not functional substitutes for one another, as

[38] *Id*. at 1394, para. 27 ("We interpret the terms in [section 706(d)], such as 'advanced,' 'high-speed,' and 'high-quality' . . . by examining trends in providers' speed offerings, what technical speeds are required to use various common applications, and data regarding what speeds consumers are adopting when they have the option to purchase various speeds.").

[39] *See id*. at 1393-94, paras. 26-27.

[40] *Id.* at 1395-98, paras. 30-32.

[41] *Id.* at 1399-1401, paras. 37-40.

[42] *Id.* at 1401-03, paras. 41-44.

[43] 47 U.S.C. § 1302(c).

[44] For instance, the *2015 Broadband Progress Report* referenced the availability of data regarding the deployment of 25 Mbps/3 Mbps services as a factor favoring the adoption of a 25 Mbps/3 Mbps speed benchmark. *2015 Broadband Progress Report*, 30 FCC Rcd at 1401, para. 48.

[45] *Id*. at 1379-80, para. 9.

[46] *2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd 8825-26, para. 5-6; *see also 2015 Broadband Progress Report*, 30 FCC Rcd at 1379-80, para. 9; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10365-68, paras. 31-43.

[47] *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8826-31, paras. 7-18, 8833-35, paras. 26-30.

[48] *See, e.g.*, *id*. at 8835, para. 31, 8838, para. 41.

[49] *See id*. at 8832, paras. 24-25.

some commenters suggest.[50] Rather, as many commenters recognize, in today's society, fixed and mobile broadband are both critically important services that provide different and complementary capabilities, and are tailored to serve different consumer needs.[51]

18. Additionally, the data from the revised Form 477 collection now enable us to explore satellite broadband speed data in our section 706(b) analysis. We find that it is reasonable to apply the same speed benchmarks to all fixed services, including fixed terrestrial and fixed satellite broadband services for the purposes of our section 706(b) determination in light of the technological neutrality mandated by the statute.[52] However, we also observe different technical characteristics and adoption patterns for fixed satellite service—factors that remain a part of our section 706(b) analysis. The Form 477 data show that no fixed satellite broadband service reaches the 25 Mbps/3 Mbps speed benchmark as of the reporting period. Accordingly, we do not need to address the question of whether a fixed satellite service meeting this benchmark would be considered to provide advanced telecommunications capability under section 706 of the Act.[53]

19. Finally, we find that our current standard of 25 Mbps/3 Mbps continues to represent an appropriate benchmark for fixed broadband service. As discussed in more detail below, the current record does not allow us to set a speed benchmark for mobile broadband service. We decline to adopt any additional benchmarks for defining the boundaries of advanced telecommunications capability at this time.[54] Likewise, we decline to adopt any additional, non-speed benchmarks in this Report, in part due to concerns about the adequacy of our data on these metrics.[55] Although we do not today set specific standards for metrics such as latency or service consistency, we continue to recognize the importance of developing a holistic analysis of broadband performance that considers factors other than speed in evaluating advanced telecommunications capability.[56] As such, we intend to continue our evaluation of these additional performance characteristics in future reports.

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[50] *See, e.g.*, Verizon Comments at 9 (arguing that fixed and mobile broadband "often are interchangeable" and that therefore "mobile broadband supplements and substitutes for fixed broadband."); Free State Foundation Comments at 4 ("Wireless broadband should be incorporated into the Section 706 analysis in a manner that recognizes wireless as a substitute or potential substitute for wireline—in other words, as another provider in the same broadband marketplace.").

[51] *See, e.g.*, CCA Comments at 3 (arguing that our section 706 determination "should take into account the divergent uses, capabilities and architectures of mobile broadband versus fixed broadband networks"); The Rural Associations Comments at 4-5 (stating that "significant technical and marketplace differences" indicate that "fixed and mobile services are not equivalent or substitutable for policymaking purposes"); T-Mobile Reply at ("Both fixed and mobile services are essential components of advanced telecommunications capability.").

[52] Currently, certain earth stations also are used in motion and operate using Fixed Satellite Service satellites. Due to size and cost, however, such earth station equipment is generally not suitable for widespread consumer offerings comparable to those for terrestrial mobile services. *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8832, para. 26. ViaSat, a leading provider of satellite broadband services and one of the only commenters to directly address this issue, argued that "whatever benchmarks the Commission may adopt apply equally to terrestrial and satellite-based service providers." ViaSat Comments at 1; *see also* The Rural Associations Comments at 6-7.

[53] We note that there are significant differences, including in technical characteristics and demand patterns, between a fixed satellite service and a fixed terrestrial service, and nothing in this Report should be considered as a determination about the economic substitutability of these services. *See infra* notes 168-169 (discussing current technical and market-based distinctions between residential fixed terrestrial and fixed satellite broadband services).

[54] *See infra* Section III.C.1.a.

[55] *See infra* Section III.C.2.

[56] *See infra* Sections III.C.2.a; III.C.2.b.

A. Advanced Telecommunications Capability Requires Access to Both Fixed and Mobile Broadband

20. We begin this evaluation by making the determination that mobile broadband is as essential as fixed broadband service. Americans increasingly rely on mobile devices as indispensable tools of daily life as personal and business interactions have rapidly become interwoven with smartphone- and tablet-based texting, email, social media, and entertainment applications that rely on mobile broadband services. In emergency situations, Americans often use mobile devices to contact first-responders when a fixed connection is not readily available, whether at home, at work, or when traveling. As smartphone and tablet use increases, mobile broadband will play an increasingly central role in American culture, business, and the economy. Indeed, mobile device usage is on a steeply increasing trajectory. The smartphone share of mobile phones in the U.S. increased to 77 percent in November 2015 from 50 percent two years earlier.[57] Monthly data usage per subscriber with data capable units also increased to 849 MB from 122 MB over the 2010 to 2013 period.[58] Ericsson predicts that by 2021, the mobile data traffic per active smartphone in the U.S. and Canada will be almost 25 GB per month.[59] In addition to the increasing demand from smartphones and tablets, other connected devices such as health monitors could significantly increase the number of wireless connections. Americans also now rely on mobile devices for important tasks. Pew Research reports that over half of American smartphone users in the year before October 2014 used their phone to look up health information and do online banking, and significant percentages use their smartphones for job searches and for education.[60] Data and speed demand from smartphones, tablets and other wireless connections is increasing constantly, as is the capability of such devices. Thus, advanced telecommunications capability over mobile is needed to satisfy consumer demands of high speed applications.

21. With these trends expected to continue,[61] and future technological developments imminent, the central importance of mobile broadband use in the United States will only increase. Based on the current widespread use of mobile broadband for communications, information access, location-based services, and social media and business networking, as well as emerging trends and the clear prospect of future innovation, we find that mobile broadband is now an important component of advanced telecommunications services and will play an increasingly important role in the future.

22. In the previous Report, we did not include mobile services in our statutorily mandated finding.[62] We stated, however, that future Reports would benefit from more reliable analysis because of substantially improved mobile data from the revised Form 477 collection.[63] Since our last Report, we have, in fact, substantially increased our collection of data, particularly through the required reporting of

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[57] *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 15-125, DA 15-1487, Eighteenth Report, Chart III.C.3 (Dec. 23, 2015) (*Eighteenth Mobile Competition Report*).

[58] *Id*. at 15348, Chart III.C.2.

[59] Ericsson Mobility Report, North America (November 2015), http://www.ericsson.com/mobility-report.

[60] More precisely, 62 percent of respondents reported using their smartphones to get information about a health condition, 57 percent used it for online banking, 43% used it for looking for job information; 18% used it to submit a job application, and 30 percent used the phone to take a class or get educational content. *See* Aaron Smith, U.S. Smartphone Use in 2015 (April 1, 2015), http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015.

[61] For example, the GSMA predicts that monthly U.S. data usage will increase from 1.9 GB per consumer in 2014 to 10.8 GB in 2019, and smartphone penetration will increase from 35 percent in 2010 to 76.6 percent in the U.S. in 2020. GSMA, The Mobile Economy North America (2015) at 10-11.

[62] *2015 Broadband Progress Report*, 30 FCC Rcd at 1379-80, para. 9.

[63] *Id.* at 1380, para. 10.

minimum advertised speeds through the Form 477. In addition, we are informed by the mobile Measuring Broadband America (mMBA) initiative, which crowdsources test results obtained from users of the Commission's mobile application.[64] Although some current limitations of the available data sources prevent us from reporting geographic areas that lack advanced mobile services with reliable accuracy at this time, these data from the Form 477 and mMBA program help us better analyze mobile broadband deployment than in years past.

23. There is little doubt that mobile broadband plays an increasingly influential role in consumers' lives, and in achieving the Commission's goal that all Americans will have access to advanced telecommunications capability.[65] Indeed, the record reflects widespread acknowledgement of the importance of mobile broadband, and support for its inclusion into our section 706(b) finding,[66] but while commenters generally agree that the Commission should consider mobile broadband in analyzing the deployment and availability of advanced telecommunications capability,[67] the record reveals significant disagreement as to the appropriate means of doing so. Several commenters argue that mobile and fixed broadband each provide the same Internet access service, and that, insofar as the services are substitutes for one another, advanced telecommunications capability is deployed wherever consumers have access to either service.[68] Other commenters disagree, arguing that mobile and fixed broadband provide distinct services to consumers and are not substitutes, and that deployment of advanced telecommunications capability therefore requires access to both services.[69] Still other commenters argue that the time for consideration of these issues is premature,[70] or that the Commission should find that

[64] *See* Measuring Broadband America *available at* https://www.fcc.gov/measuring-broadband-america (last visited Nov. 18, 2015); FCC Speed Test *available at* https://play.google.com/store/apps/details?id=com.samknows.fcc&hl=en (last visited Nov. 18, 2015).

[65] *See, e.g.*, U.S. Cellular Comments at 3-5; PCIA Reply at 2-3.

[66] *See, e.g.*, Public Knowledge Comments at 1 (arguing that mobile is a "critical" part of the nation's telecommunications infrastructure, and observing that "[c]onsumers have become increasingly dependent on mobile broadband and location-based services such as maps, location-sensitive search results, and other tools to manage their daily lives."); CCA Comments at 2 ("In the *Notice*, the Commission asks whether mobile broadband should be included in the definition of 'advanced telecommunications capability,' and the answer is a resounding 'yes.'"); CTIA Comments at 2 ("[T]he Section 706 Report should account for the significant role that mobile broadband plays in Americans' lives."); The Free State Foundation Comments at 3; PCIA Reply at 3 ("[T]he Commission's inclusion of mobile broadband services in the definition of "advanced telecommunications capability" under Section 706 is long overdue.").

[67] *See, e.g.*, Verizon Comments at 4-5 ("The *Eleventh NOI*'s recognition that mobile broadband should be incorporated into Section 706 broadband progress inquiries going forward . . . is an overdue course correction."); CTIA Comments at 2; CCA Comments at 1. *But see* Windstream Comments at 1; California PUC Comments at 3 (recommending that the Commission "defer its decision on including mobile broadband in its definition of advanced telecommunications capability").

[68] *See, e.g.*, Free State Foundation Comments at 10 ("The proposal to treat broadband as deployed only in areas where both wireline and mobile wireless broadband have been deployed also appears to be premised on the faulty premise that wireline and wireless broadband are somehow distinct, non-competing, and non-substitutable services. But the assumed dichotomy between wireless and wireline broadband is based on hair-splitting. Wireline and wireless are platforms for providing the same type of service: broadband service.").

[69] *See, e.g.*, Public Knowledge Reply at 7 ("Despite carriers' assertions to the contrary, there is ample data to demonstrate that consumers perform different functions depending on whether they are connected to wireline or mobile broadband networks"); WISPA Reply at 2 ("Mobile broadband is not an adequate substitute for fixed broadband—it does not enable home-based businesses, online educational opportunities or other applications that consumers in urban and suburban areas take for granted.").

[70] *See* Windstream Comments at 2-4, California PUC Comments at 15-16.

advanced telecommunications capability is being deployed in a reasonable and timely manner without specifying the precise relationship between fixed and mobile broadband services.[71]

24. We find that today fixed and mobile broadband are often used in conjunction with one another and, as such, are not functional substitutes. We base this finding on the capabilities both services offer to consumers,[72] the manner in which these services are marketed to and used by consumers,[73] and evidence suggesting that consumers overwhelmingly purchase both services when they have the financial means.[74] Taken together, fixed and mobile broadband are currently tailored to serve different consumer needs. Finally, we find that fixed and mobile broadband each provide essential components of advanced telecommunications capability, and that, as such, advanced telecommunications capability should be deemed deployed only in areas where consumers have access to both services as defined herein.[75]

1. Fixed and Mobile Broadband Have Distinct Characteristics and Capabilities

25. Although fixed and mobile broadband services each provide consumers with access to the public Internet, they offer distinct functionalities utilizing very different network technologies.[76] Mobile broadband services offer consumers mobility – the ability to access the Internet while at myriad locations and while in transit from one location to another. As a result, fixed and mobile broadband services also have distinct capabilities and characteristics.[77] Therefore, while fixed and mobile services sometimes provide overlapping functionality, each service has unique attributes. Additionally, mobile and fixed broadband services often enhance the quality of one another.[78]

a. Fixed Broadband

26. There are several different types of fixed broadband service that generally share the common characteristic of utilizing a physical transmission path to connect a user to the Internet—predominantly through coaxial cable, copper wire, or fiber-optic cable. Today, cable modem service is the most common fixed broadband service in the United States, accounting for approximately 59 percent of all fixed broadband service subscriptions.[79] Wired services, including cable, DSL, and fiber,

[71] *See, e.g.*, CTIA Comments at 6-7 (arguing that mobile broadband deployment is reasonable and timely).

[72] *See infra* Section III.A.1.

[73] *See infra* Sections III.A.2.a and III.A.2.b.

[74] *See infra* Section III.A.2.c.

[75] *See infra* Section III.A.3.

[76] *See, e.g.*, The Rural Associations Comments at 3-5. *See also* GAO, Fixed Broadband Data Caps Report at 4-6.

[77] *See* T-Mobile Reply at 3 (noting that fixed and mobile broadband have "different technical service capabilities" and that "consumers generally access different content and services on different devices depending on the nature of their broadband connection").

[78] For example, many services allow cashless transactions through mobile devices, and accounts which can be managed through fixed connections. In another example, commuters can work on projects via a mobile connection while using public transport, saving time for more intense tasks when they reach a fixed connection. In the near future, the Internet of Things will require both fixed and mobile connections to seamlessly link communications devices to non-communication devices and services, like appliances, utilities or even vehicles. *See generally* Scott Amyx, *Why the Internet of Things Will Disrupt Everything*, Wired (July 2014), http://www.wired.com/insights/2014/07/internet-things-will-disrupt-everything/ (stating that communications of smart objects will be multimodal).

[79] Form 477 Broadband Subscriber Data, as of December 31, 2014 (measuring numbers of residential connections over 200 Kbps in at least one direction). Digital Subscriber Line (DSL) is the second most common service type, with roughly 29 percent of the fixed broadband market. *Id*. Fiber-to-the-premises (FTTP) connections represent approximately 9 percent of the market, while satellite and fixed wireless account for less than three percent. *Id.*

collectively represent approximately 97 percent of the fixed broadband market.[80] While there are fixed broadband services that connect users to the Internet using wireless transmission pathways, such as fixed satellite and fixed wireless service, they are adopted by less than three percent of residential fixed broadband subscribers.[81]

27. Reliance on physical transmission pathways allows wired terrestrial broadband—particularly the advanced cable and fiber-to-the-premises (FTTP) services that account for the majority of fixed connections in the U.S.—the ability to deliver high-speed, high-capacity connections.[82] Residential fixed broadband providers now offer service tiers of up to 1 Gbps in certain markets,[83] with even faster services currently in development.[84] Even outside these areas, download speed offerings by fixed terrestrial providers of 50 Mbps or more are common in urban and suburban markets.[85] In addition to high bandwidth, use of a physical transmission media allows for high-quality broadband access services. The high-speed cable and fiber services that make up the majority of the fixed broadband market generally offer low latency, low packet loss, and consistent speeds, even during peak usage times.[86] Further, these services are also high in capacity, meaning that they can handle more traffic without becoming congested.[87]

28. While services like cable and FTTP have many advantages, use of a physical connection also has inherent limitations—most notably that the service is tied to a particular static location. Wi-Fi routers allow a fixed connection to be easily shared by a variety of devices at the same time, however, coverage is generally limited to nearby devices.[88] Fixed broadband connections may also be vulnerable to local service interruptions due to power outages or other types of equipment failure.[89]

b. Mobile Broadband

29. Although advances in technologies and functionalities have made mobile broadband services much more versatile and useful to consumers, there are important differences between mobile

[80] *See supra* note 80. Dial-up technology represents roughly one percent of the overall household Internet subscriptions (0.853 million dial-up subscriptions out of 88.867 million Internet subscriptions). U.S. Census Bureau, 2014 American Community Survey 1-Year Estimates 2014 ACS One Year Estimates, B28002.

[81] Form 477 Broadband Subscriber Data, as of December 31, 2014.

[82] As of December 31, 2014, 86 percent of residential household subscriptions to fixed services with a minimum speed of 25 Mbps/3 Mbps were to cable services, 13 percent were to FTTP services and 1 percent were to DSL services. Form 477 Broadband Subscriber Data, as of December 31, 2014.

[83] *See, e.g.*, AT&T, *U-verse with AT&T GigaPower*, (last visited January 15, 2015), https://www.att.com/shop/u-verse/gigapower.html (last visited Dec. 15, 2015) (advertising "Internet up to 1 Gbps on a 100% fiber-optic network"), Google Fiber, *About*, https://fiber.google.com/about/ (Jan. 15, 2015) (advertising a connection "that's up to 1,000 megabits per second").

[84] *See, e.g.*, FTTH Comments at 9 (noting that "Comcast's new 2 Gbps all-fiber offering . . . is nearly 80 times faster than the Commission's proposed 25 Mbps/3 Mbps benchmark."). Verizon indicates that it has begun testing "next-generation 10 Gbps speeds over its all-fiber network." Verizon Comments at 6.

[85] Form 477 data suggest that 277.3 million Americans (86 percent) have access to fixed 50 Mbps download broadband service or higher and 63 percent of these 277.3 million Americans reside in urban areas. Form 477 Data, as of December 31, 2014. *See* 2015 Measuring Broadband America Report at 8 (listing the most popular service tiers for a variety of fixed broadband providers).

[86] *See* 2015 Measuring Broadband America Report at 1-2, 10, 16-18.

[87] *See, e.g.*, T-Mobile Reply at 6-7.

[88] GAO Fixed Broadband Data Caps Report at 5-6 & 6 n.10.

[89] *See, e.g.*, Comcast Xfinity, *What to Do if Your Cable or Internet is Out*, (last visited Jan. 15, 2015), http://customer.xfinity.com/help-and-support/cable-tv/cable-not-working/.

and fixed broadband. Mobile transmissions are subject to environmental factors that fixed line transmissions do not encounter and, thus, cannot achieve the same kinds of consistent speeds at the current level of technology.[90] Further, mobile devices by their nature must be portable and thus smaller than their fixed counterparts. This limits the computational abilities of mobile devices and makes their interfaces smaller, especially screens.[91] It follows that data-intensive activities such as telecommuting or the highest-quality multimedia experiences are generally inappropriate for mobile devices.[92]

30. On the other hand, mobile devices also provide unique advantages over fixed connections. Unmoored from a fixed point, mobile devices empower Americans to access to the web and web-based applications while on the go. An innovative ecosystem of user-friendly apps has emerged for both iOS- and Android-based mobile smartphones. These apps harness the unique capabilities of mobile devices. For example, because mobile devices can pinpoint a user's location, there are many apps that will give directions, recommend nearby businesses, or even alert a user when friends are nearby. Mobile broadband has a special relationship with social media, as it allows users to easily update their social media while at live events.

2. Fixed and Mobile Broadband Currently Serve Different Needs

31. The different characteristics of fixed and mobile networks contribute to further dissimilarities in the ways in which these services are marketed to and used by consumers. Critically, fixed and mobile services generally have distinct pricing models, providing consumers with very different levels of data/capacity,[93] which, in combination with the differences in capability discussed above, lead to significant differences in the ways that most consumers use fixed and mobile broadband.[94] Collectively, these differences indicate that fixed and mobile broadband currently serve different needs, and are not adequate substitutes for one another.[95] This finding is also strongly supported by the preferences and purchasing decisions of American consumers, who overwhelmingly adopt both services when they have the means.[96]

a. Marketing and Pricing

32. *Fixed Broadband.* Fixed broadband services generally do not face the same limitations regarding capacity and congestion that affect mobile broadband networks and, some fixed broadband

[90] For example, the cell traffic loading or demand is dependent on the overall number of concurrent active mobile broadband users sharing the same cell, which in turn depends on user locations, the day of the week, and the time of the day. The capacity of a service provider's wireless network is dependent on the deployed mobile wireless technology, sites and equipment, available bandwidth, and enhanced backhaul connections. *See Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993, Annual Review and Analysis of Competitive Market Conditions With Regard to Mobile Wireless, Including Commercial Mobile Services*, WT Docket 11-186, 28 FCC Rcd 3700 at 3894, para. 293 (March 19, 2013) (*Sixteenth Competition Report*).

[91] *See* Matt Smith, *Why Your Smartphone Won't Be Your Next PC*, Digital Trends (Aug. 3, 2013), http://www.digitaltrends.com/computing/why-your-smartphone-wont-be-your-next-pc/.

[92] Fixed broadband's hold on high-resolution multimedia is borne out by Sandvine's 2015 report on broadband usage, where video service Netflix represented 34.7 percent of aggregate Peak Traffic for fixed broadband in North America, compared with 3.22 percent of peak aggregate traffic over mobile networks. *See* Sandvine Global Internet Phenomena Report 2015, at 3-7 (2015), https://www.sandvine.com/trends/global-internet-phenomena/ (2015 Sandvine Report).

[93] *See* Public Knowledge Comments at 3 ("In part to deal with the technical limitations, pricing and purchasing patterns for mobile broadband are substantially different from wireline."). *See also infra* Section III.A.2.a.

[94] *See infra* Section III.A.2.b.

[95] PCIA Reply at 3 ("[F]ixed and mobile broadband services meet different consumer needs . . . .").

[96] *See infra* Section III.A.2.c.

providers offer consumers unlimited data usage plans at a given connection speed for a flat monthly fee.[97] Where fixed providers have introduced data caps, these caps have generally been set significantly higher than those accompanying mobile broadband data plans.[98] For this reason, fixed terrestrial broadband services are generally far less expensive on a cost-per gigabyte basis than mobile broadband services.[99]

33. *Mobile Broadband*. There are two main types of billing plans for mobile service in the United States: postpaid and prepaid. Postpaid plans require monthly payment after service has been provided; prepaid requires payment in advance on a minutes, day or data used basis.[100] Most U.S. mobile telephone consumers subscribe to postpaid plans.[101] Historically, a postpaid plan required a two-year service contract that included early termination fees as a method of subsidizing the provision of a mobile phone handset at a discounted price. Since 2013, carriers have been departing this model, with more postpaid plans offered without contracts and with consumers paying separately for handsets (either at full retail price or through an equipment installment plan, or EIP).[102]

34. Unlike fixed broadband, comparable metrics of price across carriers is not entirely straightforward. Postpaid plans generally include a flat fee for a specified limit, or allowance, on megabytes or gigabytes of data available for use without additional charge and either slower speeds on data that exceeds the allowance, the option to buy additional data, or a separate overage fee based on how much one exceeds the allowance.[103] Moreover, there are many different plans that differ on numerous dimensions, such as the data allowance amount or the device used. For example, a standard single line plan with an EIP in April of 2015, the price per GB of data (as defined by the flat fee divided by the data allowance) for AT&T, Sprint and T-Mobile was $13, and $20 for Verizon.[104] For a comparable 4-line plan, the effective price per GB is lower, with AT&T and Verizon at $10 and Sprint and T-Mobile at $8.[105] Data allowances differ, with AT&T, Verizon, Sprint and T-Mobile respectively having 3, 2, 2 and

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[97] *See* GAO, Broadband Internet: FCC Should Track the Application of Fixed Internet Usage-Based Pricing and Help Improve Consumer Education at 1 (Nov. 2014), http://www.gao.gov/assets/670/667164.pdf.

[98] For example, in the Washington D.C. metro area, Comcast currently offers an unlimited 25 Mbps download service for an introductory price of $39.95 per month. Comcast Xfinity, *Internet Service*, http://www.xfinity.com/internet-service (last visited Nov. 17, 2015). In select areas where Comcast has begun to trial data caps for residential broadband subscribers, monthly usage has been capped between 250 and 600 GB per month, depending on the location and service tier. *See* Comcast Xfinity, *Questions and Answers about Our Data Usage Plans*, http://customer.xfinity.com/help-and-support/internet/common-questions-datapolicy (last visited Nov. 16, 2015). Furthermore, in most areas where Comcast has imposed data caps, consumers may choose to purchase additional data in 50 GB increments for $10 per block, or an unlimited data plan for an additional fee of $30 to $35 per month. *See* Comcast Xfinity, *What is the Unlimited Data Option?*, http://customer.xfinity.com/help-and-support/internet/exp-unlimited-data (last visited Nov. 16, 2015). In contrast, data caps accompanying typical mobile broadband plans tend to range from 2 to 12 GB per month. *See infra* para. 34.

[99] *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8830, para. 16 & n. 43-44 ("The potential impact of data allowances and overage charges in mobile broadband plans if customers tried to switch from fixed terrestrial broadband to mobile broadband service could be substantial."). The GAO has investigated the use of data caps by fixed broadband providers and found that most consumers do not currently exceed these caps. *See* GAO Usage-Based Pricing Report at 20. In contrast, as Public Knowledge notes in its comments, "[r]esearch has shown that 30% of smartphone-dependent Americans 'frequently' exhaust their data allowance, and 51% report that it happens at least occasionally." Public Knowledge Comments at 2.

[100] *Eighteenth Mobile Competition Report*, WT Docket No. 15-125, DA-15-1487, paras. 74-103.

[101] *Id*. at para. 72.

[102] *Id*. at paras. 82-85.

[103] *Id*. at paras. 97-103.

[104] Philip Cusick, *North America Equity Research*, J.P. Morgan (April 15, 2015).

[105] *Id*.

3 GB allowances for their single line plans, and 10, 10, 12, and 12 for the four line plans.[106] However, mobile plans on a per GB basis are more expensive and have lower data allowances than fixed plans.[107]

b. Usage Patterns

35. *Fixed Broadband.* As a service that is generally high in speed and network capacity, fixed broadband is better positioned than mobile to accommodate multiple simultaneously connected devices and bandwidth-heavy household uses, particularly streaming video services, which are increasingly popular with consumers.[108] Additionally, as a service that generally permits significant amounts of monthly data usage, fixed broadband offers consumers an economical way to take advantage of bandwidth and data-intensive applications like HD video streaming and video conferencing.[109] For these reasons, today's broadband consumers largely view fixed and mobile as providing different functionality.[110] As T-Mobile explains, "fixed services allow consumers to view high definition video for larger screens and download and share large files, while mobile broadband powers smartphones, wearable devices, mobile health monitoring, video suitable for smaller screens and countless location-based services."[111] These preferences are also reflected in the different composition of broadband traffic across fixed and mobile networks. As we observed in the *2015 Broadband Progress Notice of Inquiry*, real time entertainment accounts for 64.5 percent of all peak traffic on fixed networks,[112] while on mobile broadband networks, real-time entertainment accounts for only 36.5 percent of aggregate peak traffic.[113]

36. *Mobile Broadband*. Technological advances in the last decade have created new, powerful, and diverse capabilities for mobile devices, which has fostered consumer demand. Smartphones and tablets allow Internet access, streaming video, and many other digital activities away from a fixed connection. Today, smartphone and tablet use is widespread. The Pew Research Center reports that as of July 2015, 68 percent of Americans use a smartphone.[114] Additionally, Americans spend an increasing amount of time on their mobile devices. For example, market-research firm comScore estimated that in June 2015 mobile usage represented 62 percent of the time Americans spend on a computing device.[115] Nielsen reports that in the third quarter of 2013, users spent 34 hours and 17 minutes per month on average using their mobile browser or apps and nearly six hours watching video on

[106] *Id.*

[107] *See supra* note 99.

[108] *See* David B. Stewart Comments at 1 (noting that "increasing numbers of customers [are] cancelling their cable TV subscriptions in favor of online streaming of news and entertainment programming . . . .").

[109] *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8830, para. 16 & nn.43-44.

[110] *See* T-Mobile Comments at 3 ("[C]onsumers generally access different content and services on different devices depending on the nature of their broadband connection."); *see also* Public Knowledge Comments at 4 (citing a recent study finding that consumers "use[] the two connections for different purposes, favoring their smartphone for social networking and their at-home fixed network for media, shopping, and information searches.").

[111] T-Mobile Comments at 6.

[112] Sandvine Global Internet Phenomena, Latin America & North America 2015 at 3.

[113] *Id*. at 6.

[114] Pew Research Center, Home Broadband 2015 (December 21, 2015), http://www.pewinternet.org/2015/12/21/home-broadband-2015/ (Pew December 2015 Report).

[115] Adam Lella, Andrew Lipsman & Ben Martin, *The 2015 U.S. Mobile App Report*, comScore (Sept. 22, 2015).

a mobile device.[116] This robust mobile usage is expected to increase with further technological innovation and even more diverse capabilities for mobile devices.[117]

37. Consumers' relative amounts of data usage differs between fixed and mobile broadband services. Sandvine reports that fixed broadband consumers in North America use an average of 57.4 GB of data per month per household.[118] In contrast, the GSMA reports 1.9 GB of data used per month per U.S. consumer.[119] The ways in which consumers use this data differs as well. For example, for 2013, the Pew Research Center reported 50 percent of users download apps, 49 percent "get directions, recommendations, or other location-based information," and 8 percent "'check in' or share [their] location."[120] Many fast-growing apps take advantage of the hardware built into mobile phones that can track movement or location, like fitness apps such as FitBit, or on-demand transportation services like Uber or Lyft.[121]

c. Adoption Figures

38. Analysis of consumers' purchasing habits supports the conclusion that fixed and mobile broadband are not currently substitute services. If mobile were a substitute for fixed broadband, then significant numbers of mobile broadband subscribers could be expected to drop their fixed broadband subscriptions to avoid the substantial cost of purchasing a redundant service. However, in a recent survey referenced by Public Knowledge, "ninety-two percent of consumers said they were 'very' or 'somewhat' unlikely to cancel their home broadband connection in favor of a purely mobile experience."[122] Indeed, as several commenters note, many Americans continue to purchase to both fixed and mobile broadband, and both services continue to add subscribers.[123] According to the Pew Research Center, 55 percent of adults

[116] Nielsen, The Digital Consumer Report (February 2014).

[117] It is important to note, however, that usage of a mobile device does not necessarily correspond to usage of a mobile broadband service. This is because consumers frequently offload traffic generated by the use of a mobile device to a fixed Wi-Fi connection, when one is available. *See* 2015 Broadband Progress Report, 30 FCC Rcd at 1399-1400, para. 37. This WiFi offload may account for as much as 80 percent of the data traffic generated by wireless devices. *See Lifeline and Link Up Reform and Modernization, Telecommunications Carriers Eligible for Universal Service Support, Connect America Fund*, WC Docket Nos. 11-42, 09-197, 10-90, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, Second Report and Order, Memorandum Opinion and Order, 30 FCC Rcd 7818, 7840, para. 45 & n.134 (2015).

[118] Sandvine, Global Internet Phenomena at 5 (2014), https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/2h-2014-global-internet-phenomena-report.pdf.

[119] GSMA, The Mobile Economy North America (2015) at 11, http://gsmamobileeconomy.com/northamerica/.

[120] Pew Research Center, Cell Phone Activities (2013), http://www.pewinternet.org/2013/09/19/cell-phone-activities-2013/.

[121] From June 2014 to June 2015, FitBit grew 922 percent in unique users, Uber 453 percent and Lyft 187 percent. *See* Adam Lella, Andrew Lipsman & Ben Martin, *The 2015 U.S. Mobile App Report*, comScore (Sept. 22, 2015).

[122] Public Knowledge Comments at 3-4.

[123] *See, e.g.*, T-Mobile Reply at 3 ("Millions of Americans subscribe to both fixed and mobile broadband services and these numbers are increasing.").

report having both a smartphone and a home broadband connection, up from 47 percent in 2013.[124] These trends have been observed in other countries as well.[125]

39. Moreover, the data suggest that those Americans that do rely on mobile broadband exclusively often lack the means to purchase both services. In a recent survey of smartphone adoption in America, Pew Research found that only 13 percent of Americans rely on a smartphone only for broadband access at home, compared to eight percent in 2013.[126] Critically, this group of "smartphone only" users is disproportionately comprised of young, low income, and minority Americans.[127] Pew also found that these users also are more likely than other users to run up against data-allowance limits that often accompany smartphone service plans, and more frequently have to cancel or suspend service due to financial constraints.[128] In addition to these demographic differences, Pew found in another recent report that when compared with other smartphone owners, "smartphone-dependent consumers"[129] are less likely to own a computer or tablet, less likely to have a bank account or health insurance, and less likely to own their current residence.[130] That report also found that although some 13 percent of Americans with a household income of less than $30,000 per year are smartphone dependent, only one percent of Americans with an annual income of $75,000 or more rely solely on mobile broadband.[131] These data suggest that the decision to rely exclusively on mobile broadband service is frequently driven by financial necessity, rather than the view that fixed and mobile broadband are adequate substitutes for one another.[132]

3. Consumers Require Access to Both Services

40. The aforementioned differences dispel the notion that fixed and mobile broadband, as they exist today, provide consumers with the same service. On the contrary, they are distinct services with complementary strengths and weaknesses, distinguishable in capability, pricing, and in the utility they provide consumers.[133] Perhaps most tellingly, as the record demonstrates, American consumers simply do not treat the two services as functional substitutes.[134] On the contrary, Americans, including those who do not have broadband, increasingly view an at-home, high-speed broadband connection as a critical communications tool.[135] Indeed, as Pew recently found, two-thirds of Americans believe that "not

[124] Pew December 2015 Report at 8. Although the Pew Research Center also reports an uptick in the number of people using smartphone only for broadband access while fixed, home broadband use has "plateaued," there is no evidence to suggest any causal connection between the increase in smartphone-only broadband use and the plateau in fixed, home broadband use, or the observed one-year decrease in home broadband usage.

[125] A comprehensive survey of over 160,000 people in 27 EU countries has found mobile and fixed wireless to be complements. Lukasz Grzybowksi & Frank Verboven, Substitution between Fixed-Line and Mobile Access: the Role of Complementarities, KU Leuven Center for Economic Studies Discussion Paper, DPS14.12 (June 2014).

[126] Pew December 2015 Report at 9.

[127] *Id*. at 9-10. *See also* Pew Smartphones April 2015 at 3.

[128] Pew Smartphones December 2015 at 10.

[129] As the term is used in the Pew April 2015 Report, "smartphone-dependent" users are Americans who own a smartphone and both have "no broadband at home other than a smartphone data plan," and "have limited options" for Internet access besides their phone. *See* Pew Smartphones April 2015 Report at 3-4.

[130] Pew Smartphones April 2015 at 18.

[131] *Id*. at 17.

[132] *Id*. at 18.

[133] *See supra* Sections III.A.1 and III.A.2.

[134] *See supra* Section III.A.2.c.

[135] Pew December 2015 Report at 4-5.

having a home high-speed internet connection would be a *major disadvantage* to finding a job, getting health information or accessing other key information."[136] Additionally, as discussed earlier, the number of Americans with both fixed and mobile broadband connections is increasing.[137] We therefore conclude that our analysis of whether advanced telecommunications capability is being deployed in a reasonable and timely fashion requires access to both fixed and mobile broadband services.

41. Nonetheless, several commenters argue that, because fixed and mobile broadband services sometimes fulfill the same needs, the availability of either service is sufficient for a finding that advanced telecommunications capability is deployed.[138] It is true that, at a high level of generality, both services provide consumers with broadband Internet access service.[139] As we have explained, however, significant differences in service capability and pricing prevent fixed and mobile broadband from being adequate substitutes for one another.[140] Although fixed and mobile broadband sometimes provide overlapping functionality, this does not compel the conclusion that the two services are interchangeable for purposes of our Inquiry. Indeed, Americans with access to only one type of service are often unable to take advantage of the full range of functionality offered by advanced telecommunications capability.[141] As Public Knowledge notes, those that rely on only mobile broadband tend to perform a more limited range of tasks than those who have access to both fixed and mobile broadband.[142] Consumers that are dependent solely on mobile broadband are significantly more likely to exceed their monthly data allowances, causing them to incur additional fees or forego use of the Internet. And, as several commenters note, mobile broadband networks lack the capacity or consistency of service to support most bandwidth intensive uses such as full-screen HD video streaming, online gaming, and video conferencing applications including telehealth and education platforms.[143] In contrast, fixed broadband does not offer

[136] *Id*. at 4. This figure is up from 56 percent in 2010. *Id*.

[137] *See supra* paras. 38-39.

[138] *See* The Free State Foundation Comments at 10 ("Wireline and wireless are platforms for providing the same type of service: broadband service."); Verizon Comments at 9 (arguing that "fixed and mobile often are interchangeable"); AT&T Comments at 7 (asserting that AT&T's LTE deployment efforts alone would satisfy Section 706's standard for deployment to all Americans).

[139] *See generally* The Free State Foundation Comments at 10 ("Wireline and wireless are platforms for providing the same type of service: broadband service.").

[140] *See, e.g.*, WISPA Reply at 2-3 ("Mobile broadband is not an adequate substitute for fixed broadband – it does not enable home-based businesses, online educational opportunities or other applications that consumers in urban and suburban areas take for granted."); T-Mobile Reply at 3 ("Fixed and mobile broadband . . . have different technical service capabilities. Fixed services may offer certain advantages, such as greater capacity and potentially lower latency. Mobile broadband, by contrast, is uniquely able to provide consumers with an 'anywhere, anytime' experience, including for example, location-based services.").

[141] *See, e.g.*, T-Mobile Reply at 4 ("Even as consumers increase their adoption of mobile broadband, they continue to depend on wired broadband connectivity to meet many of their needs. Consumption patterns suggest that Americans with the purchasing power to do so often invest in both fixed and mobile technologies.").

[142] Public Knowledge Comments at 3.

[143] NTCA, WTA, ERTA and NECA Comments at 3; Public Knowledge Comments at 3; T-Mobile Comments at 3; United States Cellular Comments at 3; and Wireless Internet Service Providers Association Comments at 2. Although mobile broadband allows consumers the flexibility to stream video while away from a fixed connection, this capability is limited by the speed, capacity, and service consistency restrictions faced by mobile broadband networks. As a result, video streaming on a mobile broadband network is often lower quality when compared to that using a fixed connection. Further, the lower data allowances on network usage and/or tethering, which result in significantly higher costs for the purchase of large amounts of data, make mobile broadband networks impractical for the use of popular streaming services like Netflix.

consumers mobility, and is unable to provide consumers with Internet access needed to support the myriad mobile applications they depend on as they go about their lives outside the home.[144]

42. Therefore, mobile and fixed services are distinct.[145] As we observed in the last Report, even though a fixed connection suffices for many basic household uses, it is not adequate for all household broadband needs.[146] In fact, residential and business consumers alike often use mobile and fixed services, for example, when service providers offload traffic from cellular networks to Wi-Fi systems that are connected to the Internet via a fixed service.[147] In addition, the increasingly dynamic nature of residential and business communication requires a mix of fixed and mobile broadband access to provide sufficient functionality for families and businesses whose members often simultaneously rely on data-capacity intensive applications at fixed locations and mobile applications on the go.[148] Thus, we find that the deployment of advanced telecommunications services to all Americans depends on two distinct but complementary components: fixed broadband and mobile broadband.

43. Finally, we reject arguments suggesting that the technological neutrality of section 706 precludes us from considering fixed and mobile broadband separately in this Inquiry,[149] or that the Commission cannot reach a conclusion on this issue without first "conduct[ing] a detailed market analysis" regarding the substitutability of fixed and mobile broadband.[150] As we have explained, the technologically neutral language used by Congress to frame section 706 requires the Commission to focus on end-user functionality in lieu of the particular transmission media used by a service. Although fixed and mobile broadband may utilize different network technologies, the salient differences between the two service types are found not in their technological differences, but in the distinct capabilities that they provide consumers. Nothing in the language of section 706 prevents the Commission from considering these features, indeed, they are of particular importance to our inquiry insofar as they impact consumer access to "high-quality" and "advanced" telecommunications services.

44. Nor are we required to conduct a formal economic substitutability analysis before reaching the conclusion that advanced telecommunications capability requires access to both fixed and mobile services, as ADTRAN suggests.[151] The fact that fixed and mobile broadband generally provide different capabilities for today's consumers is widely acknowledged.[152] Our finding that mobility is a key element of advanced telecommunications in today's world is strongly supported by the record in this proceeding, as is our judgement that fixed broadband is currently unable to provide consumers with this

[144] *See supra* Sections III.A.1 and III.A.2.

[145] Public Knowledge Comments at 3 ("[C]onsumers treat mobile and fixed broadband differently, and primarily treat wireless as a complement to, not a substitute for, fixed broadband.").

[146] *2015 Broadband Progress Report*, 30 FCC Rcd at 1392, para. 53 (finding that household members routinely use multiple broadband services simultaneously, and that even a single person often uses more than one broadband service at the same time).

[147] *See supra* note 118. We note that the *2015 Open Internet Order* recognized that Wi-Fi is a different technology from mobile wireless and requires particular network architecture. *Protecting and Promoting the Open Internet*, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5601, 5611, 5700, 5711, paras. 34, 216, 244 (2015) (*2015 Open Internet Order*). The *Order* is currently in effect, pending judicial review in the D.C. Circuit Court of Appeals following legal challenge in *U.S. Telecom Ass'n v. FCC et al*., docket No. 15-1063.

[148] *See generally 2015 Broadband Progress Report*, 30 FCC Rcd at 1392, para. 53.

[149] Verizon Comments at 9; Mobile Future Comments at 5; ADTRAN Comments at 10-15.

[150] ADTRAN Comments at 12-13.

[151] *Id*.

[152] Deere & Company Comment at 7; NTCA, WTA, ERTA and NECA Comments at 3; Public Knowledge Comments at 3; T-Mobile Comments at 3; and Wireless Internet Service Providers Association Comments at 2.

type of flexibility.[153] Furthermore, as we have shown, mobile broadband is currently unable to provide the capabilities that fixed broadband offers.[154] For these reasons, we find that advanced telecommunications capability requires access to both services.

B. Fixed Satellite Broadband

45. As anticipated in the *2015 Broadband Progress Notice of Inquiry*, the revised Form 477 broadband deployment data enable us to more closely examine satellite broadband deployment at various speeds for the first time. Satellite broadband providers have continued to invest substantial resources into their networks, making progress in their home broadband offerings.[155] These providers offer a range of speeds with different usage limits at different prices, with differing latency and capacity, depending on the type of services, with monthly service price offerings currently as low as $50.[156]

46. As part of our Inquiry regarding the deployment of advanced telecommunications capability, we conclude that it is reasonable to apply the same speed benchmark to both fixed terrestrial and fixed satellite broadband service. Both services are fixed, and fixed satellite broadband providers claim that with the new satellites, they can offer speeds exceeding our current fixed broadband speed threshold.[157] Similar to fixed terrestrial broadband service, fixed satellite service also may be used as a home broadband solution. Considering that, for the purposes of our Inquiry, section 706 requires us to measure advanced telecommunications capability irrespective of transmission technology or media, with respect to speed threshold, it is reasonable to conclude that fixed satellite services must meet the same speed benchmark as any other fixed services.[158]

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[153] *See supra* Sections III.A.2 and III.A.3. *See also* T-Mobile Reply at 3-8.

[154] *See, e.g.*, Remarks of William Baer, Assistant Attorney General-Antitrust Division, DOJ, The Future of Video Competition and Regulation, Oct. 9, 2015) (noting that mobile is not currently "an adequate substitute" for fixed broadband due to capacity and cost restraints).

[155] *2014 Fourth Measuring Broadband America Report* at 4-5, 15-16, 18. Existing providers also are planning to expand service offerings with the launch of new satellites in the near future, reflecting upgraded designs. For example, with the launch ViaSat-2, ViaSat anticipates that its systems will have capability to provide speeds exceeding our current speed benchmarks. *See* Webcast: Q2 2015 ViaSat Earnings Conference Call, ViaSat Inc. (Nov. 9, 2015), http://investors.viasat.com/events.cfm. ViaSat also is planning a future series of ViaSat-3 satellites, which it claims will eventually support a total throughput capacity of roughly one Terabit per second. Peter B. de Selding, *ViaSat Willing to Bet Big on Super-high-throughput Satellites*, SpaceNews (Nov. 10, 2015), http://spacenews.com/viasat-willing-to-bet-big-on-super-high-throughput-satellites/. Hughes plans to launch its Jupiter 2 satellite in 2016, which according to Hughes, will have more than 150 Gbps throughput, operating with a 50 percent greater capacity than the Jupiter 1 satellite. Hughes, *World's Highest-Capacity Broadband Satellite Coming in 2016*, http://www.hughes.com/company/newsletters/spring-2013/worlds-highest-capacity-broadband-satellite-coming-in-2016/ (last visited Nov. 12, 2015). O3b, a global broadband satellite provider with 12 satellites in medium Earth orbit, also plans to expand its satellite constellation to accommodate additional customer demand for high speed broadband offerings. *See* O3b Comments at 1-3; *see also* Caleb Henry, *New Antennas on the Horizon for O3b Networks*, Via Satellite (Aug. 18, 2015), http://www.satellitetoday.com/telecom/2015/08/18/new-satellites-new-antennas-on-the-horizon-for-o3b-networks/.

[156] *See e.g.,* Exede Internet, *Exede Internet Packages and Pricing*, http://www.goexede.com/packages/ (last visited Nov. 12, 2015); HughesNet, *HughesNet Plans and Pricing*, http://www.hughesnet.com/plans-and-pricing/internet-service (last visited Nov. 12, 2015); Hughes Net*, Find the Right Plan for You*, http://www.hughesnet.com/learn-more/guide (last visited Jan. 27, 2016).

[157] *See supra* note 156. *See also e.g.*, *Fastest Home Satellite Internet Service in the U.S. With the New Exede WiFi modem and a 25 Mbps Plan*, ViaSat Inc. (Nov. 18, 2015), https://www.viasat.com/news/fastest-home-satellite-internet-service-us-new-exede-wifi-modem-and-25-mbps-plan.

[158] 47 U.S.C. § 1302(d).

47. We note, however, that consumer usage patterns and prevailing trends in the residential broadband market are relevant to the deployment and availability of advanced telecommunications capabilities under the Act.[159] Although we find that fixed satellite broadband service must be subject to the same speed benchmark as fixed terrestrial broadband as part of our statutory determination under section 706(b) and in light of the substantial investments made by satellite providers to improve service and extend broadband access to new markets,[160] we continue to observe significant differences involving technical capabilities and adoption patterns between fixed terrestrial and fixed satellite services.[161] Most satellite broadband service providers face technological challenges separate and apart from those faced by fixed terrestrial providers.[162]

48. Our finding that fixed satellite services must meet the same speed benchmark as any other fixed services also should not be construed as a finding that the two services are interchangeable, or that fixed satellite broadband is a substitute for fixed terrestrial broadband service. By this finding, we

[159] *2015 Broadband Progress Report*, 30 FCC Rcd at 1394, para. 27 ("We interpret the terms in [section 706(d)], such as 'advanced,' 'high-speed,' and 'high-quality' . . . by examining trends in providers' speed offerings, what technical speeds are required to use various common applications, and data regarding what speeds consumers are adopting when they have the option to purchase various speeds.").

[160] *See supra* note 156. *See also* Letter from Tom Stroup, President, Satellite Industry Association (SIA), to Marlene H. Dortch, Secretary, FCC, WC Docket No. 15-191 at 2-3 (filed Jan. 21, 2016); ViaSat (VSAT) Mark D. Dankberg on Q2 2016 Results - Earnings Call Transcript, Seeking Alpha (Nov. 10, 2015), http://seekingalpha.com/article/3669846-viasat-vsat-mark-d-dankberg-on-q2-2016-results-earnings-call-transcript?part=single.

[161] We note that the actual usage and adoption patterns for satellite services may differ from those for terrestrial broadband due to differences in available speeds, pricing, data allowances, capacity, and latency. *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8833, para. 26; *see also supra* para. 26 & nn.80-81 (discussing the significantly larger market share of fixed terrestrial broadband providers compared to other types of fixed service, including fixed satellite broadband).

[162] Due to constraints on network capacity, most fixed satellite providers were generally offering home broadband solutions with lower monthly usage plans and slower maximum speeds than fixed terrestrial providers during the reporting period. Currently, fixed satellite providers generally offer residential broadband packages that provide download speeds ranging between 5 Mbps and 15 Mbps, and upload speeds between 1 Mbps and 3 Mbps. *See, e.g.*, Exede Internet, *Plans & Pricing*, http://promo.exede.com/nov-2015-b/liberty10-99-132LN-1487EY.html?keyword=exede (last visited Jan. 22, 2016); Dish, *High-Speed Internet*, https://www.infinitydish.com/internet/dishnet (last visited Jan 22, 2016); HughesNet, *Plans and Pricing*, http://www.hughesnet.com/plans-and-pricing/internet-service (last visited Jan. 22, 2016). In comparison, many fixed terrestrial providers offer speeds at or above 25 Mbps/3 Mbps, with certain providers offering download speeds well in excess of 50 Mbps. *See 2015 Measuring Broadband America Report* at 8; *see also* Google Fiber, *About*, https://fiber.google.com/about/ (last visited Dec. 15, 2015) (advertising a connection "that's up to 1,000 megabits per second"). In addition, to date, residential fixed satellite broadband services available in the United States predominantly utilize geostationary satellites to provide Internet access. Due to the large distances involved in transmitting data to and from geostationary satellites, these fixed satellite services are also typically characterized by higher latencies than terrestrial services. *See 2015 Measuring Broadband America Report* at 17 (noting that "the average latencies of satellite-based broadband services (which range from 603 ms to 659 ms) are much higher than those for terrestrial-based broadband services (which range from 14 ms to 52 ms)."). As the Commission observed in the *2015 Measuring Broadband America Report*, "[t]he higher latencies of satellite-based broadband services may negatively affect the perceived quality of . . . highly interactive applications" such as VoIP calls, video chat, and online multiplayer games. *Id*. at 18. Additionally, residential fixed satellite broadband service packages are often subject to data caps, which generally range from 10 to 70 gigabytes per month. *See, e.g.*, Exede Internet, *Plans & Pricing*, http://promo.exede.com/nov-2015-b/liberty10-99-132LN-1487EY.html?keyword=exede (last visited Jan. 22, 2016); Dish, *High-Speed Internet*, https://www.infinitydish.com/internet/dishnet (last visited Jan. 22, 2016); HughesNet, *Plans and Pricing*, http://www.hughesnet.com/plans-and-pricing/internet-service (last visited Jan. 22, 2016). In contrast, many fixed terrestrial broadband providers offer unlimited service plans, or utilize data caps set at significantly higher levels. *See supra* para. 32 & n.99.

recognize the importance of the fixed satellite service and the role that the future satellite systems may play as a home broadband alternative. Although speed is an important factor, characteristics such as latency and consistency also may affect whether a service is able to support the "high-quality voice, data, graphics, and video telecommunications" required for the provision of advanced telecommunications capability.[163] Based on the 477 data covering the relevant period in this Report, no satellite broadband provider offers residential service meeting our fixed speed benchmark of 25 Mbps/3 Mbps, meaning that the inclusion of satellite broadband in our calculations does not affect our ultimate finding under section 706(b).[164] Because fixed satellite broadband does not meet the speed threshold for advanced telecommunications capability, we do not need to evaluate whether fixed satellite broadband service as provided today would otherwise satisfy the definition of advanced telecommunications capability under the Act. We also do not need to address the technical and other distinctions between the current fixed terrestrial and fixed satellite service offerings that may be relevant to our Inquiry. We will continue to evaluate the effect of non-speed performance metrics, such as latency, capacity, and service consistency, on the deployment and availability of advanced telecommunications capability in future Reports.

C. Benchmarking Advanced Telecommunications Capability

49. Although the Commission uses a holistic approach to analyzing broadband Internet access services, the Commission has ultimately defined advanced telecommunications capability primarily in terms of download and upload speeds, an approach that we continue in this Report.[165] Speed provides a particularly useful metric for analyzing the deployment of advanced telecommunications capability because it generally provides a good proxy for service capability,[166] and because the Commission has long had reliable geographic speed data, at least for fixed services.[167] This type of granular geographic data is critical for fulfilling our statutory mandate to determine areas unserved by advanced telecommunications capability under section 706(c).[168]

1. Speed

50. The *2015 Broadband Progress Notice of Inquiry* proposed to retain the 25 Mbps/3 Mbps speed benchmark for fixed broadband, while also seeking comment on whether any developments suggested that the 25 Mbps/3 Mbps benchmark should be updated, or supplemented with an additional, forward-looking speed benchmark.[169] Additionally, the *Notice* sought comment on whether to apply the 25 Mbps/3 Mbps benchmark to fixed satellite services, should the data allow their inclusion in our finding.[170] Finally, the *Notice* sought comment on whether to adopt a speed benchmark for mobile broadband,[171] and the proper approach to setting a mobile broadband-specific speed benchmark.[172]

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[163] 47 U.S.C. § 1302(d).

[164] *See infra* Table 1.

[165] In the *2015 Broadband Progress Report*, for example, we found that the increasing demand for online video services and proliferation of connected devices within the home necessitated access to broadband services capable of providing 25 Mbps/3 Mbps throughput in order to deliver advanced telecommunications capability. *See 2015 Broadband Progress Report*, 30 FCC Rcd at 1394, para. 27.

[166] *See e.g.*, ViaSat Comments at 3 ("Speed is the most crucial element of high-quality broadband service, and by far the most important factor in ensuring a quality experience with video streaming applications, which now account for more than 50 percent of peak downstream traffic over fixed broadband facilities in North America.").

[167] *See 2015 Broadband Progress Report*, 30 FCC Rcd at 1392, para. 25.

[168] *See supra* para. 15.

[169] *2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8833, paras. 24-25.

[170] *Id*. at 8833, para. 26.

[171] *Id*. at 8834-35, para. 30.

a. Fixed Broadband

51. We find that the current 25 Mbps/3 Mbps benchmark for fixed services remains an appropriate measure of whether a service provides advanced telecommunications capability. We therefore decline to modify our fixed speed benchmark, or to supplement it with an additional forward-looking component.

52. We conclude that 25 Mbps/3 Mbps continues to provide consumers with the capacity necessary to utilize "advanced" services that "enable[] users to originate and receive high-quality voice, data, graphics, and video telecommunications."[173] As noted by various commenters, use of the existing 25 Mbps/3 Mbps standard is appropriate for determining whether consumers have access to advanced telecommunications capability.[174]

53. Certain commenters, however, assert that the 25 Mbps/3 Mbps benchmark is "already forward-looking,"[175] in the process arguing that it sets a higher threshold than is currently necessary to meet the needs of broadband consumers.[176] These commenters either misunderstand the nature of our finding, or ignore the reality of today's broadband marketplace. The past year has seen rapid expansion in service offerings far exceeding the 25 Mbps/3 Mbps threshold, including services at speeds greater than 100 Mbps.[177] Moreover, as many commenters observe, consumers have increasingly flocked to these higher-speed services, belying the notion that the 25 Mbps/3 Mbps benchmark is somehow divorced from the needs of today's consumers.[178] And, as we observed last year, arguments by providers to this effect are contradicted by their own marketing of broadband services, which often recommend speeds well in excess of 25 Mbps/3 Mbps to serve normal household broadband needs.[179]

54. Despite the growth in adoption of broadband services at or above our 25 Mbps/3 Mbps threshold, we find that household usage patterns for fixed broadband services have not changed so significantly in the past year that further increase in our fixed speed benchmark is required. Our fixed broadband download speed threshold of 25 Mbps remains sufficient to ensure that a household can access a range of bandwidth intensive services, including HD video streaming, simultaneously over multiple

(Continued from previous page)

[172] *Id*.

[173] 47 U.S.C. § 1302.

[174] The Rural Associations Comments at 6; WISPA Comments at 4; ViaSat Comments at 3.

[175] ADTRAN Comments at 6.

[176] ADTRAN, for example, suggests that our speed benchmark in the *2015 Broadband Progress Report* was based on the projected near-term adoption of 4K television by consumers, and then argues that our finding is undercut by the fact that "usage of services such as 4K TV . . . is *de minimis* presently." ADTRAN Comments at 6-7. Similarly, The Free State Foundation claims that the *2015 Report* set a speed benchmark of 25 Mbps at a "level[] considered compatible for 4K ultra HD TV," and did so "despite the fact that few consumers have HD TV sets." The Free State Foundation Comments at 7. However these commenters mischaracterize our finding, which was not based primarily on the demands of ultra HD 4K television, or predictions about its future adoption. Instead, our interpretation of the definition of advanced telecommunications capability was based on cumulative, household demand for common broadband services such as HD video streaming, video chat, and online gaming. *2015 Broadband Progress Report*, 30 FCC Rcd at 1399-1401, paras. 37-40.

[177] *See, e.g.*, *supra* notes 84-85.

[178] Verizon, for example, notes that "64 percent of FiOS Internet customers subscribe to service plans with speeds of 50 Mbps or higher." Verizon Comments at 6.

[179] *2015 Broadband Progress Report*, 30 FCC Rcd at 1400, paras. 38; *see also, e.g.* Comcast, Xfinity, *Internet Service*, http://www.xfinity.com/internet-service.html (last visited Nov. 17, 2015) (advertising 75 Mbps as "[b]est for 3-5 devices online at the same time," allowing customers to "[s]tream and download HD TV shows, game online, video chat, share photos and videos").

devices.[180] The *2015 Broadband Progress Notice of Inquiry* also observed that consumers may be making greater use of upload-intensive services, such as HD video calling and online gaming, and sought comment on whether these trends warranted any change in our upload speed benchmark.[181] Although some commenters argued that the Commission should place greater emphasis on upload capacity in our analysis of advanced telecommunications capability,[182] others suggest that the asymmetric nature of broadband traffic is unlikely to change significantly in the near term.[183] While we agree that upload capacity is increasingly important for the delivery of advanced telecommunications capability, we find that services offering 3 Mbps upload speed continue to support advanced broadband services including HD video calling, virtual private network (VPN) platforms, telemedicine, and distance learning applications.[184] We therefore conclude that an increase in fixed broadband upload speed threshold is not required at this time.

55. Finally, we decline to apply any additional speed benchmarks to fixed broadband service. While the Commission continues to recognize the importance of gathering and publishing data on advanced services that exceed our threshold interpretation of the definition of advanced telecommunications capability, we do not feel that use of additional speed benchmarks is necessary to further this goal.[185] We therefore continue our approach of analyzing and reporting data regarding these higher-speed services in this Report,[186] but do so without incorporating these services into our finding through any additional fixed speed benchmarks.

b. Mobile Broadband

56. Speed is a central factor in the user experience of mobile Internet services and is a key determinant of advanced telecommunications capability. While traditional mobile services such as text messaging remain widely popular, new uses that require high speeds, such as two-way, real-time high definition video calling, high definition streaming video, and real-time educational courses, are becoming increasingly commonplace. Such uses require consistent, reliable connectivity at higher speeds than ever before. Thus, an appropriate advanced telecommunications capability benchmark for mobile services must be both forward-looking and attainable.

57. In the *Notice*, the Commission sought comment on the specific mobile speed benchmark that should be adopted if the Commission were to find that advanced telecommunications capability requires access to both fixed and mobile broadband meeting applicable benchmark standards.[187] As we observed in the *Notice*, trends in deployment and adoption, the speeds that providers are offering today, and the speeds required to use high-quality video, data, voice, and other broadband applications all inform

[180] The record developed in this proceeding broadly supports maintaining our current speed standard rather than increasing it in this *Report*. *See, e.g.*, The Rural Associations Comments at 6; WISPA Comments at 4; ViaSat Comments at 3 ("Continued use of the 25 Mbps/3 Mbps standard is appropriate in determining whether consumers have access to "advanced telecommunications capability.").

[181] *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8833, para. 24.

[182] *See* Christopher Morgan Comments at 1; Glen Akins Reply at 1.

[183] ADTRAN Comments at 7.

[184] For example, Skype currently recommends 1.5 Mbps upload capacity for an HD video call. Skype, *How Much Bandwidth Does Skype Need?*, https://support.skype.com/en/faq/FA1417/how-much-bandwidth-does-skype-need (last visited Jan. 5, 2016).

[185] The few parties that responded to our request for comment on this issue did not endorse use of additional speed benchmarks to supplement our existing 25 Mbps/3 Mbps standard. *See* ADTRAN Comments at 7; The Rural Associations Comment at 6 n.18.

[186] *See supra* note 86.

[187] *2015 Eleventh Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8824-25, para. 3.

a mobile benchmark.[188] We take these factors, as well as the needs of multiple users, into account when considering what level of service is necessary to be considered advanced telecommunications capability.[189] We consider, too, the services that providers are offering today, as well as the services that American consumers are choosing and the development of new technologies.[190]

58. After review of comments submitted in the record, however, we have determined that the current record is not sufficient to set a mobile speed benchmark. There is insufficient evidence in the record of what an appropriate speed benchmark for mobile should be. The record does not provide adequate use cases, engineering models, or empirical evidence for mobile that could be used to support a particular benchmark. We disagree with those commenters who suggest that we should adopt a benchmark at 5 Mbps/1Mbps.[191] We find that these comments do not account for uses that require high speeds, such as video calls, streaming media and real-time educational courses. These uses are becoming increasingly common, and require consistent connectivity in a mobile network environment at increasingly higher speeds than ever before. In addition, we note that mobile broadband providers' own marketing of mobile broadband services often recommend speeds well in excess of 5 Mbps/1 Mbps.[192] We also find that those commenters recommending that we set a higher mobile speed benchmark do not provide substantive evidence that 10 Mbps/1 Mbps they recommend should be the benchmark.[193] Nor do they address whether a higher speed benchmark is a forward looking benchmark that will reflect the projected trajectory of consumer demand for mobile data.

59. As we consider setting a mobile speed benchmark, and other relevant technical requirements for mobile ATC in future Reports, we will need to consider the distinct nature of mobile versus fixed networks. As discussed in the *Notice*,[194] and earlier in this Report,[195] a number of factors appear to indicate that mobile and fixed broadband respectively address different consumer needs and different components of the definition of advanced telecommunications capability. We may need to consider the adoption of benchmarks for mobile service that are different than those for fixed services.[196]

60. In addition to current mobile needs, we will need to account for the mobile services that are anticipated for the future. To establish a speed benchmark that is truly forward looking, we will need to project future trends in consumer demand and device functionality required to meet that demand. For example, automobile-based mobile services, which allows multiple users on one mobile connection, are in nascent states of introduction into the marketplace, and tethering and hotspot use for these and other

[188] *Id*.

[189] *Id*.

[190] *Id*.

[191] *See, e.g.*, AT&T Comments at 13 (asserting that 10 Mbps would be too high of a benchmark for mobile broadband and 5 Mbps/1 Mbps is sufficient for most mobile broadband functionalities).

[192] T- Mobile and AT&T are currently marketing their LTE with 20 Mbps as the upper range of the speed, while Sprint is advertising 15 Mbps as the upper range and Verizon advertises 12 Mbps as the upper range. *See* T-Mobile, *About T-Mobile*, http://www.tmobile.com/Company/CompanyInfo.aspx?tp=Abt_Tab_ConsumerInfo&tsp=Abt_Sub_InternetServices&link=unav (last visited Jan. 6, 2016); AT&T, *Broadband Information*, http://www.att.com/gen/public-affairs?pid=20879 (last visited Dec. 9, 2016); Sprint, *Important Coverage and Performance Information*, http://coverage.sprint.com/coverageDescVMU.html (last visited, Jan. 6, 2016), Verizon, *4G LTE Speeds vs. Your Home Network*, http://www.verizonwireless.com/mobile-living/network-and-plans/4g-lte-speeds-compared-to-home-network/ (last visited Jan. 6, 2016).

[193] *See, e.g.*, AT&T Comments at 13 (asserting that 10 Mbps would be too high of a benchmark for mobile broadband and 5 Mbps/1 Mbps is sufficient for most mobile broadband functionalities).

[194] *2015 Eleventh Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8834-35, paras. 27-30.

[195] *See supra* Sections III.A.2 and III.A.3.

[196] *2015 Eleventh Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8834-35, paras. 27-30.

systems will likely grow. There are also mobile services contemplated by the development of next-generation 5G wireless technologies. An appropriate mobile benchmark must take into account—in the mobile as opposed to the fixed context—the ability to serve multiple consumers at once with some consumers using larger, more data-intensive tablets. We find that some of the commenters do not give enough weight to these trends and developing technologies in their assessments of speed benchmarks. This finding builds on our last Report, where we assessed comments on what speed would be an appropriate benchmark and, in doing so, observed various functionalities that would be available at different speeds.

61. As mentioned above, a mobile speed benchmark will need to take into account the unique technical characteristics of mobile wireless communication. For example, mobile broadband encounters greater degrading effects from factors such as congestion, interference, and challenges presented by physical velocity of a mobile antenna. A data-intensive activity like video conferencing may be able to operate at relatively slow speeds if such speeds are consistently available. Video conferencing, however, may be unsupportable at such speeds due to mobile network congestion that temporarily reduces throughput to much lower speeds. Accordingly, even though it might be currently possible to provide certain advanced telecommunications capabilities at lower data rates in certain circumstances, in the not-too-distant future such speeds may not be sufficient to account for potential signal degradation as well as the advent of new technologies and increasing consumer demand. In doing so, we anticipate the possibility that we may need to set a speed benchmark well in excess of what may be necessary to support a current mobile service in ideal network conditions, while accounting for the different network and economic characteristics of mobile and fixed services.

2. Other Performance Metrics

62. Although speed is generally the most useful metric for assessing broadband performance, other metrics can also provide valuable insight into the capabilities of broadband services.[197] Therefore, in addition to broadband speeds, the *2015 Broadband Progress Notice of Inquiry* also discussed the impact of other performance characteristics on the delivery of advanced telecommunications capability. For example, the Commission observed that latency and consistency of service seem to figure prominently into whether a broadband service is able to provide advanced capabilities.[198] The Commission noted that latency—a measurement of the time it takes a data packet to travel through the network[199]—is "important for a variety of applications, including Voice over Internet Protocol (VoIP), video calling, distance learning, and online gaming" which "may be effectively unusable over high latency connections, regardless of the download/upload speeds being offered."[200] Similarly, the Commission observed that consistency of service may also factor into our interpretation of the definition of advanced telecommunications capability, and that consistent performance may be "of particular importance for users of certain advanced services, such as VoIP, distance learning, or telemedicine."[201] The Commission sought comment on adoption of latency and service consistency as quality of service metrics to supplement our speed benchmark.[202]

63. While we continue to recognize the importance of low latency, high consistency broadband networks for the deployment of advanced telecommunications capability, we do not adopt

[197] Via Sat Comments at 2 ("[W]hile speed is often the single best predictor of broadband service quality, no single performance criterion adequately measures such quality or, in and of itself, predicts consumer satisfaction with respect to broadband performance.").

[198] *2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8835-40, paras. 31-46.

[199] *Id.* at 8835, para. 32.

[200] *Id.* at 8835, para. 32 n.69.

[201] *Id.* at 8838-39, para. 42.

[202] *Id.* at 8835, para. 31, 8838, para. 41.

non-speed performance benchmarks in this Report.[203] Several commenters argued that analysis of additional criteria would provide the Commission a valuable complement to our review of speed data, and present a more accurate and complete picture of advanced telecommunications capability deployment.[204] However, because we currently lack comprehensive data on factors other than speed, we are unable to formally incorporate these factors into our interpretation of the definition of advanced telecommunications capability. Instead, we intend to continue gathering information about these important features of broadband service, with an eye to reevaluating their role in providing advanced telecommunications capability in a future Report. In addition, we will continue to update and refine our tools to evaluate privacy and security concerns as they affect broadband deployment.[205]

a. Latency

64. Latency[206] is an important measurement of broadband network performance because it significantly impacts the performance of interactive, real-time applications, including VoIP, online gaming, videoconferencing, and VPN platforms.[207] As the Commission has observed, these kinds of applications are contemporary examples of the advanced services that Congress directed the Commission to consider in our section 706 inquiry. Latency, therefore, is also relevant to this proceeding.[208]

65. A number of commenters argue that the Commission should analyze latency as a factor affecting the deployment and availability of advanced telecommunications capability.[209] Other commenters oppose the adoption of additional criteria, including latency, arguing that latency is not a useful tool to assess broadband, or alternatively that the Commission lacks the technical capability to analyze latency at this time.[210] While the Commission disagrees with commenters who suggest that latency is not a useful or important metric for measuring the deployment of advanced telecommunications capability,[211] we nonetheless agree with those commenters who argue that adoption of a latency benchmark at this time would be premature.[212]

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[203] *See, e.g.*, *2015 Measuring Broadband America Report* at 7.

[204] *See, e.g.*, California PUC Comments at 18-21 (urging the Commission to consider additional factors including latency, quality, and reliability); ViaSat Comments at 1 (supporting "a multidimensional definition of broadband that accounts for more than mere speed"); Public Knowledge Comments at 6-7.

[205] *2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8841, para. 52. *See also 2015 Broadband Progress Report*, 30 FCC Rcd at 1438, para. 105 ("As communications technologies emerge and change, we must reassess and update methods for ensuring that communications, including telephony and other switched or legacy services, remain as secure and reliable over broadband as they were under legacy technologies.").

[206] For further discussion of the impact of latency on communications networks, see *Policies and Rules Governing Retirement Of Copper Loops by Incumbent Local Exchange Carriers Special Access for Price Cap Local Exchange Carriers AT&T Corporation Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services*, Report and Order, Order on Reconsideration and Further Notice of Proposed Rulemaking, 30 FCC Rcd 9372, 9482, paras. 216-217 (2015).

[207] *See 2015 Broadband Progress Notice of Inquiry*, 29 FCC Rcd at 8835-36, paras. 32-33; *see also 2015 Broadband Progress Report*, 30 FCC Rcd at 1392-93, paras. 24-25; *Eighth Broadband Progress Report*, 27 FCC Rcd at 10366, para. 36; 2015 Measuring Broadband America Report at 7.

[208] *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8835, para. 32 n.69.

[209] *See, e.g.*, Christopher Morgan Comments at 1; Eugene Liu Comments at 1, Public Knowledge Comments at 6-7, California PUC Comments at 18-21, The Rural Associations Comments at 5-6.

[210] *See, e.g.*, Verizon Comments at 11-12, AT&T Comments at 5; Competitive Carriers Association Comments at 11; CTIA Comments at 8; ViaSat Reply Comments at 2-3.

[211] *See, e.g.*, ViaSat Comments at 6 (stating that "latency is not an effective proxy for broadband service quality" and "low latency is not necessary to ensure the availability of high-quality service to consumers"); Competitive Carriers (continued….)

66. As we explained in the *2015 Broadband Progress Notice of Inquiry*, "the Commission currently lacks the kind of small-scale geographic data for latency that it has for speed."[213] While the Commission has begun to collect data on latency through the Measuring Broadband America program, these data are collected from a representative sample of volunteer participants and are national in scope.[214] Therefore, while the data are valuable for assessing Internet service provider (ISP) performance generally, the data are not sufficiently granular to use for accurately determining the deployment of advanced telecommunications capability. Several commenters have argued that without these kinds of data, the Commission cannot implement latency measurements into its interpretation of the definition of advanced telecommunications capability in the rigorous manner required by section 706, which focuses on producing geographic measurement of unserved areas.[215] Because we agree that the Commission currently lacks sufficiently comprehensive data on latency, we decline to adopt a latency benchmark in this Report.

67. We disagree, however, with commenters who suggest that incorporation of a latency benchmark into our analysis of advanced telecommunications capability deployment would somehow be improper or unhelpful to our review.[216] As the Measuring Broadband America Report has explained, "[l]atency may affect the perceived quality of highly interactive applications such as phone calls over the Internet, video chat, or online multiplayer games."[217] Further, the higher latencies of some services, particularly "satellite-based broadband services," may "negatively affect the perceived quality of such highly interactive applications."[218] Because latency plainly affects whether consumers have access to "high quality" advanced telecommunications services, particularly satellite-based services, it is both relevant to the deployment of advanced telecommunications capability, and necessary for the Commission to continue to consider ways to incorporate latency into our annual 706 inquiry.[219]

b. Consistency

68. Like latency, service consistency has the potential to significantly impact whether a broadband service delivers advanced telecommunications capability, particularly in the mobile environment. As we explained in the *2015 Broadband Progress Notice of Inquiry*, broadband services that do not perform consistently may not provide consumers with meaningful access to interactive

(Continued from previous page)
Association Comments at 11 (arguing that "latency does not effectively measure the quality of mobile broadband as it does with fixed broadband").

[212] *See, e.g.*, USTelecom Comments at 8-9 ("The Commission has in the past rejected imposing latency benchmarks because reliable data (and methodologies for reliably gathering such data) have not been available. . . . Given the continuing lack of data on these two metrics, benchmarks for latency and consistency should not be imposed at this time.").

[213] *2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8837, para. 36.

[214] *See 2015 Measuring Broadband America Report* at 6.

[215] *See* AT&T Comments at 14-18 (arguing that the Commission does not have the data sources necessary to conduct a geographically granular analysis); Competitive Carrier Association Comments at 11 ("there is not enough data yet to accurately determine latency."); Windstream Comments at 5; *see also supra* para. 15.

[216] *See, e.g.*, NCTA Comments at 9-10.

[217] *2015 Measuring Broadband America Report* at 7.

[218] *Id*.

[219] Similarly, high latencies may effectively prevent users from using interactive services altogether, thereby interfering with the ability to "originate and receive high quality voice, data, graphics and video telecommunications" services, as required by section 706. 47 U.S.C. § 1302(d).

advanced services including VoIP, telemedicine, and online education applications.[220] Because these services permit broadband consumers to "originate and receive high-quality voice, data, graphics, and video telecommunications," service consistency is relevant to the deployment of advanced telecommunications capability.

69. Several commenters object to the Commission's consideration of consistency in this proceeding, arguing that consideration of service consistency, like latency, is irrelevant or impractical.[221] We disagree. As we have explained, the plain language of section 706 undercuts assertions that service consistency is somehow unrelated to the deployment of advanced telecommunications capability. Additionally, we reject the assertion that use of additional criteria such as latency and consistency as criteria for interpreting the definition of advanced telecommunications capability is implicitly "unworkable."[222] As comments submitted by the California Public Utilities Commission and Nebraska Public Service Commission demonstrate, not only is it possible to incorporate these types of metrics into a geographical survey of broadband deployment, but doing so can yield valuable insights.[223]

70. Nonetheless, as with latency, we conclude that adoption of any service consistency benchmarks in this Report would be premature. As we have explained above, whether a broadband service performs consistently is likely to affect whether consumers are able "to originate and receive high quality voice, data, graphics and video telecommunications" services, as required by section 706.[224] We agree, however, with commenters that suggest that the Commission currently lacks sufficiently comprehensive data to measure service consistency in the rigorous fashion required by section 706.[225] Additionally, we note that different benchmarks for service consistency may be appropriate for mobile services that are inherently less consistent. It is therefore appropriate that the Commission decline to impose consistency benchmarks at this time, while continuing to consider methods to incorporate this metric into our annual inquiry in future reports.

3. Schools and Libraries Benchmark

71. We conclude that 100 Mbps per 1,000 students and staff as a short-term benchmark, and a long-term benchmark of 1 Gbps per 1,000 students and staff continue to be appropriate for evaluating deployment and availability of advanced telecommunications capability to elementary and secondary schools and libraries. These benchmarks coincide with those we set in the *2014 E-rate Modernization Order*, which found that these standards were sufficient in the short term to account for the increasing use of "digital learning strategies and one-to-one device initiatives" by American schools.[226] Furthermore, although certain commenters in this proceeding object to the manner in which the Commission measures deployment of advanced telecommunications capability to schools, they do not take issue with our benchmarks as established by the *2015 Broadband Progress Report*.[227] Access to broadband has become essential for students in all levels of education. Fixed broadband access, combined with cutting edge educational tools and content, are transforming the educational landscape in America. Mobile broadband

[220] *See 2015 Broadband Notice of Inquiry*, 30 FCC Rcd at 8838, para. 41; *see also* 2015 Measuring Broadband America Report at 7 ("Consistency of speed may be more important to customers who are heavy users of applications that are both high bandwidth and sensitive to variations in actual speed, such as streaming video.").

[221] *See* AT&T Comments at 17.

[222] AT&T Comments at 17.

[223] *See generally* California PUC Comments, Nebraska PSC Comments.

[224] 47 U.S.C. § 1302(d).

[225] Competitive Carrier Association Comments at 11; Windstream Comments at 5.

[226] *E-Rate Modernization Order*, 29 FCC Rcd at 8883, para. 34. These standards were in turn based on target recommendations by the State Education Technology Directors Association (SETDA). *Id.*

[227] *See* ADTRAN Comments at 11-12, The Rural Association Comments at 14-15.

access does not currently provide the speeds or capacity that schools and libraries need. Particularly given ongoing disparities in broadband deployment and adoption, it is critical that our Nation's students have access to high-speed broadband to effectively participate in the digital world.[228]

IV. BROADBAND DEPLOYMENT AND AVAILABILITY

72. This section presents the results from our Inquiry into the deployment and availability of advanced telecommunications capability and broadband to all Americans. We first summarize the data sources on which we rely for our deployment estimates. We then present our deployment estimates of advanced telecommunications capability and broadband to Americans, including trends in the availability of advanced telecommunications capability and broadband, demographic analyses, and an analysis of deployment to our Nation's schools and classrooms under the Commission's schools-specific advanced telecommunications capability benchmarks. We also discuss adoption and other indicators of availability of advanced telecommunications capability. Although we do not adopt a mobile benchmark in this report, we report information on mobile deployment. Finally, we discuss international broadband service capability.

A. Data Sources

1. Fixed and Mobile Broadband Deployment (FCC Form 477 Deployment Data, and Other Data Sources).

73. Consistent with our statements in the *2015 Broadband Progress Report* and the *Notice*, we rely primarily on the new, revised Form 477 deployment data for this Report.[229] We present data analysis across technologies as part of our inquiry, looking at fixed terrestrial and satellite broadband as well as mobile broadband deployment.

74. In the last several Broadband Progress Reports, the Commission relied on the SBI program for deployment data. The revised Form 477 data improves upon the SBI data in several respects. First, the revised Form 477 deployment data are a mandatory collection that requires filing parties to certify the accuracy of their filings.[230] In addition, the revised Form 477 data uses a uniform nationwide collection methodology, which reduces the likelihood of inconsistencies and inaccuracies.[231] The Form 477 data also improves upon the SBI data for fixed broadband services by collecting census block level data by customer class (i.e., residential and business) and by maximum advertised speed for each technology.[232] This data also improves upon the SBI data for mobile data services by requiring providers

[228] As reflected in our benchmarks, schools and libraries have large capacity needs and almost exclusively receive service over fixed broadband. We therefore do not consider mobile broadband access or deployment as part of our evaluation at this time.

[229] *2015 Broadband Progress Report*, 30 FCC Rcd at 8827-28, paras. 10-11, 68; *2015 Eleventh Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8824, para. 3.

[230] All facilities-based providers of broadband connections to end users are required to provide data on broadband deployment and subscription. Examples of facilities-based providers of broadband connections include: incumbent and competitive local exchange carriers (LECs), cable television system operators, terrestrial fixed wireless providers (including wireless Internet service providers (ISPs), or WISPs) that provide service to end user premises, satellite network operators, terrestrial mobile wireless operators with owned network facilities, electric utilities, public utility districts and municipalities. *See* Form 477 Filing Instructions (June 30, 2015) at 5, https://transition.fcc.gov/form477/477inst.pdf.

[231] *See* Form 477 Filing Instructions (June 30, 2015), https://transition.fcc.gov/form477/477inst.pdf; *Modernizing Form 477 Order,* 28 FCC Rcd at 9897, para. 23.

[232] *See* Form 477 Filing Instructions (June 30, 2015), https://transition.fcc.gov/form477/477inst.pdf; *Data Specifications for Form 477*, 28 FCC Rcd at 12669-70.

to submit shapefiles containing information about both speed and mobile network technology (e.g., EV-DO, WCDMA, HSPA+, LTE, WiMAX).[233]

75. We rely upon the best information available for fixed and mobile broadband services.[234] In the case of fixed services, we find that the new Form 477 data is the most accurate data and we rely exclusively upon the new Form 477 broadband deployment data to identify areas without access to services meeting the 25 Mbps/3 Mbps speed threshold for fixed advanced telecommunications capability. In the case of mobile broadband services, we rely upon the new Form 477 broadband technology and speed deployment data for mobile services and other reliable data sources.

2. Elementary and Secondary Schools Deployment (FCC Form 471 and Other Sources)

76. Our assessment of developments in the elementary and secondary schools is based upon the best publically available data. To evaluate the deployment of advanced telecommunications capability to America's schools, we rely upon the new FCC Form 471 data (FCC Form 471) for E-rate funding year 2015, the *EducationSuperHighway Report*, and the CoSN Survey. Last year, the Commission revised the FCC Form 471 to improve the quality of the information collected from schools and libraries that apply for E-rate support for broadband connections.[235] The EducationSuperHighway tracks public schools progress toward the Commission's goals for K-12 connectivity using the Commission's FCC Form 471 data and its outreach efforts to FCC E-Rate applicants for clarifications on their Form 471 applications.[236] CoSN's report summarizes the results of it survey of public school district leaders regarding the current state of broadband and technology infrastructure in U.S. school systems.[237]

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[233] *See Modernizing Form 477 Order,* 28 FCC Rcd at 9888, para. 3; *Data Specifications for Form 477,* 28 FCC Rcd at 12671-72. Shapefiles also contain information about the spectrum band associated with each shape.

[234] Our analysis may overstate the deployment of services throughout an area. Providers of fixed broadband services identify, by census block, whether they provide services somewhere within the census block. Similarly, we evaluate the ability of mobile wireless providers to provide services throughout a census block by evaluating whether the provider's shapefile overlaps the centroid of the census block. Thus, our analysis could indicate that the services are offered to Americans residing within the census block even if services are offered only to a portion of the residents residing in that census block. *Modernizing Form 477 Order,* 28 FCC Rcd at 9904-05, para. 35; *2015 Broadband Progress Report*, 30 FCC Rcd at 1414, para. 72, n.284. In addition, our identification of areas without access to advanced telecommunications capability, may be understated or overstated to the extent that broadband providers fail to report data or misreport data. While over 3,000 providers of broadband services have submitted Form 477 data to the Commission, the Commission has initiated compliance actions against some providers that have failed to submit data. *See Rio Verde Wireless, LLC*, Order, DA 15-1014 (EB Oct. 7, 2015) ($10,500 civil penalty for failure to provide data in a timely manner and failing to respond to the Bureau inquiry letter); *Marseilles Telephone Co., Metamora Telephone Co. and MTCO Communications, Inc.*, Order, 29 FCC Rcd 2603 (EB 2014). We have performed quality and consistency checks on the submitted data, and we have contacted many filers with questions about inconsistencies or likely errors in the data. For example, the instructions require that the data be reported in Mbps. Some providers submitted data reporting 768 for an upload and download speed suggesting 768 Mbps download and 768 Mbps upload. These types of filing resulted in a question to the filer whether the reported data should be for 0.768 Mbps download and 0.768 Mbps upload. We also contacted filers when it seemed likely that the filer may have omitted decimal points in their fixed broadband speed data or reported a top maximum speed for fixed broadband services that either seemed too high for the reported technology or was inconsistent with the filers' advertised speed for residential services. While, many filers submitted corrected filings in response to our inquiries; in order to move forward with our analysis, we have had to implement coding in some instances for apparent data errors. These amendments to the filers' data have been documented and the appropriate filers have been contacted. *See* https://www.fcc.gov/general/explanation-broadband-deployment-data (explaining adjustments made to the December 31, 2014 Form 477 data as filed).

[235] *2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8842, para. 55.

[236] We recognize that services may be deployed in an area even in the absence of an application for 100 Mbps services for each 1,000 students or 1 GB of service per 1,000 students. *See* ADTRAN Comments at 12; NTCA, (continued….)

B. Broadband Deployment Estimates

77. This section presents our deployment estimates of advanced telecommunications capability and broadband to Americans. We present information for the Nation as a whole, for Tribal lands, and for U.S. Territories, and provide an urban/rural breakdown within these three geographies.[238] First, we present estimates of deployment of fixed advanced telecommunications capability. Then, we present data to illustrate the extent to which Americans may have access mobile broadband services.

78. Our identification of areas without access to 25 Mbps/3 Mbps fixed broadband services is by census block. We identify the population in each census block that does not have access to 25 Mbps/3 Mbps fixed broadband services (as indicated by the Form 477 fixed broadband speed data). In section IV.B.2, we present estimates of mobile broadband deployment based upon our Form 477 mobile broadband technology data for LTE services and our mobile broadband technology speed data based upon LTE services with a minimum advertised speed of 10 Mbps/1 Mbps.[239]

1. Access to Fixed Advanced Telecommunications Capability

79. We first present data showing Americans without access to fixed advanced telecommunications capability, which demonstrates that a significant percentage of the country lacks access to fixed broadband services. As of December 31, 2014, approximately 34 million (10 percent) of Americans lack access to fixed 25 Mbps/3 Mbps advanced telecommunications capability.[240] At slower speeds, 6 percent of Americans lack access to fixed terrestrial service at 10 Mbps /1 Mbps and 5 percent lack access to such services at 4 Mbps /1 Mbps.[241] There is also a significant disparity between rural and

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WTA and National Exchange Carrier Comments at 15. The figures reported in the *EducationSuperHighway Report* may overstate or understate school's connectivity. The *EducationSuperHighway Report* is based upon the original Form 471 requests and does not include any subsequent updates made to the Form 471 as part of the Universal Service Administrative Company's Program Integrity Assurance process. *EducationSuperHighway Report* at 101. The report presents state-level metrics that are calculated based upon a sample of the total school districts in each state. *See EducationSuperHighway Report* at 100-118 (discussing statistical methodology and efforts to validate and clean the data).

[237] *CoSN Survey* at 4.

[238] The deployment estimates are based on Form 477 Data, as of December 31, 2014, unless otherwise noted. Rural areas are identified using the 2010 Census block identification. Our assessment of Tribal lands is conducted by examining the census blocks identified by the Census Bureau in the 2010 Census as federally recognized Tribal lands. Tribal lands are identified using the American Indian Area Alaska Native Area Hawaiian Home Land Class Code (AIANHHCC) affiliation. *See* Appx. C (Data Sources and Definitions); Appx. D (Americans Without Access to Fixed Advanced Telecommunications Capability by State & U.S. Territory; and Appx. G (Tribal Lands Without Access to Fixed Advanced Telecommunications Capability by State).

[239] *See infra* Section IV.B.2.

[240] *See* Appx. D (Americans in Urban and Rural Areas Without Access to Fixed Advanced Telecommunications Capability by State & U.S. Territory) and Appx. E (Americans Without Access to Fixed Advanced Telecommunications Capability by County) at https:// www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report. We provide interactive online maps at https://www.fcc.gov/reports-research/reports/2016-broadband-progress-report. These maps indicate whether fixed advanced telecommunications capability is available in each census block. In addition, for each area, the maps identify the area as Tribal lands, rural or urban; provide demographic analysis required in section 706(c) (i.e., population, population density, and per capita income); and provide the name and maximum advertised speed for each provider of fixed services. We also will continue to monitor the deployment of higher broadband speeds. For example, Form 477 data suggest that 277.3 million Americans (86%) have access to fixed 50 Mbps download broadband service or higher.

[241] *See* Appx. F (Impact of Inclusion of Satellite Services on Deployment and Overall Adoption Rates for Fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps Services). For example, excluding satellite services, 16.080 million out of 323.785 million Americans (or 5%) lack access to 4 Mbps/1 Mbps services.

urban areas, with more than 39 percent of Americans living in rural areas lacking access to 25 Mbps/3 Mbps advanced telecommunications capability, as compared to 4 percent of Americans living in urban areas.[242] We also see that approximately 41 percent of Americans living on Tribal lands and 66 percent of Americans living in the U.S. Territories lack access to advanced telecommunications capability as compared to 10 percent of the U.S. population as a whole. The significant number of Americans that lack access to services at the speeds that we find best represent advanced telecommunications capability, as well as the disparity in availability of services to Americans residing in urban versus rural areas, on Tribal lands and in the U.S. Territories, indicate that advanced telecommunications capability is not available to all Americans.

Table 1
Americans Without Access to Fixed Advanced Telecommunications Capability (Millions)

	Population	Percentage of Population
United States	33.982	10%
Rural Areas	23.430	39%
Urban Areas	10.552	4%
Tribal Lands	1.574	41%
Rural Areas	1.291	68%
Urban Areas	0.283	14%
U.S. Territories	2.628	66%
Rural Areas	1.078	98%
Urban Areas	1.550	54%

a. Tribal Lands Without Access to Fixed Advanced Telecommunications Capability

80. Table 2 presents the number of Americans residing on Tribal lands that lack access to fixed advanced telecommunications capability. While over 40 percent of citizens living on Tribal lands lack access to fixed advanced telecommunications capability, there is a larger disparity between rural Tribal lands residents and the rest of the country. As in prior years, our assessment of Tribal lands considers availability of services in census blocks identified for the 2010 Census as federally recognized Tribal lands. We present information for all federally recognized Tribal Lands, and separately for Alaskan Villages, Hawaiian Home Lands, Tribal Lands in the Lower 48 States and Tribal Statistical Areas.[243]

- Approximately 1.6 million Americans living on Tribal lands (41 percent) lack access to fixed advanced telecommunications capability. While only 1 percent of Americans residing on Hawaiian Home Lands do not have fixed advanced telecommunications capability, 49 percent of Americans living in Alaskan Villages and 58 percent of Americans living on Tribal lands in the lower 48 states are without access to fixed advanced telecommunications capability.
- More than 68 percent of Americans living on Tribal lands in rural areas lack access to advanced telecommunications capability compared to 14 percent of Americans living on Tribal lands in urban areas.

[242] For fixed terrestrial broadband at slower speeds, 25 percent of rural Americans lack access to 10 Mbps/1 Mbps fixed terrestrial broadband services compared to 2 percent of urban Americans, and 19 percent of rural Americans lack access to 4 Mbps/1 Mbps fixed terrestrial broadband service compared to 2 percent of urban Americans.

[243] *See* Appx. C (Data Sources and Definitions) and Appx. G (Tribal Lands Without Access to Fixed Advanced Telecommunications Capability by State).

Table 2
Tribal Lands Without Access to Fixed Advanced Telecommunications Capability

	Population	Percentage of Population
Tribal Lands	1,573,925	41%
Rural Areas	1,291,330	68%
Urban Areas	282,595	14%
Alaskan Villages	128,638	49%
Rural Areas	113,706	70%
Urban Areas	14,932	15%
Hawaiian Home Lands	367	1%
Rural Areas	307	7%
Urban Areas	60	0%
Tribal Lands in the Lower 48 States	588,324	58%
Rural Areas	469,818	72%
Urban Areas	118,506	33%
Tribal Statistical Areas	856,596	34%
Rural Areas	707,499	66%
Urban Areas	149,097	10%

b. U.S. Territories without Fixed Advanced Telecommunications Capability

81. Table 3 presents the number of Americans residing in each of the U.S. Territories that lack access to fixed advanced telecommunications capability and, much like the Tribal data depicted in Table 2, it shows an overwhelmingly large percentage of Territorial residents without access to fixed advanced telecommunications capability.[244]

[244] *See* Appx. E (Americans Without Access to Fixed Advanced Telecommunications Capability by County) at https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report.

Table 3
U.S. Territories Without Access to Fixed Advanced Telecommunications Capability

	Population	Percentage of Population
U.S. Territories	2,628,397	66%
Rural Areas	1,077,935	98%
Urban Areas	1,550,462	54%
American Samoa	54,504	100%
Rural Areas	13,197	100%
Urban Areas	41,307	100%
Guam	159,377	99%
Rural Areas	52,333	100%
Urban Areas	107,044	99%
Northern Mariana Islands	51,455	100%
Rural Areas	17,549	100%
Urban Areas	33,906	100%
Puerto Rico	2,259,097	62%
Rural Areas	933,414	98%
Urban Areas	1,325,683	50%
U.S. Virgin Islands	103,964	100%
Rural Areas	61,442	100%
Urban Areas	42,522	100%

2. Access to Mobile Broadband Services

82. We next present some estimates of Americans without access to mobile services. We present figures based upon Form 477 mobile deployment data for services using an LTE technology and a LTE technology with a minimum advertised speed of 10 Mbps/1 Mbps. The estimates for mobile services are not comparable to the estimates reported in prior years because those estimates were based upon the SBI Data, which collected data for the *maximum* advertised speed whereas the Form 477 Mobile broadband data is based upon the *minimum* advertised speed.[245] Because of this difference, estimates for mobile services in prior Reports are not directly comparable to the figures reported in Tables 4 and 5.[246]

83. The figures in Table 4 suggest that 1.7 million (1 percent) of Americans do not have access to a mobile provider using LTE technology, and that 171.5 million (53 percent) of Americans do

[245] *See 2015 Broadband Progress Notice of Inquiry*, 30 FCC Rcd at 8843, para. 57 (explaining that the Commission has shifted away from collecting maximum advertised speed, as NTIA had done with the SBI data, to collecting minimum advertised speed for mobile broadband).

[246] The Commission can rely upon Form 477 reported maximum advertised speeds for fixed services because the Commission has found that actual speeds experienced by most ISPs' subscribers are close to or exceed the advertised maximum speed. *See e.g.*, 2015 Measuring Broadband America Fixed Broadband Report at 6. In contrast, the relationship between advertised and actual speed is more complex for mobile services because the mobile providers report their minimum advertised speed and each mobile provider advertises the minimum speed at various points of their actual speed distribution. For example, one provider's advertised speed may fall within the 20th percentile; for another it may fall in the 60th percentile. Therefore, we cannot assume a uniform correspondence between actual and minimum advertised speed for mobile services.

not have access to mobile service provider with a LTE technology service with a minimum advertised speed of 10 Mbps/1 Mbps.[247] In rural areas, 1.5 million (3 percent) of Americans are without access to LTE services, and 52.2 million (87 percent) of Americans are without access to a LTE services with a minimum advertised speed of 10 Mbps/1 Mbps. In contrast, in urban areas, the estimates are, respectively, 163,000 (0 percent) and 119.3 million (45 percent).

Table 4
Americans Without Access to Mobile Broadband Services (Millions)

	LTE Technology		10 Mbps/1 Mbps	
	Population	Percentage of Population	Population	Percentage of Population
United States	1.682	1%	171.486	53%
Rural Areas	1.519	3%	52.231	87%
Urban Areas	0.163	0%	119.255	45%

3. Deployment of Fixed Advanced Telecommunications Capability (25 Mbps/3 Mbps) and Mobile Broadband Services

84. Table 5 presents estimates of the number and proportion of Americans without access to fixed 25 Mbps/3 Mbps service and two measures of mobile services. Overall, 34.7 million (11 percent) Americans lack access to both a 25 Mbps/3 Mbps fixed service and a mobile services provisioned using LTE technology.[248] This estimate increases to approximately 177 million (55 percent) Americans based upon access to a 25 Mbps/3 Mbps fixed service and a mobile service with a minimum advertised speed of 10 Mbps/1 Mbps. In rural areas, these estimates range from approximately 24 million (40 percent) to 54 million (90 percent).[249] In contrast, in urban areas, the estimate ranges from 10.6 million (4 percent) to 122.8 million (47 percent), as depicted in Table 5 below.[250]

Table 5
Americans Without Access to Fixed Advanced Telecommunications Capability and Mobile Broadband Services (Millions)

	Fixed 25 Mbps/3 Mbps and LTE Technology		Fixed 25 Mbps/3 Mbps and 10 Mbps/1 Mbps Mobile Services	
	Population	Percentage of Population	Population	Percentage of Population
United States	34.477	11%	176.959	55%
Rural Areas	23.897	40%	54.139	90%
Urban Areas	10.580	4%	122.820	47%

[247] Last year, approximately 2 percent of Americans did not have access to LTE technology and that approximately 3 percent of Americans did not have access to a mobile service with a *maximum advertised* speed of 10 Mbps/768 kbps. *2015 Broadband Progress Report*, 30 FCC Rcd at 1442, para. 113, Table 15.

[248] The population in a census block has access to fixed and mobile only if consumers have access to a fixed service *and* to a mobile service.

[249] Last year, we reported 54 percent of Americans residing in rural areas did not have access to a fixed 25 Mbps/3 Mbps and LTE service, and that 56 percent of these Americans did not have access to a fixed 25 Mbps/3 Mbps service and a mobile 10 Mbps/768 kbps service. *2015 Broadband Progress Report*, 30 FCC Rcd at 1445, para. 121, Chart 5.

[250] Last year, we reported 9 percent of Americans residing in urban areas did not have access to a fixed 25 Mbps/3 Mbps and LTE service, and 9 percent of these Americans did not have access to a fixed 25 Mbps/3 Mbps service and a mobile 10 Mbps/768 kbps service. *Id.*

4. Estimated Maximum Options for Advanced Telecommunications Capability

85. Our consideration of the availability of advanced telecommunications capability also encompasses the number of options consumers have for these services because the price of services is often cited as a deterrent to subscription, and the existence of multiple providers of a product or services can result in lower prices than would be found in areas where there is a single service provider.[251] We present a series of tables depicting the proportion of Americans with multiple options for fixed advanced telecommunications capability.

86. Table 6 reports the proportion of Americans with multiple competitive options for fixed 25 Mbps/3 Mbps advanced telecommunications capability.

- Approximately 51 percent of Americans have one option for a provider of 25 Mbps/3 Mbps fixed broadband service, 38 percent of Americans have more than one option for 25 Mbps/3 Mbps fixed broadband service, and approximately 10 percent of Americans have no options for 25 Mbps/3 Mbps fixed broadband service.
- Americans in urban areas have significantly more providers offering 25 Mbps/3 Mbps speeds than Americans in rural areas. In rural areas, only 13 percent of Americans have more than 1 option for service compared to 44 percent in urban areas.

Table 6
Estimated Percentage of Americans With Multiple Options for Fixed Advanced Telecommunications Capability

	No Provider	One Provider	More Than One Provider
United States	10%	51%	38%
Rural Areas	39%	48%	13%
Urban Areas	4%	52%	44%

5. Trends in the Availability of Fixed Advanced Telecommunications Capability (2012 to 2014)

87. We next report on the trends in the availability of our recently adopted 25 Mbps/3 Mbps speed threshold for fixed advanced telecommunications capability. These trends show that fixed advanced telecommunications capability is only gradually becoming more available to consumers. We caveat this analysis because the Commission's deployment analysis of advanced telecommunications capability has transitioned from one based upon the SBI Data to one based upon the new Form 477 Data. The analysis below is based upon the best data available for the time period reported. The estimates for 2014 are based upon the new Form 477 Data, whereas the estimates for prior years are based upon the SBI Data. Because of differences in the collection methodology, results for years prior to 2014 are not directly comparable to results since 2014.[252] As noted above, the new Form 477 data reporting is mandatory for all providers, and providers are expected to submit data separately for residential and business services.[253] We report how our estimates of the population without fixed advanced telecommunications capability has changed over time. We expect that the data submitted with the new Form 477 should be more accurate, and that the accuracy of the data will improve over time as filers gain more experience with the Form. In future years we will be able to present similar data for mobile service meeting our definition of advanced telecommunications capability. Finally, the accuracy of our estimates

[251] The Commission has found that deployment, competition, and adoption are tightly linked. *2015 Broadband Progress Report*, 30 FCC Rcd at 1455, para. 141.

[252] *See supra* Section IV.A.1.

[253] *Id*.

are dependent upon the population data source.[254] With these caveats, we discuss the change in unavailability of services for rural and urban areas in the U.S. overall, as well as for Tribal Lands and the U.S. Territories.

88. Table 7 shows the changes in deployment of 25 Mbps/3 Mbps service from December 31, 2012 to December 31, 2014 for rural and urban areas in the U.S, Tribal Lands and the U.S. Territories. The data show, generally, a decline in unavailability for 25 Mbps/3 Mbps service, but the data also depict a striking disparity between urban and rural areas.

- From December 2013 to December 2014, there was a 7 percentage point decline in the proportion of Americans without fixed advanced telecommunications capability in the U.S. as a whole, a 22 percentage point decline for Americans living on Tribal lands, and a 3 percentage point increase for Americans living in the U.S. Territories.
- From December 2013 to December 2014, there was a 14 percentage point decline in Americans without fixed advanced telecommunications capability in rural areas, 17 percentage point decline for Americans living on Tribal lands in rural areas and a 19 percentage point increase for Americans living in rural areas in the U.S. Territories.[255]

Table 7
Percentage of Americans Without Fixed Advanced Telecommunications Capability (2012-2014)

	2014	2013	2012
United States	10%	17%	20%
Rural Areas	39%	53%	55%
Urban Areas	4%	8%	11%
Tribal Lands	41%	63%	68%
Rural Areas	68%	85%	89%
Urban Areas	14%	41%	47%
U.S. Territories	66%	63%	100%
Rural Areas	98%	79%	100%
Urban Areas	54%	57%	100%

6. Demographic Analysis of the Areas Without Access to Fixed Advanced Telecommunications Capability

89. In this Inquiry, we provide the demographic analysis required by section 706(c), which requires the Commission to compile a list of geographical areas that are not served by any provider of advanced telecommunications capability and to determine, based on available census data the population, the population density, and average per capita income for each such unserved area.[256] In Table 8, we report average population, average population density and average per capita income for each area without access to advanced telecommunications capability.[257] In addition, we report median household

[254] We do not have a good block-level data source for the population of the U.S. Territories for years since the 2010 census. *See* Appx. C (Data Sources and Definitions).

[255] We caveat the results for the U.S. Territories because our estimates are dependent upon the source of population data for the area.

[256] 47 U.S.C. § 1302(c). *See* Appx. E (Americans Without Access to Fixed Advanced Telecommunications Capability by County) at https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report.

[257] 47 U.S.C. § 1302(c).

income and the average proportion of households living in poverty. To report demographic information, including income measures, we aggregate the census block data up to the census tract level.[258]

90. Our demographic analysis includes the United States as a whole, Tribal lands, and U.S. Territories.[259] For each of these geographic areas, we also present results within the urban core and outside of the urban core using the 2010 Census classification of a census tract as part of the "urban core."[260] For purposes of this Report, we call these areas urban and non-urban. We conduct this additional analysis because census tracts are large and typically include urban centers as well as rural or sparsely populated areas. Finally, we conduct hypothesis testing to determine if there is a statistically significant difference in the demographics between areas with and without access to advanced telecommunications capability. Comparing Americans with and without access to advanced telecommunications capability, we find that Americans without access to these services typically live in areas with a higher average population,[261] a lower average population density, lower average per capita income, lower median household income, and a higher percentage of households living in poverty than Americans livings in areas with access to this broadband service.

[258] A census tract is categorized as "Without Full Access" if any of the census blocks have been identified as without access to fixed broadband. We compare demographic data between census tracts in which any resident lacks access to fixed broadband to census tracts in which all residents have access to fixed broadband. This approach is conservative because a census tract is classified as "Without Full Access" to fixed broadband even if only a small portion of the population of the census tract is without access to the service.

[259] A census tract is designated as Tribal land if at least 50 percent of the land area in the census tract is Tribal land. *See* Appx. C (Data Sources and Definitions). While the Census Bureau has created Tribal Census tracts, we do not employ these in this Report because our analysis of broadband adoption is based upon form 477 data collected using the Census Bureau's standard census tract boundaries. We do not have sufficient information to segment the Form 477 Data between the Tribal census tracts and standard census tracts.

[260] The Census defines an "urban core" as an area smaller than 3 square miles with a population density of at least 1,000 people per square mile. All other census tracts are "outside of the urban core." Department of Commerce, Census Bureau, Urban Area Criteria for the 2010 Census, 76 Fed. Reg. 53030, 53040 (Aug. 24, 2011) (*2011 Census Bureau Notice*).

[261] This analysis is based upon census tracts. We note that, on average, the population is generally larger in census tracts without access compared to census tracts with access because most of the census tracts without access tend to be very large either because they are entirely or in part in non-urban areas. For example, referring to the first two rows of Table 8, we find that an average population of 4,491.0 for census tracts without access compared to an average population of 4,228.2 for census tracts with access. The average land area of the census tracts without access is 84.8 square miles compared to 5.9 square miles for census tracts with access.

Table 8
Comparison of Demographic Data Between Areas
With and Without Access to Fixed Advanced Telecommunications Capability

Census Tracts	Average Population	Average Population Density (Pop./sq. mi.)	Average Per Capita Income ($2014)	Average Median Household Income (2014)	Average Percentage of Households Living In Poverty (2014)
All Areas					
Without Access	4,491.0[3]	2,330.1[3]	$27,157.80[3]	$54,777.20[3]	16.6%[3]
With Access	4,228.2	8,937.4	$29,251.10	$59,184.60	17.6%
Non-Urban Core Areas					
Without Access	4,617.7[3]	374.5[3]	$26,646.20[3]	$54,900.30[3]	15.1%[3]
With Access	4,918.5	771.7	$31,470.60	$66,365.90	13.0%
Urban Core Areas					
Without Access	4,289.4[3]	5,555.0[3]	$28,000.00[3]	$54,574.00[3]	19.1%[1]
With Access	4,096.4	11,125.4	$28,682,30	$57,354.60	18.8%
Tribal Lands					
Without Access	3,807.2[3]	499.9[3]	$21,519.00[3]	$44,476.30[3]	20.8%[3]
With Access	3282.8	2,644.3	$27,566.90	$50,599.60	18.0%
Non-Urban Core					
Without Access	3,830.6[1]	179.3[3]	$21,252.20[3]	$44,599.60[3]	20.7%[2]
With Access	3,252.3	463.0	$29,255.40	$54,510.90	16.8%
Urban Core Areas					
Without Access	3,628.3	2,953.5[2]	$23,561.30[1]	$43,538.00[1]	21.3%[1]
With Access	3,403.6	3,405.6	$27,045.60	$49,392.00	18.4%
U.S. Territories					
Without Access	4,936.0[3]	2,934.2[2]	$10,028.60[3]	$19,069.60[3]	49.3%[3]
With Access	1,533.7	4,765.0	$14,033.80	$24,819.10	40.0%
Non-Urban Core Areas					
Without Access	5,161.6[2]	830.2	$9,717.70[2]	$19,376.20[2]	48.7%
With Access	601.2	647.9	$12,767.10	$23,283.20	43.7%
Urban Core Areas					
Without Access	4,482.7[3]	7,159.8	$10,689.70[3]	$18,419.30[3]	50.6%[3]
With Access	1,678.6	5,404.8	$14,222.00	$25,047.30	39.6%

The level of statistical significance is indicated by a superscript: 1 signifies statistical significance at a 90% level of confidence, and 2 signifies statistical significance at a 95% level of confidence, and 3 signifies statistical significance at 99% level of confidence

91. Table 9 shows how the average proportion of the population without access to fixed services by speed tier varies with the county-level median household income, county-level population density, the proportion of the population categorized as living in a rural area, and the county-level poverty

rate.[262] On average, the proportion of the population without access is highest in counties with the lowest median household income, the lowest population density, the highest rural population rate and the highest poverty rate.[263]

Table 9
Average Percentage of Population Without Access to Fixed Services by Speed Tier and by Demographic Variable

	4 Mbps/1 Mbps	10 Mbps/1 Mbps	25 Mbps/3 Mbps
County Median Household Income			
First Quartile (Lowest Income)	4%	4%	50%
Second Quartile	0%	0%	40%
Third Quartile	0%	0%	33%
Fourth Quartile (Highest Income)	0%	0%	23%
County Population Density			
First Quartile (Lowest Population Density)	0%	0%	57%
Second Quartile	0%	0%	47%
Third Quartile	1%	1%	30%
Fourth Quartile (Highest Population Density)	4%	4%	13%
County Poverty Rate			
First Quartile (Lowest Poverty Rate)	0%	0%	31%
Second Quartile	0%	0%	34%
Third Quartile	0%	0%	36%
Fourth Quartile (Highest Poverty Rate)	4%	4%	46%
County Rural Population Rate			
First Quartile (Lowest Rural Population Rate)	2%	2%	13%
Second Quartile	1%	1%	30%
Third Quartile	1%	1%	45%
Fourth Quartile (Highest Rural Population Rate)	1%	1%	59%

7. Elementary and Secondary School Connectivity

92. Schools' bandwidth needs continue to grow, and school district leaders anticipate additional substantial bandwidth demands over the next three years.[264] The E-rate program provides support for broadband for elementary and secondary schools, and the changes we made to the program in

[262] The quartile county rankings are presented from the lowest value to highest value for the particular demographic variable being examined. The first quartile represents the lowest median household income, the lowest population density, lowest poverty rate, and the lowest rural population rate. *See also* Appx. E (Americans Without Access to Fixed Advanced Telecommunications Capability by County) at https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report.

[263] We include satellite services in our analysis this year and this affects the availability of fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps services. See Appx. F (Impact of Inclusion of Satellite Services on Deployment and Overall Adoption Rates for Fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps services).

[264] CoSN Survey at 16.

2014, both ensure sufficient funding for broadband to schools, and provide schools with additional tools for purchasing high-speed broadband. Schools increasingly have access to high-speed connections. According to the *EducationSuperHighway Report*, in 2013, only 30 percent of school districts had Internet access connectivity that satisfied the short term goal of 100 Mbps per 1,000 users that we set in the first *E-rate Modernization Order*.[265] ESH estimates that, "77% of school districts, representing 59% of schools and 53% of students" have met the Commission's goal.[266] That means that 23 percent of schools districts representing 41 percent of schools and 47 percent of students, do not receive broadband services that meet our near-term goal of 100 Mbps per 1,000 users.[267] This is consistent with the CoSN survey data that found that 23 percent of the school districts reported that none of the schools in their district meet the FCC's short term connectivity goals.[268]

93. ESH estimates that 9,500 schools still need access to fiber to meet our speed goals.[269] These schools appear to be disproportionately in small town and rural areas. ESH estimates that 16 percent of schools located in small towns and 21 percent of schools located in rural areas do not have a fiber connection compared to only 5 percent of schools located in urban areas and 10 percent of schools located in suburban areas.[270]

94. In the *E-rate Modernization proceeding*, the Commission also established a long-term goal for schools of broadband speeds of 1 Gbps per 1,000 students. The *EducationSuperHighway Report* estimates that, based on the most recent FCC Form 471 data, only 9 percent of schools currently have sufficient connectivity to meet our long-term connectivity goal for schools.[271] The *EducationSuperHighway Report* expects that bandwidth demand will increase at a rate of 50 percent or more per year, so even those schools and school districts that currently meet the Commission's short-term connectivity goals will likely require more connectivity in the future.[272]

C. Adoption and Other Indicators of Availability of Advanced Telecommunications Capability to All Americans

95. We continue to affirm the Commission's prior findings that, for the purpose of our analysis, the terms broadband "deployment" and "availability" are broader than mere physical presence of broadband networks.[273] Indeed, section 706 requires the Commission to conduct an inquiry into broadband "availability" and determine whether broadband "is being deployed" in a reasonable and timely fashion. As stated in the *2015 Broadband Progress Report*, section 706 does not indicate that we must consider a set of circumstances narrower than the "availability" inquiry to determine that broadband is being deployed.[274] Thus, we continue to make our annual determination as to how broadband ''is being deployed'' by assessing how well we are progressing toward the goal of "availability to all Americans."

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[265] *EducationSuperHighway Report* at 6 (ESH reports the Commission's short-term goal in terms of 100 kbps per user rather than 100 Mbps per 1,000 users). *Id*. at 10.

[266] *Id.* at 12.

[267] *Id.*

[268] CoSN Survey at 5.

[269] *EducationSuperHighway Report* at 23.

[270] *Id*.

[271] *Id*. at 7, 10.

[272] *Id.* at 20. *See also* CoSN Survey.

[273] *See 2015 Broadband Progress Report,* 30 FCC Rcd at 1410-11, para. 64; *see also 2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10363, para. 27; *2011 Seventh Broadband Progress Report*, 26 FCC Rcd at 8020-21, paras. 18-20.

[274] *2015 Broadband Progress Report,* 30 FCC Rcd at 1410-11, para. 64.

96. As in previous Reports, some commenters urge the Commission to look only to physical deployment,[275] while others recommend that we continue to interpret these terms more broadly.[276] We continue to reject comments that request our interpretation of section 706(b) be limited to physical deployment. Rather, in determining whether broadband is "being deployed to all Americans in a reasonable and timely fashion," we must look at a variety of factors that affect access to broadband. Consistent with our prior analyses, our inquiry includes an assessment of factors indicative of broadband availability, such as price, quality, and adoption by consumers, as well as physical network.[277] In the *2015 Broadband Progress Notice of Inquiry*, we sought comment on several pricing surveys for consideration on availability of advanced telecommunications capability.[278] We have also considered GAO's Report— Broadband Internet: FCC Should Track the Application of Fixed Internet Usage-Based Pricing and Help Improve Consumer Education—for further information on the impact of usage-based pricing on broadband availability.[279] We further sought comment on possible factors, beyond those listed above, to determine whether broadband is being deployed to all Americans in a reasonable and timely fashion.[280]

97. We continue to abide by the statutory construction of section 706(b) utilized by the Commission in the prior two Reports.[281] We find that "is being deployed" refers to "existing deployment and current actions that will meaningfully affect broadband deployment in the near future . . . [but not] general plans or goals to deploy broadband, particularly long-range plans or goals that are uncertain to be realized."[282] The phrase "reasonable and timely fashion" also lends itself to various interpretations. While there is no single objective standard, we interpret the language in light of Congress' directive to encourage and promote the universal availability of advanced telecommunications capability as a national priority.[283] As stated in the previous Report, progress in the United States should compare favorably to progress in other countries as demonstrated by the international comparison of broadband capabilities that Congress added to the inquiry in 2008.[284] As the Commission has stated previously, "broadband deployment is more likely to be reasonable and timely if communities in the United States compare favorably to comparable foreign communities on broadband service capability metrics, and less likely to be reasonable and timely if U.S. communities compare unfavorably."[285]

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[275] *See, e.g.*, Verizon Comments at 12 (arguing that the 706 mandate only speaks in terms of deployment and therefore requires the Commission to distinguish between broadband availability and broadband adoption).

[276] *See, e.g.*, Public Knowledge Comments at 6 ("The Commission should move forward with its plan to include non-speed metrics, such as latency, reliability, and data caps in its inquiry."); Comment of Christopher Morgan at 1 ("I think it's wise to evaluate all aspects of an internet connection to ensure it meets the needs of consumers using it. This includes considering aspects such as latency, data allowance, download speeds, and upload speeds.").

[277] *See 2015 Broadband Progress Report*, 30 FCC Rcd at 1411, para. 65; *see also 2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10363, para. 27.

[278] *2015 Eleventh Broadband Notice of Inquiry*, 30 FCC Rcd at 8848-49, paras. 75-76 (surveys include the International Broadband Data Reports and Urban Rate Surveys).

[279] *See* GAO Usage-Based Pricing Report; *see also 2014 Broadband Progress Report*, 30 FCC Rcd at 1411, para. 65, n.267.

[280] *2015 Eleventh Broadband Notice of Inquiry*, 30 FCC Rcd at 8841, para. 50.

[281] *2015 Broadband Progress Report*, 30 FCC Rcd at 1412, para. 66; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10400-01, para. 135 n.347.

[282] *Id*.

[283] *See, e.g.*, 47 U.S.C. § 1302(a) ("shall encourage"); 47 U.S.C. § 157 ("It shall be the policy of the United States to encourage the provision of new technologies and services to the public.").

[284] *Id*. § 1303(b); *see also 2015 Broadband Progress Report*, 30 FCC Rcd at 1412, para. 66.

[285] *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10400-01, para. 135 & n.347.

1. Broadband Adoption

98. This section presents adoption rates for fixed advanced telecommunications capability and broadband services. We provide estimates for the adoption rates based upon our Form 477 data for the United States as a whole, non-urban, urban, and Tribal lands.[286] The adoption rate we report is the number of residential connections to fixed broadband at or above the specified level of speed divided by the total number of households in the area with access to fixed broadband services advertised at or above the specified level of speed.[287]

99. Broadband adoption informs our Inquiry in multiple ways, including both what consumers choose to purchase when they have options at multiple speed levels and prices, and also whether service in a particular area is truly available in the sense of being offered at an affordable price and with features and functionalities that cause consumers to want to purchase it.[288] As of December 2014, 73 percent of households have a subscription to a fixed broadband service of at least 200 kbps in one direction, and 46 percent of these subscriptions were to services with a speed of at least 25 Mbps/3 Mbps.[289] As noted above, our analysis considers more than physical network deployment and includes an assessment of broadband adoption because it is indicative of the availability of broadband services.

a. Broadband Adoption Estimates for Fixed Advanced Telecommunications Capability

100. Table 10 shows the overall adoption rates for fixed services at or above 25 Mbps/3 Mbps services from December 31, 2012 to December 31, 2014 for Americans in the United States as a whole, non-urban, urban, Tribal lands,[290] and U.S Territories.[291]

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[286] Because the Form 477 Data are based upon the standard census tract definition, we caution interpretation of the estimates as being representative for all Tribal lands. Our process for segmenting areas into Tribal lands and non-Tribal lands is the best available analysis for this Report, but will result in the exclusion of some Tribal lands from a Tribal land category and include non-Tribal land in the Tribal land category. We do not present the adoption trends in the U.S. Territories to maintain firm confidentiality.

[287] *See* Appx. C (Data Sources and Definitions). Our adoption rate does not account for households that use broadband services at work, their local library, community center, or a retail establishment.

[288] *See 2011 Seventh Broadband Progress Report*, 26 FCC Rcd at 8020-21, paras. 18-20; 2012 *Eighth Broadband Progress Report*, 27 FCC Rcd at 10363, para. 27.

[289] The 73 percent figure is expressed as a percentage of all households. Form 477 Data, as of December 31, 2014. Our data is based upon a data collection of all facilities-based providers of broadband connections to end users. Services Providers that are required to file the Form 477 but fail to do so may be subject to enforcement action under sections 502 and 503 of the Communications Act and any other application law. FCC, *Instructions for Local Telephone Competition and Broadband Reporting (FCC Form 477)*, http://transition.fcc.gov/Forms/Form477/477inst.pdf at 5, 33. As of 2015, Pew estimates that 80 percent of adults have *either* a home broadband subscription or a smartphone, and 13 percent of adults have a smartphone but no broadband at home. The Pew estimates suggest that 67 percent of adults have fixed broadband at home. Pew, Home Broadband 2015. We note that our estimate of adoptions are based upon provider data and are expressed as a percentage of households. In contrast, the Pew estimates are based upon a national sample of 2,001 adults ages 18 and older, were conducted during a landline or cellphone interview, and have a margin of error of 2.5 percentage points. In addition, the adoption rates reported by Pew are not for services meeting our interpretation of advanced telecommunications capability, but instead reflect the consumer's interpretation of broadband. *Id.* at 22-23.

[290] Because the Form 477 Data are based upon the standard census tract definition, we caution interpretation of the estimates as being representative for all Tribal lands. Our process for segmenting areas into Tribal lands and non-Tribal lands is the best available analysis for this Report, but will result in the exclusion of some Tribal lands from a Tribal lands category and include non-Tribal lands in the Tribal lands category.

[291] We report overall adoption for the U.S. Territories in the national figures for 2014. We do not report figures for 2013 to maintain confidentiality of the providers. This is signified by a star. Fixed advanced telecommunications

(continued….)

- From December 2013 to December 2014, the overall adoption rate for fixed advanced telecommunications capability increased to over 37 percent for the United States. In contrast, overall adoption for this service declined on Tribal lands by 5 percent, and is less than 5 percent in the U.S. Territories.
- Overall adoption rates in urban areas exceed overall adoption rates in non-urban areas by almost 7 percentage points in the United States and on Tribal lands.[292]

Table 10
Overall Adoption Rate for Fixed Advanced Telecommunications Capability (2012-2014)

	2014	2013	2012
United States	37%	29%	11%
Non-Urban Core Areas	33%	28%	11%
Urban Core Areas	40%	30%	11%
Tribal Lands	28%	33%	7%
Non-Urban Core Areas	25%	29%	7%
Urban Core Areas	33%	36%	7%
U.S. Territories	4%	*	Not Available
Non-Urban Core Areas	5%	*	Not Available
Urban Core Areas	3%	*	Not Available

b. Demographic Analysis of Adoption Rates for Fixed Services

101. Table 11 reports average county level overall household adoption rates against the quartile ranking for median household income, unemployment rate, the poverty rate, the rural population rate (the proportion of the population that resides in a rural area), and population density. We present results for average overall adoption rates for 4 Mbps/1 Mbps, 10 Mbps/1 Mbps and 25 Mbps/3 Mbps services.[293]

102. Examining the data by quartile and demographic features offers another way to understand differences in adoption rates. For example, the data indicate that, in the counties with the lowest median household income (the first quartile), the average adoption rate for fixed services with a speed of at least 25 Mbps/3 Mbps broadband service is 12 percent. The average adoption rate for the counties with the highest median household income, the fourth quartile, is 32 percent. These data suggest that the average household adoption rate increases with median household income and population density, but the adoption rate decreases as the poverty rate, rural population rate, and unemployment rate increases.

(Continued from previous page)
services were not available in the U.S. Territories in 2012. To the extent possible, we report adoption rates for the U.S. Territories in Appendix H. *See infra* Appx. H (Overall Adoption Rates for Advanced Telecommunications Services by State & U.S. Territory).

[292] We caveat the results for the U.S. Territories because our estimates are dependent upon the source of household data for the area.

[293] We include satellite services in our analysis this year. See Appx. F (Impact of the Inclusion of Satellite Services on our Deployment and Overall Adoption Rates for Fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps Services).

Table 11
Average Overall County Adoption Rate by Speed Tier and by County Demographic Variable

	4 Mbps/1 Mbps	10 Mbps/1 Mbps	25 Mbps/3 Mbps
County Median Household Income			
First Quartile (Lowest Median Household Income)	23%	18%	12%
Second Quartile	34%	26%	19%
Third Quartile	41%	32%	21%
Fourth Quartile (Highest Median Household Income)	51%	44%	32%
County Population Density Rate			
First Quartile (Lowest Population Density Rate)	36%	20%	14%
Second Quartile	28%	22%	16%
Third Quartile	35%	30%	23%
Fourth Quartile (Highest Population Density Rate)	51%	48%	32%
County Poverty Rate			
First Quartile (Lowest Poverty Rate)	48%	38%	27%
Second Quartile	40%	32%	22%
Third Quartile	36%	29%	22%
Fourth Quartile (Highest Poverty Rate)	26%	20%	14%
County Rural Population Rate			
First Quartile (Lowest Rural Population Rate)	53%	48%	34%
Second Quartile	37%	32%	23%
Third Quartile	28%	23%	16%
Fourth Quartile (Highest Rural Population Rate)	31%	18%	11%
County Unemployment Rate			
First Quartile (Lowest Unemployment Rate)	44%	32%	22%
Second Quartile	41%	35%	23%
Third Quartile	36%	31%	22%
Fourth Quartile (Highest Unemployment Rate)	28%	23%	18%

2. Other Indicators of Availability of Advanced Telecommunications Capability

103. For purposes of evaluating availability of advanced telecommunications capability, we examine not only physical deployment and adoption, as presented above, but also quality and price.[294] To understand broadband service quality, we look at the *2015 Fifth Measuring Broadband America Report* and the data from the Commission's Measuring Mobile Broadband America program. The Measuring Broadband America program is an ongoing, rigorous nationwide study of consumers' broadband performance in the United States. Below, we present some information about advertised prices for fixed broadband and mobile broadband services and usage limits for fixed services.[295] However, we are unable

[294] *See supra* para. 96.

[295] *See supra* Section III.A.2 and *infra* Section IV.D.

to provide a rigorous analysis regarding price because we lack reliable data as to the actual prices consumers pay for these services and information about the extent that consumers subscribe to or whose on-line activities are affected by usage allowances.

a. Performance Measures for Fixed Services

104. *2015 Fifth Measuring Broadband America Report*. We examine the quality of fixed broadband services by considering the *2015 Fifth Measuring Broadband America Report.*[296] We summarize the results related to actual speed experienced by consumers, consistency of service, latency and packet loss.[297] The results presented in the *2015 Fifth Measuring Broadband America Report* suggest that, in general, consumers of higher speed broadband services, such as those provided by Cablevision, Comcast and Verizon FIOS receive high quality services, while services provided by some DSL providers do not consistently provide high quality services.

105. *Actual Speeds*. We continue to find that consumers' broadband services using cable, fiber or satellite technologies are close to or exceed advertised speeds, while consumers' broadband services from certain DSL-based ISPs experience actual speeds that are on average below the advertised "up-to" speed.[298]

106. *Consistency of Service.* We present two measures of consistency of service discussed in the *2015 Fifth Measuring Broadband America Report*. The first metric is the percentage of an ISP's sampled panelists who experience an actual monthly average download speed that was greater than 95 percent of the advertised speed. Measured by this performance metric, the highest performing ISPs are Cablevision, Comcast and Hughes because over 90 percent of their customers were able to attain an actual download speed of at least 95 percent of the advertising download speed.[299] In contrast, the ISP with the lowest performance for this metric is AT&T DSL services because less than 10% of its customers were able to attain an actual download speed of at least 95 percent of advertising download speed.[300]

107. The second metric, the "80/80 consistent speed" metric, considers how speeds experienced by an ISP's sampled panelists vary during the day.[301] The "80/80 consistent speed metric" is the minimum actual speed experienced by 80 percent of the sampled panelists during at least 80 percent of the peak usage period. Consistency of speed may be more important to heavy users of applications that are both high bandwidth and sensitive to variations in actual speed.[302] Measured by this service metric, the results indicate that customers of Cablevision, Comcast and Verizon FiOS experienced very consistent actual download speed, with over 80 percent of their customers experiencing actual download speeds at or above advertised download speeds during at least 80 percent of the peak usage period.[303]

108. *Latency*. The *2015 Fifth Measuring Broadband America Report* found that the differences in average latencies among terrestrial-based broadband services area small, and are unlikely to

[296] Our Measuring Broadband America Program measures network performance for subscribers ISPs serving over 80% of the residential marketplace. *2015 Fifth Measuring Broadband America Report* at 6.

[297] A small of amount of packet loss is expect and some Internet protocols use packet loss to assess Internet congestion and adjust the send rate. *Id.* at 19.

[298] *Id*. at 6, 14.

[299] *Id.* at 15.

[300] *Id*.

[301] *Id.*

[302] *Id.* at 16.

[303] *2015 Fifth Measuring Broadband America Report* at 16.

affect the perceived quality of web browsing and video streaming.[304] Average latency for all terrestrial technologies ranged from 14 ms to 52 ms.[305] Among Terrestrial ISPs, Cablevision and Verizon FiOS had the lowest average latency results and CenturyLink, Frontier DSL and Windstream have the highest average latency.[306] Average latency for satellite-based broadband services range from 603 ms to 659 ms.[307]

109. *Packet Loss*. The Measuring Broadband America program denotes a packet is lost if the latency exceeds 3 seconds or it the packet is never received.[308] The Report asserts that packet losses over a few tenths of a percent are sufficiently small so that they are unlikely to significantly affect the perceived quality of phone calls, over the Internet video chat and some online multiplayer games and video streaming.[309] The *2015 Fifth Measuring Broadband America Report* found that packet loss for all participating cable providers was less than 0.2 percent; while packet loss for the participating fiber providers was just over 0.2 percent.[310] In contrast, packet loss for DSL providers ranged from a low of just over 0.1 percent for AT&T U-verse to almost 0.8 percent for Frontier DSL, and packet loss for satellite services ranged from under 0.2 percent for Hughes Satellite to almost 0.4 percent for ViaSat/Exede.[311]

b. Performance Measures for Mobile Services

110. While the data available to the Commission is currently insufficient to establish a fixed speed benchmark to be applied at the very local level, the Commission has identified various measures of mobile broadband speed on a national level. The Commission runs the Mobile Measuring Broadband American program (mMBA), which crowdsources data from a mobile app. Other sources include Ookla, a company that crowdsources data from a mobile app, and Root Metrics, a company that conducts runs a test program that measures mobile data, call and text performances in all 50 states. The most current numbers can be found in the *Eighteenth Mobile Competition Report*,[312] along with other sources of data.[313]

111. On a national level, mMBA reports median LTE download speeds for the first two quarters of 2015 as 11.6, 7.5, 5 and 13.6 megabits per second for Verizon, AT&T, Sprint and T-Mobile, respectively.[314] Ookla reports somewhat higher download LTE speeds during this period of 13.2, 10.7, and 14.4 megabits per second but with the same relative ordering.[315] In contrast, Root Metrics has a

[304] *Id.* at 7, 17.

[305] *Id.* at 17.

[306] *Id.*

[307] *Id*. at 18.

[308] *Id.*

[309] *2015 Fifth Measuring Broadband America Report* at 19.

[310] *Id.*

[311] *Id.*

[312] *See Eighteenth Mobile Competition Report*, WT Docket No. 15-125, DA 15-1487 at Table VI.C.5.

[313] The FCC also reports in the 18th report data from CalSpeed, a testing program run by the California Public Utilities Commission. The report also acknowledges the existence of crowdsourcing data from OpenSignal and M-Lab, though the FCC does not report their numbers. *See Eighteenth* Mobile Competition Report, WT Docket No. 15-125, DA 15-1487, Section VI.C.

[314] *See Eighteenth Mobile Competition Report*, WT Docket No. 15-125, DA 15-1487 at Table VI.C.3. Including all technologies and all discount brands results in slower speeds. For example, the MMBA reports median 1 Half 2015 download speeds of 10, 5, 2 and 8 megabits per second, respectively. *See Eighteenth Mobile Competition Report*, WT Docket No. 15-125, DA 15-1487, Table VI.C.ix.

[315] *Eighteenth Mobile Competition Report*, WT Docket No. 15-125, DA 15-1487 at Table VI.C.1.

different relative ordering for its median download LTE speeds for the H1 2015, with 16, 10, 5 and 10 megabits per second.[316]

112. As these numbers are averages on a national level, they do not imply universal attainment of certain speeds to a fixed percentage of the U.S. population or land area. However, using July 2015 data, the commission has estimated up to 99.6% of the U.S. population is covered by at least one carrier with LTE.[317] Thus the earlier cited speeds are at least suggestive of typical speeds available for a large number of U.S. consumers. However, we note that these numbers—at a nationwide level—will mask regional disparities in coverage and may convey a false sense of consistency of speeds across geographic areas and service providers. As the Commission has found in the past, the methodology and data used to report this coverage has the potential to overstate that coverage.[318] Additionally, the data do not expressly account for factors such as signal strength, bit rate, or in-building coverage, and may convey a false sense of consistency of speeds across geographic areas and service providers.

113. MMBA also measures latency for 2H2014 and 1H2015.[319] Verizon had the lowest mean latency during this period, followed by AT&T, T-Mobile and then Sprint.

D. International Broadband Service Capability

114. Section 706(b) requires the Commission to "include information comparing the extent of broadband service capability (including data transmission speeds and price for broadband service capability) in a total of 75 communities in at least 25 countries abroad for each of the data rate benchmarks for broadband service utilized by the Commission to reflect different speed tiers."[320] We are incorporating by reference a Report from our International Bureau.[321] The *2016 Fifth International Broadband Data Report* approaches its analysis differently from this Report by employing, in certain cases, different data sources, different definitions, and/or different time periods to facilitate comparisons across national borders, and its observations must be read in that context.[322] The international analysis serves as a year-to-year measure of our progress in comparison to other nations.

115. In the *2016 Fifth International Broadband Data Report,* International Bureau assessed "high-speed" broadband deployment at 25 or 30 Mbps download, as available, to most closely match available European data.[323] The International Bureau reported that with respect to deployment of high

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[316] *Id.* at Table VI.C.5.

[317] These numbers are based on data from the company Mosaik. *See Eighteenth Mobile Competition Report*, WT Docket No. 15-125, DA 15-1487, Table III.A.3.

[318] *2015 Broadband Progress Report*, 30 FCC Rcd at 1414-15, para. 74. These estimates likely overstate the coverage actually experienced by consumers because Mosaik reports advertised coverage as reported to it by service providers, each of which uses a different definition or determination of coverage.

[319] *See Eighteenth Mobile Competition Report*, WT Docket No. 15-125, DA 15-1487, at para. 134.

[320] 47 U.S.C. § 1303(b).

[321] *International Comparison Requirements Pursuant to the Broadband Data Improvement Act*; *International Broadband Data Report*, GN Docket 15-191, Fifth Report, DA 16-97 (IB rel. Jan. 29, 2016) (*2016 Fifth International Broadband Data Report*).

[322] For example, for fixed services, the *2016 Fifth International Broadband Data Report* includes in its analysis any service above 200 kbps as "basic broadband." *2016 Fifth International Broadband Data Report*, Appx. G at 4. The *2016 Fifth International Broadband Data Report* also relies on different sources of data or different time-sets than the analysis contained herein.

[323] *2016 Fifth International Broadband Data Report* at para. 15. For an appropriate comparison, the *2016 Fifth International Broadband Data Report* uses the European Union's definition of "high-speed" broadband, which is 30 Mbps. For 2013, it uses fixed broadband coverage data at 25 Mbps for the United States based on the SBI Data, which most closely matches the 30 Mbps threshold used in the 2013 and 2014 European Commission's study (EC (continued….)

speed fixed broadband, the United States remains ahead of Europe in both non-rural and rural areas, with 89 percent of all U.S. households having access compared to 68 percent of households in the European countries in the EC study in 2014. In rural areas in 2014, 58 percent of U.S. households have access to fixed high-speed broadband, compared to 25 percent of households in the European countries in the EC study.[324]

116. The International Bureau also reported that with respect to fixed broadband speed, for example, in 2014, the United States ranked 26th of the 40 countries studied in the *2016 Fifth International Broadband Data Report*, with an average download speed (weighted by sample size) of 26.68 Mbps, an 8.01 Mbps improvement from 2013. The International Bureau compared the Commission's most recent Measuring Broadband America[325] data for fixed broadband to the European Commission's actual broadband speed measurement data for Europe. In the United States, broadband providers appeared to be more effective than European providers in delivering (or exceeding) promised broadband speeds to consumers when comparing results of hardware-based speed tests.[326]

117. In the *2016 Fifth International Broadband Data Report*, the International Bureau also examined advertised broadband prices for both fixed and mobile service plans around the world, and reported data including detailed price information for smartphone broadband plans. For standalone fixed broadband plans with data usage limits and taking those limits into account by calculating price per GB of data allowed, the United States was the third least expensive in 2014 with a price of $0.22 per GB for plans with speeds less than 25 Mbps out of nine countries.[327] The U.S. ranking was fourth least expensive with $0.33 per GB for plans with speeds greater than 25 Mbps.[328] When comparing countries according to average monthly cost of stand-alone broadband plans with unlimited usage, the United States ranked near the middle for several speed tiers. For example, the United States ranked eighth least expensive of 17 countries for unlimited plans with speeds less than 10 Mbps ($33.12) and 15th out of 29 countries for unlimited plans with speeds less than 25 Mbps ($32.60).[329] The United States, however, ranked 23rd least expensive out of 33 countries for overall fixed broadband plans (*i.e.*, when considering all fixed plans in the sample together).[330] Among countries that have mobile smartphone plans with unlimited data and unlimited minutes, the United States ranked 13th least expensive out of 17 countries in 2014 (compared to fourth least expensive out of five countries in 2013).[331]

118. The International Bureau also reported Organization for Economic Co-operation and Development (OECD) broadband penetration data (based on subscriptions per 100 inhabitants) from December 2014. The United States ranked 16th out of 34 countries for overall fixed broadband subscriptions, with 31.4 broadband subscriptions per 100 inhabitants. In 2013, the United States also ranked 16th out of 34 countries with 30.35 broadband subscriptions per 100 inhabitants.[332] The United

(Continued from previous page)
Study). In 2014, using the new Form 477 data, the *2016 Fifth International Broadband Data Report* is able to compare the coverage data for the United States and Europe at the same speed level (*e.g.*, 30 Mbps). *Id*.

[324] *2016 Fifth International Broadband Data Report* at paras. 14-19.

[325] Measuring Broadband America is discussed in more depth above. *See supra* Section IV.C.2.

[326] *2016 Fifth International Broadband Data Report* at paras. 28, 30.

[327] *Id*. at 37.

[328] *Id*.

[329] *Id*. at para. 38.

[330] *Id*. at para. 36.

[331] *Id*. at para. 41.

[332] *2016 Fifth International Broadband Data Report* at para. 23 (citing OECD Broadband Portal, Table 1.2.1 (December 2014)).

States ranked eighth overall out of the 34 OECD countries in mobile broadband subscriptions, with 104.0 mobile broadband subscriptions per 100 inhabitants as of the end of 2014,[333] and by comparison, Finland ranked first in 2014 with 138.0 mobile broadband subscriptions per 100 inhabitants.[334] The United States ranked seventh out of 34 countries in 2013 with 94.2 mobile broadband subscriptions per 100 inhabitants.[335]

V. ADVANCED TELECOMMUNICATIONS CAPABILITY IS NOT BEING DEPLOYED TO ALL AMERICANS IN A REASONABLE AND TIMELY FASHION

119. As discussed in detail above, although deployment has increased, many Americans are still without advanced telecommunications capability, especially in rural areas and on Tribal lands.[336] Moreover, we find that many schools continue to lack access to advanced telecommunications capabilities. Based on our findings, we "take immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market" as required by our section 706 mandate.

120. Recent data show that approximately 34 million Americans (10 percent of the population) lack access to fixed 25 Mbps/3 Mbps broadband or higher service.[337] In urban areas, nearly 10.6 million Americans (4 percent) remain unserved.[338] These data are notably better than last year, when one in six Americans overall—17 percent—were unserved.[339] Still, we are not satisfied that approximately 34 million Americans lack service, nearly the population of Canada.[340]

121. Moreover, beneath the aggregate, nationwide total, the data show a stark contrast in service between urban and rural America. Americans living in rural areas and Tribal lands disproportionately lack access to advanced telecommunications capability, where approximately 23.4 million (39 percent of the population, or approximately two out of every five residents) lack fixed access at 25 Mbps/3 Mbps.[341] In other words, Americans who live in rural areas are ten times more likely to be unserved than their urban counterparts. Small businesses are also likely subscribe to mass market broadband service, so the rural-urban disparity in deployment of these services may prevent small businesses in rural areas from competing successfully in the 21st century economy. The disparity is even more severe for Americans on rural Tribal lands, where 68.2 percent lack access to fixed access service at 25 Mbps/3 Mbps or higher.[342] Under these circumstances we find that broadband is not being deployed to *all* Americans in a reasonable and timely fashion.

122. In addition, the available international broadband data, though not perfectly comparable to U.S. data, suggest that broadband services in the United States appear to be behind a number of other

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[333] *Id*. at para. 24 (citing OECD Broadband Portal, Table 1.2.2 (December 2014)).

[334] *Id*.

[335] OECD Broadband Portal, Table 1.5.2, OECD Historical Mobile Broadband Penetration Rates (*see also* note 42 above.).

[336] *See supra* para. 79, Table 1 Americans Without Access to Fixed Advanced Telecommunications Capability (Millions).

[337] *Id*.

[338] *Id.*

[339] *2015 Broadband Progress Report*, 30 FCC Rcd at 1378, para. 4.

[340] *See* Central Intelligence Agency, *The World Factbook: Canada*, https://www.cia.gov/library/publications/the-world-factbook/geos/ca.html (last visited Jan. 29, 2016) (reporting Canada's population as 35,099,836).

[341] *See supra* para. 79, Table 1.

[342] *Id*.

developed countries in certain respects, although we also compare favorably to some developed countries in other respects.[343]

123. Looking at schools and classrooms, the *EducationSuperHighway Report* estimates that 59 percent of schools have met the Commission's short-term goal of 100 Mbps per 1,000 students, but 41 percent of schools, representing 47 percent of students, have not met our short-term goal.[344] With regard to our long-term goal of 1 Gbps per 1,000 students, the *EducationSuperHighway Report* estimates that only 9 percent of schools have connectivity that meets this goal.[345] Given the emphasis Congress placed on advanced telecommunications capability in schools and classrooms, these data alone would preclude a positive finding.

124. In light of our findings, we conclude that much work remains to be done to ensure that all Americans have the access to advanced telecommunications capability, as Congress demanded in section 706.[346] As we have stated in previous reports, the standard for success is universal availability of advanced telecommunications capability and we will continue to take action to achieve this mandate.[347]

VI. REMOVING BARRIERS, PROMOTING COMPETITION AND EFFORTS TO ACCELERATE DEPLOYMENT

125. We continue to work to accelerate advanced telecommunications capability deployment, but there is still more work to do. As the Commission has found in recent Reports, there are numerous barriers to infrastructure investment.[348] In particular, the high cost of deploying and operating a broadband network is a substantial barrier, as are low broadband adoption rates in some circumstances.[349] We continue to work to remove barriers to deployment, in part by direct subsidies, and in part by identifying and helping to reduce potential obstacles to deployment, competition, and adoption—concepts that we continue to recognize are tightly linked.[350] By taking steps to remove barriers, the Commission continues its work to ensure that all Americans have access to, and can afford, the high-quality services that constitute advanced telecommunications capability. There have also been other noteworthy federal and public and private sector initiatives to accelerate broadband deployment.

126. Barriers to broadband deployment are many and varied. They include the high cost of serving rural areas and Tribal lands; potential customers that find service or devices unaffordable; and costs and impediments to making use of existing infrastructure, such as poles and conduits. This list of barriers is not exhaustive, and we remain vigilant in monitoring for other impediments to adoption and deployment. For example, if consumers have concerns about the privacy of their personal information, such concerns may restrain them from making full use of broadband services, thereby lowering the

[343] *See supra* Section IV.D. *See also generally 2016 Fifth International Broadband Data Report.*

[344] *EducationSuperHighway Report* at 12.

[345] *Id*. at 7, 10.

[346] 47 U.S.C. § 1302(b). *See 2015 Broadband Progress Report*, 30 FCC Rcd at 1442, para. 132.

[347] *2015 Broadband Progress Report*, 30 FCC Rcd at 1455, para. 140; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10403, para. 138; *2011 Seventh Broadband Progress Report*, 26 FCC Rcd at 8033, para. 48; *2010 Sixth Broadband Progress Report*, 25 FCC Rcd at 9574, para. 28.

[348] *2015 Broadband Progress Report*, 30 FCC Rcd at 1455-160, paras. 141-152; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10403-10, paras. 139-54; *2011 Seventh Broadband Progress Report*, 26 FCC Rcd at 8040, para. 65; *2010 National Broadband Plan* at 167-90.

[349] *See 2015 Broadband Progress Report*, 30 FCC Rcd at 1455-1460, paras. 141-152; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10403, para. 139.

[350] *2015 Broadband Progress Report*, 30 FCC Rcd at 1455, para. 141.

likelihood of broadband adoption and decreasing consumer demand.[351] Conversely, the protection of customers' personal information may spur consumer demand for those services, in turn "driving demand for broadband connections, and consequently encouraging more broadband investment and deployment' consistent with the goals of the 1996 Act."[352]

127. *Broadband in Rural Areas*. We continue our commitment to incenting the deployment of broadband in rural areas as we implement the reforms adopted by the Commission in the *2011 USF/ICC Transformation Order* and subsequent Connect America and related orders, which comprehensively reformed and modernized the high-cost program within the universal service fund (USF or Fund) to support networks capable of providing voice and broadband services, both fixed and mobile, to all Americans throughout the nation.[353] In December 2014, the Commission revised the minimum speed requirement necessary to qualify for fixed universal service high cost (Connect America Fund) support, and finalized the decisions necessary to proceed with the offer of model-based support to price cap carriers.[354] On April 29, 2015, the Wireline Competition Bureau (Bureau) announced the offers of model-based Phase II Connect America support to price cap carriers to fund the deployment of voice and broadband-capable networks in their service territories, a total of $1.675 billion annually for six calendar years (2015-2020).[355] On August 27, 2015, the Bureau announced that ten telecommunications carriers accepted over $1.5 billion in annual support for rural broadband deployment from the Connect America Fund to serve over 3.6 million homes and businesses by the end of 2020.[356] This support, along with carrier investment, will expand broadband to nearly 7.3 million rural consumers in 45 states and one U.S. territory.

128. In July 2014, the Commission adopted a $100 million budget for rural broadband experiments and established an objective methodology for selecting projects among formal applications

[351] Although we do not base our determination in this *2016 Broadband Progress Report* on these issues, we observe that past Broadband Progress Reports found that a correlation exists between non-adoption of broadband and security and privacy concerns. *See 2015 Broadband Progress Report*, 30 FCC Rcd at 1438, para. 104; *see also Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket 14-126, FCC 14-113, Tenth Broadband Progress Notice of Inquiry, 29 FCC Rcd 9747, 9769, para. 47, n. 108 (2014); *Eighth Broadband Progress Report*, 27 FCC Rcd at 10410, para. 154, nn.432-33; *2011 Seventh Broadband Progress Report*, 26 FCC Rcd at 8044-45, para. 75, nn.248-49.

[352] *2015 Open Internet Order*, 30 FCC Rcd 5601, 5821, para. 464 and n.1387 (2015).

[353] *Connect America Fund et al*., Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663 (2011) (*2011 USF/ICC Transformation Order*), *pets. for review denied sub nom*., *In re FCC 11-161,* 753 F.3d 1015 (10th Cir. 2014).

[354] *See Connect America Fund et al.,* Report and Order, 29 FCC Rcd 15644, 15645, para. 2 (2014) (*2014 Connect America Order*).

[355] *Wireline Competition Bureau Announces Connect America Phase II Support Amounts Offered to Price Cap Carriers to Expand Rural Broadband*, Public Notice, 30 FCC Rcd 3905 (WCB 2015).

[356] *Carriers Accept Over $1.5Billion in Annual Support from Connect America Fund to Expand and Support Broadband for Nearly 7.3 Million Rural Consumers in 45 States and One Territory*, Press Release, 30 FCC Rcd 8577 (WCB 2015). The carriers accepting support include AT&T, Cincinnati Bell, CenturyLink, Consolidated Communications, Fairpoint Communications, Frontier Communications, Hawaiian Telecom, Micronesian Telecom, Verizon and Windstream. The Bureau provided all non-contiguous carriers the option of choosing either to continue to receive frozen support amounts or to elect to receive the model-determined support amount. *CAM Inputs Order*, 29 FCC Rcd at 4019. ACS (Alaska), PRTC (Puerto Rico), and Vitelco (Virgin Islands) elected to receive frozen support. Later, the Commission proposed and sought comment on specific service obligations for non-contiguous carriers electing to continue to receive frozen support amounts. *April 2014 Connect America FNPRM*, 29 FCC Rcd at 7117-7121. The obligations have not yet been decided.

from those carriers that would deploy new, robust broadband to consumers in price cap areas.[357] As of December 11, 2015, the Bureau authorized approximately $34 million in rural broadband experiment support to provide broadband in nearly 5,200 census blocks in 12 states.[358]

129. As part of the Commission's efforts to ensure access to robust and affordable mobile voice and broadband service, the Commission established the Mobility Fund. The Mobility Fund Phase I auction—the first reverse auction as a mechanism for distributing universal service support— was completed on September 27, 2012 with 33 winning bidders eligible to receive a total of up to approximately $300 million in one-time support to provide 3G or better mobile voice and broadband services to areas where those services did not exist.[359] On July 1, 2015, Mobility Fund Phase I support recipients filed the second of their annual reports on use of that support with 16 support recipients reporting that they had already extended 3G or 4G coverage to 46.59 percent of the total road miles to be covered with Mobility Fund Phase I support.[360] On February 28, 2014, the Wireless Telecommunications Bureau and Wireline Competition Bureau announced completion of the Tribal Mobility Fund Phase I auction, with five winning bidders eligible to receive a total of up to approximately $50 million in one-time support to provide 3G or better mobile voice and broadband services to Tribal lands.[361] Since July 2014, the Bureaus have authorized support to all five winning bidders and initial disbursements have been made totaling $16.6 million.[362]

130. *E-rate Modernization.* Congress also requires the Commission to evaluate the availability of advanced telecommunications capability to schools and classrooms. Our actions over the past year implementing the 2014 *E-rate Modernization Order* and *Second E-rate Modernization Order*, in which the Commission took major steps to modernize the schools and libraries universal service support mechanism, better known as the E-rate program,[363] is helping to improve broadband deployment and Internet speeds to schools and, by making available funding for Wi-Fi networks within schools, to the classrooms as well. As part of the modernization, we expanded the number of schools that could receive

[357] *Connect America Fund, ETC Annual Reports and Certifications*, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 8769 (2014).

[358] *Rural Broadband Experiment Support Authorized for Ten Winning Bids, et.al.*, WC Docket Nos. 10-90, 14-259, Public Notice, 30 FCC Rcd 8283 (WCB 2015); *Rural Broadband Experiment Support Authorized for Five Winning Bids for First Step Internet, LLC and Northeast Rural Services, Inc*., WC Docket Nos. 10-90, 14-259, Public Notice, 30 FCC Rcd 9886 (WCB 2015); *Rural Broadband Experiment Support Authorized for Winning Bids Submitted by Skybeam, LLC, Daktel Communications, LLC, Federated Telephone Cooperative, and Paul Bunyan Rural Telephone Cooperative*, WC Docket Nos. 10-90, 14-259, Public Notice, DA 15-1306 (WCB rel. Nov. 12, 2015); *Rural Broadband Experiment Support Authorized for Winning Bids Submitted by BARC Electric Cooperative, Douglas Services, Inc., and Northeast Rural Services, Inc.*, WC Docket Nos. 10-90, 14-259, Public Notice, DA 15-1416 (WCB rel. Dec. 11, 2015).

[359] *USF/ICC Transformation Order*, 26 FCC Rcd at 17771-825, paras. 295-497; *Mobility Fund Phase I Auction Closes; Winning Bidders Announced for Auction 901*, AU Docket No. 12-25, Public Notice, 27 FCC Rcd 12031 (WTB 2012) (*Mobility Fund Auction Public Notice*).

[360] Mobility Fund Phase I annual reports are available for viewing via the Commission's Electronic Comment Filing System (ECFS), http://apps.fcc.gov/ecfs/, by entering the docket number, WT No. 10-208.

[361] *Tribal Mobility Fund Phase I Auction Closes; Winning Bidders Announced for Auction 902*, AU Docket No. 13-53, Public Notice, 29 FCC Rcd 1974, 1975, para. 1 (WTB 2014).

[362] *Tribal Mobility Fund Phase I Support authorized public notices are available for support at the Commission's Auction 902 website, http://wireless.fcc.gov/auctions/902P*.

[363] *Modernizing the E-Rate Program for Schools and Libraries*, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 8870 (2014) (*E-rate Modernization Order*); *Modernizing the E-rate Program for Schools and Libraries*, WC Dockets No. 13-184, 10-90, Second Report and Order and Order on Reconsideration, FCC 29 FCC Rcd 15538 (2014) (*Second E-rate Modernization Order*).

funding for Wi-Fi networks in schools and libraries across America while maximizing options for schools and libraries to purchase high-speed broadband services.[364] The Commission also raised the funding cap on the E-rate program to make available an additional $1.5 billion in support while at the same time putting in place important measures to encourage cost effective spending and to encourage deployment of high capacity broadband networks to schools. The Commission, working in partnership with the Universal Service Administrative Company (USAC), administrator of the USF,[365] continues to implement reforms of the *E-rate Modernization Orders*. Following modernization of the E-rate program to better support fiber and Wi-Fi in schools and libraries, USAC has issued more than $2.8 billion in funding commitments, including $1 billion for broadband connections of 100 Mbps and higher, and $1.1 billion for Wi-Fi for Funding Year 2015.

131. *Lifeline and Broadband*. The Commission is also taking a major step in improving access to broadband for our nation's most vulnerable populations. The Lifeline program provides discounted voice telephony service to qualifying low-income consumers.[366] On June 18, 2015, however, the Commission adopted the *2015 Lifeline Further Notice*, which proposes to support broadband service through the Lifeline program while also proposing several important measures to reduce burdens on carriers providing Lifeline service as well as minimizing burdens on ratepayers supporting the program.[367] Additionally, building upon our recent modernization of the E-rate program, where we took major steps to close the Wi-Fi gap within schools and libraries,[368] and recognizing the valuable role that the Lifeline program can play beyond the school day in the lives of elementary and secondary-school students living in low-income households, the Commission sought comment on how the Lifeline program can address the "homework gap" issue—the gap between those households with school-age children with home broadband access to complete their school assignments and those low-income households with school-age children without home broadband access.[369]

132. *Emerging Wireline Networks and Services*. On August 6, 2015, the Commission adopted a Report and Order, Order on Reconsideration, and Further Notice of Proposed Rulemaking,[370] adopting policies to encourage the ongoing transition to next-generation communications networks while ensuring that consumers are able to make informed choices, new retail services meet consumers' fundamental needs, and competition continues to thrive. The Order revises the Commission's copper retirement rules and service discontinuance rules to ensure that: (i) competitive carriers are adequately informed about technology changes that impact them; (ii) the interests of end users impacted by upstream changes in service by providers of wholesale inputs are adequately recognized as important to our service discontinuance process; and (iii) competitive carriers do not lose the access that they need to continue to provide the benefits of competition.[371] The Further Notice of Proposed Rulemaking proposed and sought comment on specific criteria for the Commission to use in evaluating applications to discontinue legacy

[364] *Id*. at 8894-939, paras. 63-167.

[365] 47 C.F.R. § 54.701.

[366] *See Lifeline and Link Up Reform and Modernization et al.*, WC Docket Nos. 11-42 et al., Report and Order and Further Notice of Proposed Rulemaking, 27 FCC Rcd 6656 (2012); 47 C.F.R. § 54.401.

[367] *2015 Lifeline Further Notice*, 30 FCC Rcd 7818.

[368] *See E-rate Modernization Order*, 29 FCC Rcd 8870; *Second E-rate Modernization Order*, 29 FCC Rcd 15538.

[369] *Lifeline Further Notice*, 30 FCC Rcd at 7831, para. 22.

[370] *Technology Transitions et al.*, Report and Order, Order on Reconsideration, and Further Notice of Proposed Rulemaking, 30 FCC Rcd 9372 (2015) (*Emerging Wireline Order*).

[371] *Id*. at 9375-77, paras. 5-6.

services pursuant to section 214 of the Act in order to safeguard the public interest through these transitions.[372]

133. *Open Internet*. On February 26, 2015, the Commission adopted the *Open Internet Order*.[373] The *Order* establishes three bright-line rules banning specific practices that invariably harm the open Internet—blocking, throttling, and paid prioritization—and applied those rules to both fixed and mobile broadband Internet access service.[374] In addition, the *Order* puts in place a general conduct standard to prevent a broadband service provider from unreasonably interfering with or disadvantaging the ability of end users to access content, applications, devices, or services offered by edge providers.[375] The *Order* also reclassifies broadband Internet access service as a telecommunications service subject to certain provisions of Title II of the Communications Act.[376] Title II guarantees ISPs access to vital infrastructure such as utility poles, including a timeline with built-in remedies and a cost-based, regulated rate.[377] Access to pole and conduit directly enables new entrants to deploy broadband facilities.[378]

134. *Pole Attachment Rate Parity Order on Reconsideration.* The *2011 Pole Attachment Order* took a fresh look at the term "cost" as it used in the formula used to determine the pole attachment rental rates paid by telecommunications carriers (the telecom rate).[379] In particular, it sought to bring the telecom rate closer to parity with the different, and generally lower, rental rates that cable companies pay to attach facilities (the cable rate).[380] On June 8, 2011, cable operators and the National Cable Television Cable Association (NCTA) petitioned the Commission to reconsider the new rate rules, arguing that the rules only achieved the intended result if used in tandem with the Commission's presumptions regarding the number of attaching entities per pole.[381] NCTA's assertion took on new urgency when, in the *Open Internet Order*, the Commission classified broadband Internet access service as a telecommunications service.[382] On November 17, 2015, the Commission adopted the *Rate Parity Order on Reconsideration*, which delinks the assessment of costs from the Commission's presumptive number of attachers, and links

[372] *Id*. at 9378, para. 7.

[373] *Protecting and Promoting the Open Internet*, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5601 (2015) (*2015 Open Internet Order*). The *Order* is currently in effect, pending judicial review in the D.C. Circuit Court of Appeals following legal challenge by a coalition of broadband service providers in *U.S. Telecom Ass'n v. FCC et al*., docket No. 15-1063.

[374] *2015 Open Internet Order*, 30 FCC Rcd at 5607-08, paras. 14-19.

[375] *Id.* at 5608-09, paras. 20-22.

[376] *Id.* at 5612-13, paras. 37-40.

[377] *See* 47 U.S.C. § 224; 47 C.F.R. §§ 1.1401-1424.

[378] *2015 Open Internet Order*, 30 FCC Rcd at 5831, para. 478.

[379] *See Implementation of Section 224 of the Act; A National Broadband Plan for Our Future*, WC Docket No. 07245, GN Docket No. 09-51, Report and Order 26 FCC Rcd 5240at 5250-84, paras. 19-96 (improved access to utility poles); 5284-95, paras. 97-125 (improving the enforcement process), and 5295-5338, paras. 126-220 (pole rental rates); 47 U.S.C. § 224(e) (basis for the telecom rate formula) (*2011 Pole Attachment Order*).

[380] *See 2011 Pole Attachment Order*, 26 FCC Rcd at 5316-21, paras. 172-81 (discussing harms associated with disparity between cable and telecom rate formulas); 47 U.S.C. § 224(d) (basis for the cable rate formula).

[381] Petition for Reconsideration or Clarification of the National Cable and Telecommunications Association, COMPTEL, and tw telecom inc., WC Docket No. 07-245, GN Docket No. 09-51 (filed June 8, 2011) (NCTA Petition). NCTA maintained that the revision to 47 C.F.R § 1.1409(i) (which defined cost in Urbanized Service Areas as .66 x (Net Cost of a Bare Pole x Carrying Charge Rate) and in Non-Urbanized Service Areas as .44 x (Net Cost of a Bare Pole x Carrying Charge Rate) only brought parity to cable and telecom rates when used in conjunction with the Commission's presumptions in 47 C.F.R. § 1.1417 (rebuttable presumption that poles in urbanized areas have 5 attaching entities and that poles in non-urbanized areas have 3 attaching entities). *Id*. at 5.

[382] *2015 Open Internet Order*, 30 FCC Rcd at para. 308.

it instead the real number of attachers on a pole.[383] The *Rate Parity Order on Reconsideration* explains that subjecting cable operators to higher pole attachment rates merely because they also provide telecommunications services, such as broadband Internet access, could deter investment and undermine the Commission's broadband deployment policy.[384] The *Rate Parity Order on Reconsideration* also removes any rate imbalance that would disfavor investment where pole attachments are federally regulated, and any disruption of investment in rural areas that might result from a large and sudden increase in pole attachment rates.[385]

135. *Strengthening 911 and Other Critical Communications*. In the course of 2015, the Commission moved on several fronts to ensure that access to 911 services keeps pace with broadband deployment. On August 6, 2015, the Commission required those residential voice service providers that are facilities-based and fixed, yet are not line powered (in which case no loss of service occurs during outages) to let new subscribers purchase at least 8 hours of backup, standby power that will enable subscribers to call 911 during a commercial power outage.[386] In another step to ensure that 911 governance keeps pace with evolving technology, the Commission in November 2014 adopted a Policy Statement, and initiated a rulemaking proceeding, to require all entities that provide 911 to remain accountable for reliable call completion as networks transition to IP.[387] This item responded to a series of "sunny day" 911 outages in 2014 that were caused by preventable software errors, rather than by disasters or weather conditions.[388] Also, because 911 calls are increasingly made from wireless—rather than wireline—technologies, in January 2015 the Commission adopted a number of rules to ensure that wireless 911 calls provide public safety answering points (PSAPs) with caller-location information that is equivalent, if not better, than the location information of traditional wireline service.[389] In recognition of the critical role undersea cable plays in the nation's global IP-based connectivity and key economic and national security communications, the Commission initiated a rulemaking for cable licensees to report undersea cable outage data in order to provide further network health assurance, and address the need to extend its network assurance data collection efforts to the IP environment under an appropriate framework.[390] Further, the Commission also analyzed and considered how to strengthen these and other critical communications through CSRIC council efforts.[391] These measures ensure that consumers will be

[383] *Implementation of Section 224 of the Act; A National Broadband Plan for Our Future*, WC Docket No. 07-245; GN Docket No. 09-51, Order on Reconsideration, FCC No. 15-151 (rel. Nov. 24, 2015) (*Rate Parity Order on Reconsideration*). For purposes of calculating the telecom rate, the our rules define "cost," as a percentage of fully allocated costs; that percentage varies depending on the average number of attaching entities. *Id*. at 2, para 2.

[384] *Id.* at 3, para. 4.

[385] *Id.* at 11, 13, paras. 22, 27.

[386] *Ensuring Continuity of 911 Communications*, PS Docket No. 14-174, Report and Order, 30 FCC Rcd 8677 (2015).

[387] *911 Governance and Accountability; Improving 911 Reliability*, PS Docket Nos. 14-193 and 13-75, Policy Statement and Notice of Proposed Rulemaking, 29 FCC Rcd 14208 (2014), *available at* https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-186A1.pdf.

[388] *See* FCC Public Safety & Homeland Security Bureau, *April 2014 Multistate 911 Outage: Cause and Impact*, PS Docket No. 14-72, PSHSB Case File Nos. 14-CCR-0001-0007 (Oct. 2014), *available at* http://www.fcc.gov/document/april-2014-multistate-911-outage-report (*Multistate 911 Outage Report*).

[389] *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114, Fourth Report and Order, 30 FCC Rcd 1259 (2015).

[390] *Improving Outage Reporting for Submarine Cables and Enhancing Submarine Cable Outage Data*, GN Docket No. 15-206, Notice of Proposed Rulemaking, 30 FCC Rcd 10492 (2015).

[391] *See generally* Communications Security, Reliability and Interoperability Council IV, *CYBERSECURITY RISK MANAGEMENT AND BEST PRACTICES WORKING GROUP 4, Final Report*, March 2015, *available at*

(continued….)

able to rely on safety and security features over IP broadband networks that they are accustomed to expect from traditional voice telephone service, and thus address the "high quality" aspect of Congress's advanced telecommunications capability mandate.[392]

136. *Other Public and Private Sector Initiatives.* There are other noteworthy public and private sector initiatives helping to ensure access to broadband. In July 2015, HUD and the Obama Administration announced the *ConnectHome* program, which is designed to bring high-speed broadband to low-income housing in 27 cities and one Native American Tribal community.[393] The pilot initiative seeks to: (1) develop models to offer HUD-assisted residents free or discounted broadband service; (2) provide free training on digital literacy skills; and (3) provide devices and technical support.[394] On March 23, 2015, President Obama signed a Presidential Memorandum, Expanding Broadband Deployment and Adoption by Addressing Regulatory Barriers and Encouraging Investment and Training. The Memorandum created the Broadband Opportunity Council, chaired by the Departments of Commerce and Agriculture.[395] The Council reviewed all major Federal programs that provide support for broadband and released a report on August 20, 2015 with the following recommendations: (1) modernize Federal programs to expand program support for broadband investments; (2) empower communities with tools and resources to attract broadband investment and promote meaningful use; (3) promote increased broadband deployment and competition through expanded access to Federal assets; and (4) improve data collection, analysis and research on broadband.[396]

137. Private industry also continues to invest in next-generation fixed and mobile broadband networks. As stated in previous Reports, this investment demonstrates the value of a robust broadband network to meet consumers' demands.[397] CTIA's Wireless Industry Survey reports wireless providers'

(Continued from previous page)
https://transition.fcc.gov/pshs/advisory/csric4/CSRIC_IV_WG4_Final_Report_031815.pdf; Communications Security, Reliability and Interoperability Council V, *Meeting*, June 24, 2015, *available at* https://www.fcc.gov/events/communications-security-reliability-and-interoperability-council-v-meeting (video); Communications Security, Reliability and Interoperability Council IV, *Working Group Three, Emergency Alert System, EAS Security Subcommittee, Final Report* (2014), *available at* https://transition.fcc.gov/pshs/advisory/csric4/CSRIC_IV_WG3-EAS_SECURITY_FINAL_REPORT_05302014.pdf.

[392] *See* 47 U.S.C. § 1302(d)(1) ("The term 'advanced telecommunications capability' is defined, without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology.").

[393] *See* Connecting America, What High-Speed Internet Means in the 21st Century, https://www.whitehouse.gov/connect-america (last visited Oct. 19, 2015).

[394] *See* ConnectHome, http://connecthome.hud.gov/ (last visited Oct. 19, 2015).

[395] Delivering on Broadband Opportunity (Sept. 21, 2015) https://www.whitehouse.gov/blog/2015/09/21/new-steps-deliver-high-speed-broadband-across-united-states

[396] Broadband Opportunity Report and Recommendations (Aug. 20, 2015), https://www.whitehouse.gov/sites/default/files/broadband_opportunity_council_report_final.pdf

[397] *2015 Broadband Progress Report*, 30 FCC Rcd 1375, 1383, para. 15; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10401-02, para. 136.

capital investment of more than $32 billion in 2014 and over $430 billion since 1985.[398] Another industry report estimates that providers in the U.S. invested $78 billion in network infrastructure in 2014.[399]

138. Verizon continues to invest in its FiOS network, which passes almost 20 million households, an increase since the Commission's last broadband progress Inquiry,[400] and innovate, recently testing next-generation 10 Gbps speeds over its all-fiber network.[401] Moreover, as noted in our *Emerging Wireline Order*, AT&T has invested to expand its wireline IP broadband network to 57 million customer locations and extend fiber to 725,000 business locations.[402] CenturyLink has also invested in the launch of 1 Gbps broadband service to 16 cities.[403] In addition, nTelos is investing $175 million to roll out LTE across its footprint.[404] Harnessing public and private efforts brings the promise of broader access to advanced telecommunications capability.

139. The Commission and the private sector must continue these efforts to achieve universal broadband deployment and availability. Recent Broadband Progress Reports, including this Report, show that progress has been made in promoting competition and removing barriers to infrastructure investment.[405] This work is ongoing. In today's Report, we find that there is still work to be done to accelerate broadband deployment by removing barriers to investment and spurring competition so that advanced telecommunications capability can be available to all Americans. That is the Commission's statutory mandate and our overarching policy goal.

VII. ORDERING CLAUSE

140. Accordingly, IT IS ORDERED that, pursuant to section 706 of the Telecommunications Act of 1996, as amended, 47 U.S.C. §§ 1302, 1303, this Report IS ADOPTED.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

[398] CTIA, Annual Year-End 2014 Top-Line Survey Results, at 11, http://www.ctia.org/docs/default-source/Facts-Stats/ctia_survey_ye_2014_graphics.pdf?sfvrsn=2 (last visited Oct. 19, 2015). CTIA also states that carriers have spent more than $94 billion on spectrum auctioned by the Commission. CTIA Comment at 5.

[399] USTelecom Comments at 2, citing *See Broadband Investment Gains Continued in 2014*, USTelecom Research Brief (Jul. 24, 2015), http://www.ustelecom.org/sites/default/files/documents/Investment-2014-Research-Brief-July-2015.pdf.

[400] Verizon Comments at 6.

[401] *Id*.

[402] *Technology Transitions et al.*, Report and Order, Order on Reconsideration, and Further Notice of Proposed, 30 FCC Rcd 9372, 9373-74, para. 2 (2015) (*Emerging Wireline Order*).

[403] *Id*.

[404] AT&T Comments at 8, citing Press Release, nTelos Announces "4G for All" Network Expansion Plan, First LTE Launch of 2015, Fierce Wireless (Feb. 2, 2015), http://www.fiercewireless.com/search/site/pressreleases%20ntelos%20announces%204g%20all%20network%20expansion%20plan%20first%20lte%20launch%202015

[405] *2015 Broadband Progress Report*, 30 FCC Rcd at 1452-55, paras. 133-140; *2012 Eighth Broadband Progress Report*, 27 FCC Rcd at 10400-403, paras. 135-138 (discussing negative findings with regard to broadband deployment).

APPENDIX A

Commenters

Commenter	Abbreviation
ADTRAN, Inc.	ADTRAN
AT&T	AT&T
California Public Utilities Commission	California PUC
Christopher Morgan	Christopher Morgan
Competitive Carriers Association	CCA
CTIA – The Wireless Association	CTIA
David Stewart	David Stewart
Deere & Co.	Deere & Co.
Eugene Liu	Eugene Liu
Fiber to the Home Council Americas	FTTH Council
Fred Goodwin	Fred Goodwin
Microcom	Microcom
Mobile Future	Mobile Future
National Cable & Telecommunications Association	NCTA
Nebraska Public Service Commission	Nebraska PSC
NTCA, WTA, ERTA and NECA	The Rural Associations
O3b Limited	O3b
Public Knowledge	Public Knowledge
The Free State Foundation	The Free State Foundation
United States Cellular Corporation	US Cellular
United States Telecom Association	US Telecom
Verizon	Verizon
ViaSat, Inc.	ViaSat
Windstream	Windstream
Wireless Internet Service Providers Association	WISPA

Reply Commenters

Commenter	Abbreviation
ADTRAN	ADTRAN
Competitive Carriers Association	CCA
COMPTEL	COMPTEL
PCIA – The Wireless Infrastructure Association	PCIA
Public Knowledge	Public Knowledge
Telecommunications Industry Association	TIA
T-Mobile USA, Inc.	T-Mobile
United States Cellular Corporation	US Cellular
ViaSat, Inc.	ViaSat
Wireless Internet Service Providers Association	WISPA

APPENDIX B

Table Index

APPENDIX C

Data Sources and Definitions

Data Sources

1. *Deployment Data - Form 477 Data*. The fixed and mobile deployment estimates for 2014 are based upon Form 477 deployment data as of December 31, 2014. The fixed estimates are based upon deployment data for providers of consumer services for the following fixed broadband services: Asymmetric xDSL, ADSL2, VDSL, Symmetric xDSL, Other Copper Wireline, Cable Modem, Cable Modem- Docsis 1, 1.1 and 2dem-Docsis 3.0, Optical Carrier/Fiber to the End User, Satellite, Terrestrial Fixed Wireless, Electric Power Line and All other. For mobile estimates, we include Terrestrial Mobile Wireless – LTE.[1]

2. *SBI Data*. SBI data as of December 31, 2012 and December 31, 2013 are used to present deployment estimates for fixed services in 2012 and 2013. The estimates are based upon deployment data for the following services: Asymmetric xDSL, Symmetric xDSL, Other Wireline (all copper-wire based technologies other than xDSL), Cable Modem—DOCSIS 3.0, Cable Modem—Other, optical carrier (fiber to the home or FTTH), Terrestrial Fixed Wireless (provisioned/equipped over licensed spectrum or over spectrum used on an unlicensed basis), Electric Power Line, and All Other.

3. *Adoption Data – Form 477 Data.* The fixed adoption rates rely on Form 477 subscription data for residential services as of December 31, 2014, December 31, 2013 and December 31, 2012. We include the following fixed broadband services: Asymmetric xDSL (1), Symmetric xDSL (2), Other Wireline (all copper-wire based technologies other than xDSL), Cable Modem, optical carrier (fiber to the home or FTTH), Satellite, Terrestrial Fixed Wireless (provisioned/equipped over licensed spectrum or over spectrum used on an unlicensed basis), Electric Power Line, and All Other.[2]

4. *Demographic Data*. We rely primarily upon 2014 GeoLytics data for population and household count for the fifty states and the District of Columbia. For the U.S. Territories, we rely on the July 2013 CIA World Fact Book for population and household count. We rely on the Bureau of Labor Statistics, Labor Force Data, by county for estimates of the unemployment rate for December 2014. We rely on the American Community Survey (ACS) Five-Year Estimates 2010–2014 for income and poverty measures. These data are based upon surveys conducted from January 1, 2010 to December 31, 2014. The ACS collects survey information continuously nearly every day of the year and then aggregates the results over five years. The data collection is spread evenly across the entire period represented so as not to over-represent any particular month or year within the period. These multiyear estimates describe the population and characteristics of an area for the full five-year period, not for any specific day, period, or year within the multiyear time period. The ACS surveys were based upon the 50 states, the District of Columbia and Puerto Rico, and does not include American Samoa, Guam, Northern Mariana Islands, or the U.S. Virgin Islands. Thus, our demographic analysis excludes the U.S. Territories for which we do not have data. We rely upon the 2010 census for land area and American Indian Area Alaska Native Area Hawaiian Home Land Class Code (AIANHHCC) affiliation.

Definitions

5. *Fixed Adoption Rate*. We measure adoption of services at or above the speed benchmark. We rely on Form 477 Data aggregated up to the census tract level. The adoption rate is the ratio of

[1] FCC, *Instructions for Local Telephone Competition and Broadband Reporting (FCC Form 477)*, http://transition.fcc.gov/Forms/Form477/477inst.pdf at 30-31, Tables 1, and 3.

[2] FCC, *Instructions for Local Telephone Competition and Broadband Reporting (FCC Form 477)*, http://transition.fcc.gov/Forms/Form477/477inst.pdf at 30, Table 2.

residential connections to fixed broadband at or above the specified level of speed divided by the total number of households in the area with access to advertised broadband services at or above the specified level of speed. Although our deployment data is a the census block level, we aggregate the Form 477 deployment data up to the census tract level because the Form 477 subscription data for broadband services is collected at the census tract level.. We calculate adoption rates for four geographic areas: the census tract, the county, the state, and the United States as a whole.

6. *Fixed Deployment Estimates*. We measure deployment of services at or above the specified speed based on Form 477 Data for 2014. The deployment rate is the ratio of the population with access to fixed broadband service at or above the specified speed to the total population. We calculate deployment rates for four geographic areas: the census tract, county, the state, and the United States as a whole.

7. *Income Measures*. ACS Five-Year Estimates 2010-2014. We report three income measures: mean per capita income, median household income, and the poverty rate (the proportion of households living below the poverty level).[3] Mean per capita income and median household income in the past twelve months are measured in 2014 Inflation-Adjusted Dollars. The survey also reports the proportion of households living below the poverty threshold for the households for which income data are available.

8. *Land Area.* The land area is based upon the 2010 Census boundaries and measured in square miles of land.

9. *Non-Urban Area*. A *census tract* that is not part of the "urban core."

10. *Population Density*. Population density of an area is the total population residing in the area divided by the square miles of land in the area.

11. *Rural Area*. The designation of a *census block* as rural is based upon the 2010 Census. The term ''rural'' encompasses all population, housing, and territory not included within an urban area.[4]

12. *Tribal Lands*. Our assessment of Tribal lands is conducted by examining the census blocks that have been identified by the Census Bureau as federally recognized Tribal lands for the 2010 Census. These areas fall into one of the following categories of AIANHHCC: (1) Joint Use Areas; (2) Legal federally recognized American Indian area consisting of reservation and associated off-reservation trust land; (3) Legal federally recognized American Indian area consisting of reservation only; (4) Legal federally recognized American Indian area consisting of off-reservation trust land only; (5) Statistical American Indian area defined for a federally recognized Tribe that does not have reservation or off-reservation trust land, specifically a Tribal designated statistical area (TDSA) or Oklahoma Tribal Statistical Area (OTSA);[5] (6) Alaskan Native village statistical area; and (7) Hawaiian Home Lands established by the Hawaiian Homes Commission Act of 1921. Two categories of federally recognized areas were not designated by any census block with a population (off-reservation trust land portion of an American Indian area with both a reservation and off-reservation trust land; and the reservation portion of an American Indian area with both a reservation and off-reservation trust land). We exclude state-recognized areas from the analysis of Tribal lands. We note that the Tribal Statistical Areas are largely in Oklahoma, but they also include areas in California, New York, and Washington.

13. For purposes of this Report, we aggregate federally recognized Tribal lands into 4 groups: Tribal Lands in the Lower 48 States (areas 1 through 4 defined above); Tribal Statistical Areas

[3] U.S. Census, American Community Survey, Puerto Rico Community Survey, 2013 Subject Definitions (2013) 80-87 (discussing Income Measures in the Past 12 Months and adjustments to the data for inflation); 104-107 (discussing poverty measures).

[4] *See 2011 Census Bureau Notice,* 76 Fed. Reg. at 53039.

[5] The statistical areas are largely in Oklahoma, but also include areas in California, New York, and Washington.

(area 5 defined above); Alaskan Villages (area 6 defined above) and Hawaiian Home Lands (area 7 defined above). Because a census tract can be composed of Tribal lands and non-Tribal lands, a census tract is designated as one of the four Tribal land groupings if the land area of the Tribal lands comprises at least 50 percent of the land area within the census tract. The Tribal lands grouping is determined by the Tribal lands that account for the largest proportion of the census tract. We exclude Hawaiian Home Lands from our demographic analysis because this process results in only two census tracts designated as a Hawaiian Home Land and are too few observations for the statistical analysis.

14. *Urban Area*. Our identification of areas without access to broadband services is based upon availability within a census block. The designation of a *census block* as urban is based upon the 2010 Census. The term ''urban'' encompasses all population, housing, and territory included within an urban area.[6]

15. *Urban Core*. Our demographic analysis of unserved areas and our analysis of adoption rates is based upon *census tract* data. We designate census tracts as either Urban Core or Non-Urban Core. A *census tract* is designated as "Urban Core" if it has a land area less than three square miles and a population density of at least 1,000 people per square mile.[7] A census tract is designated as Non-Urban Core is it not Urban Core.

[6] *See 2011 Census Bureau Notice,* 76 Fed. Reg. at 53039.

[7] *See id*.

APPENDIX D

Americans Without Access to Fixed Advanced Telecommunications Capability by State and U.S. Territory

	All Areas		Urban Areas		Rural Areas	
	Pop. Without Access	% of Pop.	Pop. Without Access	% of Pop.	Pop. Without Access	% of Pop.
United States	33,981,660	10%	10,551,623	4%	23,430,037	39%
States and District of Columbia	31,353,263	10%	9,001,161	3%	22,352,102	38%
Alabama	985,263	20%	169,154	6%	816,109	41%
Alaska	194,375	26%	26,389	5%	167,986	67%
Arizona	898,724	13%	487,930	8%	410,794	63%
Arkansas	744,572	25%	128,125	7%	616,447	48%
California	2,017,166	5%	920,182	2%	1,096,984	61%
Colorado	539,327	10%	180,754	4%	358,573	53%
Connecticut	47,464	1%	42,220	1%	5,244	1%
Delaware	29,789	3%	13,355	2%	16,434	10%
District of Columbia	10,539	2%	10,539	2%	.	.
Florida	1,297,648	7%	795,839	4%	501,809	29%
Georgia	932,484	9%	306,414	4%	626,070	25%
Hawaii	26,201	2%	2,001	0%	24,200	22%
Idaho	301,118	18%	47,922	4%	253,196	55%
Illinois	1,188,012	9%	419,780	4%	768,232	56%
Indiana	1,131,373	17%	220,696	5%	910,677	52%
Iowa	451,148	15%	76,830	4%	374,318	37%
Kansas	436,249	15%	123,315	5%	312,934	49%
Kentucky	699,360	16%	73,542	3%	625,818	34%
Louisiana	881,763	19%	282,361	8%	599,402	50%
Maine	162,563	12%	20,362	4%	142,201	17%
Maryland	262,002	4%	166,879	3%	95,123	13%
Massachusetts	183,103	3%	129,783	2%	53,320	10%
Michigan	1,153,387	12%	245,299	3%	908,088	37%
Minnesota	641,787	12%	59,140	1%	582,647	43%
Mississippi	1,034,047	34%	129,674	9%	904,373	60%
Missouri	1,257,622	20%	204,409	5%	1,053,213	61%
Montana	317,581	31%	54,888	9%	262,693	61%
Nebraska	304,018	16%	94,847	6%	209,171	51%
Nevada	249,722	8%	151,168	5%	98,554	65%
New Hampshire	99,129	7%	22,094	3%	77,035	15%

	All Areas		Urban Areas		Rural Areas	
	Pop. Without Access	% of Pop.	Pop. Without Access	% of Pop.	Pop. Without Access	% of Pop.
New Jersey	285,478	3%	188,462	2%	97,016	21%
New Mexico	431,125	20%	156,432	9%	274,693	61%
New York	430,202	2%	40,455	0%	389,747	17%
North Carolina	738,306	7%	77,082	1%	661,224	20%
North Dakota	97,315	14%	11,294	2%	86,021	37%
Ohio	983,927	8%	202,958	2%	780,969	31%
Oklahoma	1,066,854	27%	247,333	9%	819,521	66%
Oregon	416,102	10%	150,759	5%	265,343	37%
Pennsylvania	803,645	6%	270,708	3%	532,937	20%
Rhode Island	17,996	2%	15,757	2%	2,239	2%
South Carolina	852,483	18%	247,842	8%	604,641	38%
South Dakota	92,406	11%	9,962	2%	82,444	26%
Tennessee	834,545	13%	106,128	2%	728,417	34%
Texas	2,976,879	11%	1,216,234	5%	1,760,645	46%
Utah	180,004	6%	77,530	3%	102,474	39%
Vermont	106,615	17%	5,223	2%	101,392	27%
Virginia	925,477	11%	186,349	3%	739,128	38%
Washington	200,320	3%	48,339	1%	151,981	14%
West Virginia	554,124	30%	92,104	10%	462,020	48%
Wisconsin	744,002	13%	33,517	1%	710,485	43%
Wyoming	137,922	23%	10,802	3%	127,120	63%
U.S. Territories	2,628,397	66%	1,550,462	54%	1,077,935	98%
American Samoa	54,504	100%	41,307	100%	13,197	100%
Guam	159,377	99%	107,044	99%	52,333	100%
Northern Mariana Islands	51,455	100%	33,906	100%	17,549	100%
Puerto Rico	2,259,097	62%	1,325,683	50%	933,414	98%
U.S. Virgin Islands	103,964	100%	42,522	100%	61,442	100%

APPENDIX E

Americans Without Access to Fixed Advanced Telecommunications Capability by County

https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report

APPENDIX F

Impact of the Inclusion of Satellite Services on Deployment and Overall Adoption Rates for Fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps Services

1. In this report, we include an analysis of satellite services as part our analysis of deployment and adoption.[1] Our primary deployment estimates are based upon the Form 477 data as of December 31, 2014. For this time period, deployment data at 25 Mbps/3 Mbps was not reported by satellite service providers; thus satellite services do not factor into our deployment estimates for fixed advanced telecommunications capability. However, we also report deployment estimates for 4 Mbps/1 Mbps and 10 Mbps/1 Mbps, speeds at which satellite services are offered to residential consumers.[2] Table 1 reports how the estimates of the population without access to fixed 4 Mbps/1 Mbps broadband services and fixed 10 Mbps/1 Mbps broadband services are affected by the inclusion of satellite services.

2. The inclusion of satellite services in our analysis significantly decreases the number of Americans without access to fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps services. Overall, the number of Americans without access to fixed 4 Mbps/1 Mbps broadband services declines from approximately 16.1 million to approximately 1.4 million in the U.S. as a whole; and the number of Americans without access to fixed 10 Mbps/1 Mbps broadband services declines from 19.9 million to 1.4 million. The number of Americans without access to these services is unaffected in the U.S. Territories, while the number of Americans without access to these services residing on Tribal lands fall to zero.

Table 1
Americans Without Fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps Services

	4 Mbps/1 Mbps		10 Mbps/1 Mbps	
	Including Satellite Services[3]	Excluding Satellite Services	Including Satellite Services[4]	Excluding Satellite Services
United States	1,376,047	16,080,909	1,419,962	19,899,559
Rural Areas	732,387	11,539,608	776,295	14,749,138
Urban Areas	643,660	4,541,301	643,667	5,150,421
Tribal Lands	0	776,272	0	1,126,897
Rural Areas	0	622,623	0	924,765
Urban Areas	0	153,649	0	202,132
U.S. Territories	1,376,047	1,376,047	1,419,962	1,419,962
Rural Areas	732,387	732,387	776,295	776,295
Urban Areas	643,660	643,660	643,667	643,667

3. Table 2 below shows the impact of the inclusion of satellite services in the overall adoption rates for 4 Mbps/1 Mbps and 10 Mbps/1 Mbps. The adoption rates in this year's report are not equivalent to adoption rates reported in prior years because those adoption rates excluded satellite

[1] Satellite services have not been included in the deployment statistics or the analysis of adoptions since the Seventh Broadband Progress Report. *See Seventh Broadband Progress Report*, para. 26.

[2] See para. 91, Table 9 (Average Percentage of Population Without Access to Fixed Services by Speed Tier and by Demographic Variable).

[3] The numbers in this column do not take into account limitations imposed by the currently deployed satellite capacity.

[4] *Id*.

services. For example, the adoption rate for fixed 4 Mbps/1 Mbps services is the number of residential subscribers to a service with a speed threshold of *at least* 4 Mbps/1 Mbps in the area divided by the number of households with access to services with a speed of *at least* 4 Mbps/1 Mbps services. Satellite services meet the 4 Mbps/1 Mbps speed threshold; thus, the denominator of the adoption rate increases, to the extent that satellite services are available in the area, and the numerator of the adoption rate increases, to the extent that consumers in the area subscribe to satellite services. The inclusion of satellite services increases the number of American households with access to fixed 4 Mbps/1 Mbps from approximately 116.2 million households to 121.5 million households. However, the inclusion of satellite services in the numerator of the adoption rate increases the number of subscribers to a fixed 4 Mbps/1 Mbps services from 67.2 million to only 68.4 million. Hence, the inclusion of satellite services results in a smaller overall adoption rate than would have the case if satellite services had been excluded from the analysis. The inclusion of satellite services in the analysis of fixed advanced telecommunications capability is not affected because satellite services were unavailable at 25 Mbps/3 Mbps for the time period analyzed in this Report.

4. For the U.S. as a whole, the inclusion of satellite services reduces the overall adoption rate for fixed 4 Mbps/1 Mbps broadband services from 58 percent to 56 percent and reduces the overall adoption rate for fixed 10 Mbps/1 Mbps service from 54 percent to 52 percent. The impact on the overall adoption rate is greatest for Tribal lands where the adoption rate for 4 Mbps/1 Mbps declines from 42 percent to 38 percent. A similar impact occurs on the overall adoption rates for Non-Urban Core areas on Tribal Lands.

Table 2
Impact of Satellite Services on Overall Adoption Rates for
Fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps Broadband Services

	4 Mbps/1 Mbps		10 Mbps/1 Mbps	
	Including Satellite Services	Excluding Satellite Services	Including Satellite Services	Excluding Satellite Services
United States	56%	58%	52%	54%
Non-Urban Core Areas	49%	51%	45%	48%
Urban Core Areas	62%	63%	58%	59%
Tribal Lands	38%	42%	30%	37%
Non-Urban Core Areas	33%	37%	25%	33%
Urban Core Areas	53%	53%	44%	44%
U.S. Territories	18%	18%	15%	15%
Non-Urban Core Areas	13%	13%	10%	10%
Urban Core Areas	23%	23%	19%	19%

5. The statistics reported in Table 2 must be interpreted with care. At first, the adoption rates reported in Table 2 appear counterintuitive, i.e., the inclusion of the availability of satellite broadband *reduces* the adoption rate for both 4 Mbps/1 Mbps and 10 Mbps/1 Mbps services. This reduction in the overall adoption rate is, however, an arithmetic necessity, since the adoption rate is the ratio of the number of residential subscribers to all services meeting the given speed threshold divided by all households with access to any service capable of meeting the given speed threshold. Satellite broadband is a relatively new service with a small number of customers compared to the all terrestrial

broadband customers.[5] Thus, the addition of satellite services will have only a small effect on the total number of broadband subscribers in the numerator of the adoption ratio. It is intrinsic to satellite technology that transponder beam coverage can encompass very large geographic area, and as reported above, the inclusion of satellite services increases coverage for 4 Mbps/1 Mbps service from 116.2 million households to 121.5 million households. Thus, the inclusion of satellite services added to terrestrial coverage in the denominator of the adoption ratio necessarily causes the adoption ratio to fall given the relatively small addition of satellite broadband customers now included in the numerator.

[5] Considering all residential customers in the Form 477 data, as of December 31, 2014, there are 1.467 million subscribers to a satellite service compared to 87.385 million subscribers to fixed terrestrial subscribers. December 31, 2014 FCC Form 477 Subscriber data. *See also*, FCC Internet Access Services: Status as of December 31, 2013, Table 6.

APPENDIX G

Tribal Lands Without Access to Fixed Advanced Telecommunications Capability by State

	Pop. Without Access	% of Pop.
All Tribal Lands	1,573,925	41%
Tribal Lands in the Lower 48 States and an Alaskan Reservation	588,324	58%
Alabama	188	67%
Alaska	1,375	100%
Arizona	162,382	95%
California	29,052	51%
Colorado	11,875	87%
Connecticut	119	36%
Florida	1,762	51%
Idaho	27,666	95%
Iowa	126	13%
Kansas	4,955	100%
Louisiana	725	95%
Maine	1,310	52%
Massachusetts	2	2%
Michigan	4,265	13%
Minnesota	12,047	33%
Mississippi	2,895	38%
Montana	40,944	65%
Nebraska	6,393	85%
Nevada	7,563	72%
New Mexico	108,604	80%
New York	5,472	41%
North Carolina	8,910	99%
North Dakota	19,295	80%
Oklahoma	36,739	42%
Oregon	5,517	64%
South Dakota	19,261	32%
Texas	615	32%
Utah	24,919	78%
Washington	17,104	13%
Wisconsin	13,042	33%
Wyoming	13,202	48%
Tribal Statistical Areas	856,596	34%
California	54	2%
New York	1,168	46%

	Pop. Without Access	% of Pop.
Oklahoma	855,350	34%
Washington	24	0%
Alaskan Villages	128,638	49%
Hawaiian Home Lands	367	1%

APPENDIX H

Overall Adoption Rates for Fixed Advanced Telecommunications Capability by State and U.S. Territory

	25 Mbps/3 Mbps
United States	37%
Alabama	25%
Alaska	3%
Arizona	45%
Arkansas	24%
California	43%
Colorado	52%
Connecticut	43%
Delaware	*
District of Columbia	*
Florida	37%
Georgia	35%
Hawaii	*
Idaho	25%
Illinois	40%
Indiana	30%
Iowa	6%
Kansas	26%
Kentucky	8%
Louisiana	36%
Maine	13%
Maryland	59%
Massachusetts	68%
Michigan	40%
Minnesota	42%
Mississippi	26%
Missouri	27%
Montana	*
Nebraska	34%
Nevada	*
New Hampshire	56%
New Jersey	58%
New Mexico	30%
New York	39%
North Carolina	16%

	25 Mbps/3 Mbps
North Dakota	45%
Ohio	11%
Oklahoma	34%
Oregon	49%
Pennsylvania	46%
Rhode Island	*
South Carolina	23%
South Dakota	40%
Tennessee	40%
Texas	26%
Utah	41%
Vermont	51%
Virginia	53%
Washington	52%
West Virginia	46%
Wisconsin	24%
Wyoming	46%
U.S. Territories	4%
American Samoa	NA
Guam	*
Northern Mariana Islands	NA.
Puerto Rico	0%
U.S. Virgin Islands	*
* Data Withheld to maintain confidentiality. NA – Not Available.	

STATEMENT OF
CHAIRMAN TOM WHEELER

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191.

Senator Daniel Patrick Moynihan famously said, "Everyone is entitled to his own opinion, but not to his own facts." Today, we release the facts about broadband deployment in the United States – the 2016 Broadband Progress Report. This analysis fulfills our statutory mandate to assess and report annually on whether *advanced* telecommunications are being deployed to *all* Americans in a reasonable and timely fashion. So what are the facts when it comes to broadband in America?

Fact #1: In the most recent year measured, our nation made significant progress in broadband deployment. The number of Americans lacking access to fixed broadband at the FCC's benchmark speed of 25 Mbps for downloads, 3 Mbps for uploads dropped from 55 million to 34 million. That's a nearly 40 percent reduction in the number of unserved Americans in only one year.

Fact #2: Despite recent gains, we are still fall short of the statutory goal of universal access to fixed high-speed broadband. Approximately 34 million Americans still lack access to fixed broadband at 25/3.

Fact #3: The urban-rural digital divide persists and is significant. Thirty-nine percent of Americans living in rural areas and lack access to 25 Mbps/3 Mbps, compared to 4 percent of urban Americans. On Tribal Lands in rural America, 68 percent lack access.

Fact #4: Our schools and libraries still face a connectivity gap. Forty-one percent of schools have not met the Commission's short-term goal of 100 Mbps per 1,000 students/staff. And a much smaller percentage have met the longer-term goal of 1 Gbps/1,000 users.

Fact #5: Americans rely more and more on mobile broadband service. This is particularly true of low income and minority consumers. Americans use their smart phones and tablets to access the Internet on the go so much that the concept of "advanced telecommunications" as Congress defined it must include access to both fixed and mobile broadband.

Congress directed the Commission to gather the facts on broadband deployment, it also ordered us to make a determination based on those facts. Specifically, based on our findings, the Commission must determine whether "advanced telecommunications capability" – broadband – is being deployed to all Americans in a "reasonable and timely fashion." If the answer is negative, the law requires the FCC to "take immediate action" to speed deployment.

When Americans increasingly rely on broadband for job opportunities, healthcare, education, public safety, and civic participation, but nearly 34 million Americans couldn't get high-speed fixed broadband even if they wanted it; when rural Americans are nearly ten times more likely than their urban peers to be bypassed by online opportunities; when 47 percent of our students don't have sufficient bandwidth at school to use the latest digital learning tools, we cannot say that we are meeting the standard Congress set forth. We have a moral and statutory obligation to do better.

Consistent with this obligation, the Commission continues to take actions to close the digital divide in Rural America and on Tribal lands by incenting deployment of broadband in those areas, and bringing high-speed broadband to rural and Tribal schools and libraries. We are also adopting policies to promote broadband adoption and competition in the provision of broadband services.

Regarding the finding that advanced telecommunications capability requires access to both fixed and mobile broadband, we are not ready to establish a speed benchmark for mobile services as we have for fixed broadband service. Mobile speeds are inherently less consistent than fixed, and we will ask for

more comment, and possibly consider new data, before we set a quality benchmark for an Internet access service where speeds are by nature less precise than fixed service speeds.

Moving forward, the Commission is fully committed to the goal of broadband for all, and we will take all reasonable measures to ensure that Americans have access to the networks that are increasingly essential for full participation in today's society and economy.

Thank you to our International, Public Safety and Homeland Security, Wireless Telecommunications and Wireline Competition Bureaus for their work on its item as well as our Office of Engineering and Technology and Office General Counsel. This was a broad-based effort that drew on the expertise of many within our Bureaus and Offices.

STATEMENT OF
COMMISSIONER MIGNON L. CLYBURN

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191.

I am pleased that this year's Broadband Progress Report recognizes that both mobile and fixed broadband are needed to meet the ever growing demands of today's always-on consuming society. The two services complement each other so seamlessly that we often forget how much we rely on each. Indeed, I would challenge anyone fortunate enough to subscribe to both services, to forgo either for a week, and see how challenging it is to keep on top of the daily demands of work, school, home, health, commerce, to – well – just about everything.

There is a lot of good news contained in this report. It shows impressive strides towards meeting our goal of ensuring that all Americans have access to advanced telecommunications capability. I am proud to have been part of many of the landmark Commission decisions that helped to close these gaps, including the FCC's historic reforms of the universal service fund to focus on deploying broadband-capable networks in rural areas. What is also clear, however, is that there is more work left to do, and we cannot afford to declare victory until every corner of our nation has fixed and mobile broadband-capable networks.

There are two areas in particular where I believe additional Commission action is needed so that we are able to once and for all close some chronic technology divides.

First, the Commission needs to adopt a permanent mobility fund, as envisioned by the unanimous decision in the 2011 *USF/ICC Transformation Order*. The Report's finding that mobile is necessary for advanced telecommunications capability heightens the need to move swiftly on the mobility fund so we can close any remaining gaps in mobile broadband coverage. While I applaud the levels of private sector investment, there are places that still lack coverage, and other areas that only have service because of the ongoing support from the universal service fund. A permanent mobility fund should be expressly targeted to reach these areas. Existing legacy support for wireless providers is not necessarily the most efficient use of universal service. Indeed, the Commission estimated in 2014 that wireless providers continue to receive approximately $590 million annually in legacy support but, currently, there is no obligation that this support be used to deploy broadband or to connect those unserved areas. This must change.

Second, we need to ensure that once deployed, the service is affordable. It is crystal clear that too many of our citizens, particularly those who are low-income, many with disabilities, and those living in rural and on Tribal lands, remain on the wrong side of the connectivity divide. In many of these places, ensuring that the service is affordable for consumers who are struggling remains a challenge. The Commission sought comment on modernizing the Lifeline program last year, and I am hopeful that we will move quickly to ensure that broadband is part of that matrix.

I want to thank the Chairman for his willingness to accommodate my office's edits, and I look forward to working with my colleagues to adopt a permanent mobility fund and finalize Lifeline reform with dispatch.

STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191.

I believe the future belongs to the connected. That's because a broadband connection is more than a technology—it's a platform for opportunity. No matter who you are or where you live in this country, you need access to modern communications to have a fair shot at 21st century success. That's a fact.

There are also a lot of facts in today's Report, which is our most comprehensive picture of where we stand in bringing broadband to all Americans. Much of the news is good. This is due in no small measure to the enormous investment that communications providers are making to deploy broadband across the country. At the same time, this Report demonstrates that we have communities that lack the connectivity they need today and require for the future. This is especially true in rural and Tribal areas. So we have work to do.

I also believe the future belongs to the bold. Enough with dreaming small. It's time to dream big. This is the country that put a man on the moon. We invented the Internet. We can do audacious things—if we set big goals.

So I believe we need big broadband goals. I am pleased that six years ago the Commission had the foresight to change our downstream broadband speed threshold from 200 kilobits to 4 Megabits. I am glad that last year we upped the ante and changed that threshold to 25 Megabits. I support the continued use of this standard today. But I think we need to go big and be bold. I think our new threshold should be 100 Megabits—and Gigabit speed should be in our sights. I believe anything short of goals like this shortchanges our children, our future, and our digital economy.

This may not be easy, but we can do it. That's because the history of innovation is brimming with examples of the great depths of American know-how. It's time to put that know-how to work and bring really big broadband everywhere.

CONCURRING STATEMENT OF COMMISSIONER AJIT PAI

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191.

Congress created the FCC "to make available, so far as possible, to all the people of the United States . . . a rapid, efficient, Nation-wide, and world-wide wire and radio communication service."[1] In the Telecommunications Act of 1996, Congress reiterated that charge, requiring the FCC to "encourage" the deployment of advanced telecommunications capability—broadband—to all Americans and to "take immediate action to accelerate deployment" if the country falls behind.[2] In other words, section 706 is focused on bringing high-speed Internet access to places where a business case for deployment doesn't already exist. It's all about rural America.

In the first broadband deployment report of the Obama Administration, the FCC declared that broadband was not being deployed to all Americans in a reasonable and timely fashion, finding that 14–24 million Americans could not access it.[3] As required by federal law, the Commission vowed "immediate action to accelerate deployment."[4] The Commission has since repeated that vow again[5] and again[6] and again.[7]

Today, the agency declares once more that broadband is still not being deployed to all Americans in a reasonable and timely fashion.[8] It finds that "approximately 34 million Americans lack service, nearly the population of Canada."[9] That's at least 10 million more Americans than were being left behind at the beginning of this Administration.

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[1] Communications Act § 1.

[2] Telecommunications Act § 706(a)–(b).

[3] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act; A National Broadband Plan for Our Future*, GN Docket Nos. 09-137, 09-51, Sixth Broadband Deployment Report, 25 FCC Rcd 9556, 9574, para. 28 (2010).

[4] *Id.* at 9575, para. 29; Telecommunications Act § 706(b).

[5] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 10-159, Seventh Broadband Progress Report and Order on Reconsideration, 26 FCC Rcd 8008, 8040, para. 64 (2011).

[6] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 11-121, Eighth Broadband Progress Report, 27 FCC Rcd 10342, 10403, para. 139 (2012).

[7] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 14-126, 2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment, 30 FCC Rcd 1375, 1455, para. 141 (2015).

[8] *Order* at para. 1.

[9] *Order* at para. 120.

These figures confirm that this Administration's policies to encourage and accelerate broadband deployment over the last seven years just haven't worked. The digital divide between rural and urban America hasn't been closed. And so the FCC today gives this Administration a failing grade.

You might think that for all the money the Administration has spent, there would be real progress. But the FCC doesn't think so. And in many ways, I agree.

I agree that it's a failure to spend $28.1 billion on the FCC's high-cost program since 2009 and yet still find a "stark contrast in service between urban and rural America."[10]

I agree that it's a failure to spend $8.2 billion on so-called "stimulus" spending that favors overbuilding (and, all too often, politically connected cronyism) and consequently leaves "Americans who live in rural areas [] ten times more likely to be unserved than their urban counterparts."[11]

I agree that it's a failure to agree to commit $9.4 billion through the Connect America Fund and $350 million through the Mobility Fund to deploy services that don't meet the FCC's 25 Mbps standard for broadband.[12] After these funds go out the door, we will still have to say then what we say today: "Americans living in rural areas and Tribal lands disproportionately lack access."[13]

I agree that it's a failure that the FCC has spent $10.9 billion on the Lifeline program and doubled the size of the program, yet it hasn't made a dent in telephone adoption, the supposed purpose of all those subsidies.

I agree that it's a failure that the FCC has spent $14.6 billion on the E-Rate program, yet it still finds that 91% of schools don't meet our own long-run connectivity target and 41% of schools don't even meet the short-term goal.[14]

And I agree that it's a failure that the FCC has spent a record $838 million just administering the Universal Service Fund, yet it still can't say that the Fund is administered without substantial waste, fraud, and abuse.[15]

In short, American taxpayers aren't getting the bang they deserve for their hard-earned bucks. And the FCC is living up to Ralph Waldo Emerson's dictum that "Money often costs too much."

One problem has been the Commission's inconsistent approach to supporting broadband deployment in rural America. What does it say when the FCC reconsiders its historic *Universal Service Transformation Order* seven separate times? When the agency decides first to adopt "benchmarks" for

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[10] *Order* at para. 121.

[11] *Order* at para. 121; *see also* Tony Romm, *Wired to Fail*, Politico, http://politi.co/1VupCji (July 28, 2015). The Administration received $4.7 billion for the National Telecommunications and Information Administration's Broadband Technology Opportunities Program and $3.5 billion for the Rural Utility Service's Broadband Initiatives Program.

[12] Specifically, $114 million in Connect America Fund Phase I Round 1, $324 million in Connect America Fund Phase I Round 2, and $9.005 billion in Connect America Fund Phase II Offers of Model-Based Support as well as $300 million in Mobility Fund Phase I and $50 million in Tribal Mobility Fund Phase I.

[13] *Order* at para. 121.

[14] *Order* at para. 123.

[15] *See* USAC, 2010 Second Quarter Filing M03 January 1, 2009 through December 31, 2009 – CASH BASIS; USAC, 2011 Second Quarter Filing M03 January 1, 2010 through December 31, 2010 – CASH BASIS; USAC, 2012 Second Quarter Filing M03 January 1, 2011 through December 31, 2011 – CASH BASIS; USAC, 2013 Second Quarter Filing M03 January 1, 2012 through December 31, 2012 – CASH BASIS USAC; 2014 Second Quarter Filing M03 January 1, 2013 through December 31, 2013 – CASH BASIS; 2015 Second Quarter Filing M03 January 1, 2014 through December 31, 2014 – CASH BASIS; 2016 First Quarter Filing M03 January 1, 2015 to September 30, 2015 – CASH BASIS.

rural capital and operating expenses,[16] then to rework them,[17] then to eliminate them,[18] and finally to resurrect them (they're now called "specific budgets")?[19] When the U.S. Department of Agriculture feels compelled to tell the FCC that the regulatory uncertainty it's created is devastating rural broadband deployment?[20]

That inconsistency extends to the Commission's inability to meet its own deadlines. The Connect America Fund's second phase was supposed to start in 2013,[21] not August 2015. The Commission promised to adopt a competitive bidding mechanism for that phase by December 2012,[22] but we still don't have one. The Mobility Fund's second phase was due four years ago,[23] but it has been completely immobile. The Remote Areas Fund hasn't commenced.[24] And last year, every member of this Commission promised Chairman John Thune of the Senate Committee on Commerce, Science, and Transportation that we'd adopt a stand-alone broadband mechanism before 2015 was over. (I put my plan on the table last June.) It's now 2016, and there is no plan. There is no sign of any plan. There is no plan of any sign. But there is talk.

What is worse, the Commission has actively worked to make broadband deployment more difficult. The agency has required carriers to seek government permission before discontinuing almost every network feature no matter how little-used or old-fashioned.[25] It has dragged out the copper retirement process.[26] It has suspended the Clinton-era deregulatory framework for enterprise broadband services and appears on track for full-scale rate regulation of low-bandwidth services later this year.[27] And it has raised the cost of stringing fiber along poles (only to reverse that decision six months later).[28]

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[16] *Connect America Fund et al.*, WC Docket Nos. 10-90, 07-135, 05-337, 03-109, CC Docket Nos. 01-92, 96-45, GN Docket No. 0951, WT Docket No. 10-208, Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663, 17742, para. 210 (2011) (*Universal Service Transformation Order*).

[17] *Connect America Fund; High-Cost Universal Service Support*, WC Docket Nos. 10-90, 05-337, Sixth Order on Reconsideration and Memorandum Opinion and Order, 28 FCC Rcd 2572, 2581, para. 23 (2013).

[18] *Connect America Fund et al.*, WC Docket Nos. 10-90, 14-58, 07-135, WT Docket No. 10-208, CC Docket No. 01-92, Report and Order, Declaratory Ruling, Order, Memorandum Opinion and Order, Seventh Order on Reconsideration, and Further Notice of Proposed Rulemaking, 29 FCC Rcd 7051, 7097, para. 131 (2014).

[19] Remarks of FCC Chairman Tom Wheeler as Prepared for Delivery, NTCA Fall Conference, Boston, Massachusetts at 5 (Sept. 21, 2015).

[20] *See* Letter from John Charles Padalino, Acting Administrator, Rural Utility Service, to Marlene H. Dortch, Secretary, FCC, WC Docket Nos. 10-90, 07-135, 05-337, GN Docket No. 09-51, CC Docket Nos. 01-92, 96-45, WT Docket No. 10-208, at 2 (Feb. 15, 2013).

[21] *Universal Service Transformation Order*, 26 FCC Rcd at 17674, para. 25.

[22] *Id.*

[23] *Id.* at 17675, para. 28.

[24] *Id.* at 17675, para. 30.

[25] *Ensuring Customer Premises Equipment Backup Power for Continuity of Communications et al.*, PS Docket No. 14-174, GN Docket No. 13-5, RM-11358, WC Docket No. 05-25, RM-10593, Notice of Proposed Rulemaking and Declaratory Ruling, 29 FCC Rcd 14968, 15018, para. 118 (2014).

[26] *Technology Transitions et al.*, GN Docket No. 13-5, RM-11358, WC Docket No. 05-25, RM-10593, Report and Order, Order on Reconsideration, and Further Notice of Proposed Rulemaking, 30 FCC Rcd 9372, 9390, 9421, paras. 29, 90 (2015).

[27] *Special Access for Price Cap Local Exchange Carriers et al.*, WC Docket No. 05-25, RM-10593, Report and Order, 27 FCC Rcd 10557, 10558, para. 1 (2012).

[28] *Implementation of Section 224 of the Act; A National Broadband Plan for Our Future*, WC Docket No. 07-245, GN Docket No. 09-51, Order on Reconsideration, FCC 15-151 at para. 21 (Nov. 24, 2015).

In short, the Commission has purposely ignored the iron rule that every dollar wasted maintaining last century's fading technology is by definition a dollar that cannot go to next-generation networks. And so communities that offer the lowest profit margins—inhabited by low-income Americans, rural Americans, and others—must wait that much longer for digital opportunity.

Indeed, the Administration has overseen the first-ever reduction in year-over-year investment by major broadband providers that happened outside a recession—and it occurred in the months following the FCC's rubber-stamp of President Obama's plan to regulate the Internet.[29] Countless small broadband providers have also reduced investment in the communities they serve because of the FCC's decision to treat the Internet like a 19th century railroad or 20th century water company.[30] As one small wireless provider testified to Congress earlier this month: "Before the [*Title II Order*] was adopted, it was our intention to triple our customer base" and "cover a three-county area. However, we have pulled back on those plans, scaling back our deployment to three, smaller communities that abut our existing network."[31]

This Administration has also overseen the first-ever decline in home broadband adoption since the advent of the commercial Internet. According to the Pew Research Center, "home broadband adoption seems to have plateaued," with an estimated 9,686,903 Americans having given up home broadband connections between 2013 and 2015.[32] That means over the last six years, only 4% of Americans have decided to adopt broadband at home. Compare that with the 57% of Americans that signed up for broadband during the last Administration—a yearly average of 7%, or almost twice the adoption growth during this entire Administration.[33] Indeed, as the National Broadband Plan found at the dawn of this Administration, "[f]ueled primarily by private sector investment and innovation, the American broadband ecosystem has evolved rapidly. The number of Americans who have broadband at home has grown from eight million in 2000 to nearly 200 million last year [in 2009]."[34] It's unfortunate that this incredible pace of progress fizzled thereafter.

And so we come to the fundamental question: Has the section 706 test been met? Perhaps surprisingly to some, including myself, I agree with the majority's end result: After seven years, $63.6 billion spent, and plenty of talk, this Administration's policies have failed to deliver "advanced telecommunications capability"—broadband—to the American people in a reasonable and timely fashion. The standard set forth by Congress is not being met. Rural America is being left behind.

As expected, the Commission's answer to this disappointing news is yet another vow of "immediate action to accelerate deployment."[35] But after far too many years and far too many broken promises, we have learned that the past is prologue.

What our country needs is a real broadband deployment agenda—a proactive, concrete, bipartisan, dedicated effort to deliver digital opportunity to every American who wants it.

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[29] *Protecting and Promoting the Open Internet*, GN Docket No. 14-28, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5601 (2015).

[30] *See* Statement of Commissioner Ajit Pai on New Evidence that President Obama's Plan to Regulate the Internet Harms Small Businesses and Rural Broadband Deployment (May 7, 2015), *available at* http://go.usa.gov/cEbnh.

[31] Written Testimony of L. Elizabeth Bowles, Legislative Committee Chair, Wireless Internet Service Providers Association and President, Aristotle, Inc. before the House Energy & Commerce Committee Subcommittee on Communications and Technology at 3 (Jan. 12, 2016), *available at* http://go.usa.gov/cEbP3.

[32] John B. Horrigan & Maeve Duggan, Pew Research Center, Home Broadband 2015 at 2 (Dec. 21, 2015), *available at* http://pewrsr.ch/1PbbJC9.

[33] *Id.* at 3.

[34] National Broadband Plan at xi.

[35] *Order* at para. 119.

Among other things, that means returning to the bipartisan consensus that the Internet should be unfettered by federal or state regulation so that entrepreneurs within the network and on the edge can innovate without permission.

That means embracing the IP Transition and letting carriers sunset the increasingly obsolete public switched telephone network in favor of next-generation technologies like fiber.

That means modernizing our rate-of-return policies so that rural residents can have the same choice for stand-alone broadband typically found in cities.

That means creating a roadmap for state and local governments so that every company that wants to deploy fiber, from Google Fiber to Kansas' RG Fiber, doesn't have to cut through regulatory thickets every single time in every single location.

That means reducing the red tape for deploying wireless infrastructure on federal lands, where approval currently takes twice as long as on private lands, disproportionately hurting rural wireless consumers.

That means reopening the spectrum pipeline to get more of the airwaves out of the federal government's hands and into the commercial marketplace.

That means rejuvenating the 5 GHz proceeding so that wireless broadband providers and consumers nationwide can put another 195 MHz spectrum to unlicensed use.

That means teeing up 12,500 MHz of spectrum in frequencies above 24 GHz to allow the United States to be a leader in developing 5G technologies.

And that means actually eliminating other regulatory barriers to infrastructure investment—such as high pole attachment rates—so that companies can deploy the small cells, the towers, the fiber, and the new services that consumers are demanding.

In short, that means promoting competition. That means getting rid of outdated rules and regulatory uncertainty. And that means giving everyone—large companies and small, entrepreneurs and consumers—the confidence that the government will no longer stand as the gatekeeper when it comes to broadband and the services and applications that depend on it.

To bring the bounty of broadband to all in our nation who want it, our country needs to choose a different path. As the National Broadband Plan put it half a decade ago, "It is time again to reduce talk to practical results."[36] It is time for a new beginning.

[36] National Broadband Plan at 338.

DISSENTING STATEMENT OF
COMMISSIONER MICHAEL O'RIELLY

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191.

I strongly oppose the notion that broadband is not being deployed in a reasonable and timely fashion, as outlined in the law. Regardless of whether the standard is 25/3, 10/1, or some other combination of technologies and metrics designed to abuse section 706 and generate regulation, the report continues to show steady progress in connecting unserved Americans. In fact, even at the artificially high and prematurely adopted 25/3 standard, called "table stakes" by some, the number of unserved Americans has dropped from approximately 55 million (17 percent of the population) to approximately 34 million Americans (10 percent of the population) in just one year. The report even concedes that the data are "notably better" than last year. But apparently no amount of progress will ever be good enough for a Commission that is bent on regulating broadband at all cost.

Indeed, the fact that so much progress has been made puts the FCC in an awkward spot. Last January, the Commission expressed concern that the number of unserved Americans had dropped by only three percentage points. Given that it has dropped by another seven, the FCC had to sound a new alarm. Now the Commission is "not satisfied" that the number of unserved is "nearly the population of Canada"—as if that is a useful measure of broadband deployment in the United States. If the number drops to 24 million next year, will we be reminded that that is the population of Australia? The mock outrage and phony comparisons only serve to highlight that the actual data in the report don't matter and the politically-driven findings are a sham.

To divert attention from the substantial progress made on fixed broadband, the report includes a lengthy discussion on mobile broadband. As I predicted, the Commission now finds that the availability of advanced telecommunications capability requires access to both fixed and mobile service. The idea that we would need to see close to 100 percent availability of each service in order to reach a positive finding is ludicrous. This siloed way of thinking is outdated and simply does not comport with usage trends. The report is quite certain that fixed and mobile broadband aren't substitutes, which is a completely erroneous conclusion, given that it hasn't even defined mobile broadband service yet. But it also runs completely counter to the generational preferences and views on substitutability noted in this very report. This is just another avenue to preordain next year's negative finding.

In addition, I have serious concerns with the analysis regarding broadband deployment to schools. The connectivity goals established for the E-Rate program were just that—goals. They were not intended to be used as benchmarks to be measured and acted on here. I have already heard reports that schools are making purchasing decisions based on the goals—driving up demand on the consumer-supported universal service fund—regardless of whether their actual usage warrants purchasing additional capacity. By pretending the E-Rate goals are benchmarks, as done here, the Commission gives schools a further push to overspend, wasting scarce universal service dollars without actually helping the children.

I also continue to object to the inclusion of privacy and security as barriers to deployment. The Commission has no authority to regulate in these areas, and should not be examining them here. I remain concerned that this line of thinking ultimately could result in the FCC creating duplicative and potentially conflicting burdens on broadband providers, leading to cost increases for consumers.

In sum, the task before us is to consider whether deployment in the United States is reasonable and timely, and the objective, empirical answer to that is a resounding yes. In fact, it is more than reasonable considering the unnecessary burdens that the Commission has continued to heap upon broadband providers in the meantime. While there is more work to be done—particularly in the rural and remote areas of the country that I've been spending a great deal of time on—I do not agree with the analysis or negative finding and I must dissent.