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

In the Matter of	)	
	)	
Communications Marketplace Report	)	GN Docket No. 18-231
	)	
The State of Mobile Wireless Competition	)	WT Docket No. 18-203
	)	
Status of Competition in the Market for the Delivery of Video Programming	)	MB Docket No. 17-214
	)	
Status of Competition in the Marketplace for Delivery of Audio Programming	)	MB Docket No. 18-227
	)	
Satellite Communications Services for the Communications Marketplace Report	)	IB Docket No. 18-251

REPORT

Adopted: December 12, 2018 **Released: December 26, 2018**

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

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I. INTRODUCTION

1. With this first *Communications Marketplace Report*, the Commission fulfills the requirement set forth in RAY BAUM'S Act of 2018 to streamline its numerous and varied public reports into a single document providing a comprehensive evaluation of the state of communications in the United States.[1] This *Report* consolidates the Commission's historical, statutorily required reports, all of which had been issued in separate documents and at different times, and which assessed different aspects

[1] Section 401 of the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (RAY BAUM'S Act), Pub. L. No. 115-141, 132 Stat. 1087 (codified at 47 U.S.C. § 163) (RAY BAUM'S Act).

of the diverse communications technologies the Commission oversees. For the first time, the *Report* places essential information about all of these technologies in one place.

2. Title IV of RAY BAUM'S Act of 2018 directs the Commission to publish in the last quarter of every even-numbered year "a report on the state of the communications marketplace."[2] Each biennial report must assess the state of all forms of competition in the communications marketplace; the state of deployment of communications capabilities; barriers to competitive entry, including market entry barriers for entrepreneurs and other small businesses; and must describe the actions taken by the Commission in the previous two years to address challenges and opportunities in the communications marketplace, and the Commission's agenda for continuing to address those challenges and opportunities over the next two years. The Commission must also compile a list of geographic areas that are not served by any provider of advanced telecommunications capability.

3. In addition to establishing the *Communications Marketplace Report* requirement, RAY BAUM'S Act of 2018 also expressly repealed and modified the Commission's requirement to produce many other reports. The Media Bureau, Wireless Telecommunications Bureau, Wireline Competition Bureau, and International Bureau separately sought public comment to assist the Commission in fulfilling its reporting duties under the RAY BAUM'S Act of 2018.[3] In total, RAY BAUM'S Act of 2018 eliminated or materially modified 10 separate regularly recurring Commission reports to Congress and in their place consolidated most of the data required by those reports into this single comprehensive report.[4] The Commission's regulatory reach encompasses a number of different modes of communications. The replacement of multiple separate reports on distinct schedules with a single consolidated *Communications Marketplace Report* provides greater transparency to the public, enables a more holistic examination of the state of the communications market across technologies, and simplifies for interested parties the ability to research, consider and evaluate our assessments.

II. ASSESSMENT OF COMPETITION AND DEPLOYMENT

4. This section of the *Report* addresses the requirement that the Commission assess the state of competition in the communications marketplace, including a discussion of barriers to competitive entry, including market entry barriers for entrepreneurs and other small businesses. We first discuss the state of competition in the mobile wireless market, including market characteristics, spectrum and pricing levels and trends. We then discuss competition in the audio market, such as terrestrial and satellite radio, and in the video market, including broadcast, multichannel and online video services. We next address the state of competition in the fixed broadband market, including investment trends and market barriers, as well as a discussion of the voice services market. The *Report* next addresses the state of competition in the satellite market including industry providers and recent changes in the market. We also assess in this section the state of deployment of communications capabilities as required by RAY BAUM'S Act. We also provide comparative international data on broadband services, and, where possible, a year-to-year measure of the extent of broadband service capability, including speeds and prices, in the United States

[2] 47 U.S.C. § 163(a).

[3] *See Media Bureau Seeks Comment on the Status of Competition in the Marketplace for Delivery of Audio Programming*, Public Notice, MB Docket No. 18-227, DA 18-761 (rel. July 23, 2018); *Wireless Telecommunications Bureau Seeks Comment on The State of Mobile Wireless Competition*, WT Docket No. 18-203, Public Notice, DA-18-663, (WTB 2018) (*Mobile Wireless Competition PN*); *Wireline Competition Bureau Seeks Comment on The State of Fixed Broadband Competition*, GN Docket No. 18-231, Public Notice, DA 18-784 (WCB July 27, 2018); *International Bureau Seeks Comment on Satellite Communications Services for the Communications Marketplace Report*, IB Docket No. 18-251, Public Notice, DA 18-858 (IB Aug. 17, 2018) (*International Bureau Satellite Public Notice*).

[4] *See* RAY BAUM'S Act, section 402. The Act also eliminates other, non-regularly recurring Commission reporting obligations to Congress. *See id.*, section 402(i)(1)-(5).

and select communities and countries abroad.[5] In addition, we include throughout this section data presentations related to the various markets and discussions of intermodal competition, also as required by RAY BAUM'S Act of 2018.

A. The Mobile Wireless Market

5. Mobile wireless services are an important and increasingly prevalent part of Americans' daily lives, and competition in the provision of mobile wireless services drives innovation and investment to the ultimate benefit of the American people and economy.[6] In this section, we present and review available 2017 data for all mobile wireless services, including voice, messaging, and broadband, and also present certain pricing information as of early 2018.[7]

1. Characteristics of the Mobile Wireless Industry

a. Service Providers[8]

6. *Facilities-Based Service Providers.* As of year-end 2017, there were four facilities-based mobile wireless service providers in the United States that are typically described as "nationwide": AT&T, Sprint, T-Mobile, and Verizon Wireless. Although none of these four nationwide service providers has a network that is truly ubiquitous, all four service providers have networks that cover at least 90% of the population with Long Term Evolution (LTE).[9] Therefore, this *Report* will refer to these four service providers as "nationwide service providers." Collectively, these four service providers account for over 400 million connections.[10] U.S. Cellular, currently the fifth largest facilities-based service provider in the United States, is best characterized as a multi-regional service provider, and has developed wireless networks and customer service operations in portions of 22 states.[11] As of December

[5] 47 U.S.C. § 1303(b). The Broadband Data Improvement Act, Pub. L. No. 110-385, 122 Stat. 4096 (2008), is codified in Title 47, Chapter 12 of the United States Code. 47 U.S.C. § 1301 *et seq.*

[6] The *Communications Marketplace Report* includes information in this section on the mobile wireless marketplace that previously was submitted to Congress as a separate *Mobile Wireless Competition Report* under Section 332(c)(1)(C) of the Communications Act of 1934, as amended (Communications Act). 47 U.S.C. § 332(c)(1)(C). Section 332(c)(1)(C) was amended by striking the first and second sentences, which read: "The Commission shall review competitive market conditions with respect to commercial mobile services and shall include in its annual report an analysis of those conditions. Such analysis shall include an identification of the number of competitors in various commercial mobile services, an analysis of whether or not there is effective competition, an analysis of whether any of such competitors have a dominant share of the market for such services, and a statement of whether additional providers or classes of providers in those services would be likely to enhance competition." *Id.*

[7] Our analysis in this section is data-centric; it combines discussions with substantial use of figures in accessible data formats. For additional coverage maps, *see* the web appendix. FCC, Coverage Map Appendix. Citations to Comments in this section refer to filings submitted in response to the *Mobile Wireless Competition PN*.

[8] We note that mobile satellite service providers offer satellite-based communications to mobile devices, and generally are targeted at users who require communications and asset tracking in remote areas, in disaster response situations, or other places where terrestrial mobile wireless network access may be limited. In addition, narrowband data service providers offer services including two-way messaging, as well as machine-to-machine (M2M) and other telemetry communications, and are consumed primarily by businesses, government users, and other institutions. *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. 17-126, Twentieth Report, 32 FCC Rcd 8968, 8977, paras. 17-18 (2017) (*Twentieth Report*).

[9] *See infra* Section II.A.8.

[10] *See infra* Figure A-1.

[11] United States Cellular Corp., 2017 SEC Form 10-K, at 1 (filed Feb. 26, 2018), https://www.sec.gov/Archives/edgar/data/821130/000082113018000008/usm10k.htm. U.S. Cellular is a majority-owned (83%) subsidiary of Telephone and Data Systems, Inc. *Id.* Unless otherwise noted, all websites cited in this (continued….)

31, 2017, U.S. Cellular accounted for approximately five million connections.[12] C Spire, the sixth largest service provider in the U.S., provides service in the Southeastern United States to nearly one million subscribers.[13] There are also dozens of other facilities-based mobile wireless service providers throughout the United States, many of which provide service in a single, often rural, geographic area.[14] These non-nationwide service providers increase choice for consumers and help to promote deployment in rural areas.[15]

7. *Mobile Virtual Network Operator (MVNOs).* MVNOs do not own any network facilities, but instead purchase mobile wireless services wholesale from facilities-based service providers and resell these services to consumers.[16] In 2017, TracFone Wireless (TracFone), an America Movil subsidiary, was the largest MVNO, with approximately 23 million subscribers.[17] In 2015, Google launched "Project Fi," an MVNO in partnership with T-Mobile and Sprint whereby Google Fi subscribers switch between Wi-Fi networks and these two service providers' LTE networks.[18] In 2016, both Comcast,[19] and Charter Communications,[20] the nation's two largest cable providers, activated MVNO options they held with Verizon Wireless. Comcast launched its wireless service in the spring of 2017 as Xfinity Mobile and had

(Continued from previous page)
Report were visited between Nov. 21, 2018, and Dec. 10, 2018, in order to confirm the accuracy of the information contained therein.

[12] *Id.*

[13] C Spire, About C Spire, https://www.cspire.com/company_info/about/news_detail.jsp?entryId=29600003.

[14] Examples of regional facilities-based service providers include Appalachian Wireless, Bluegrass Cellular, Carolina West Wireless, Cellcom, Choice Wireless, GCI, Nex-Tech Wireless, and Sagebrush Cellular. *Twentieth Report*, 32 FCC Rcd at 8975, para. 14 & n.50.

[15] *Policies Regarding Mobile Spectrum Holdings Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd 6133, 6207, paras. 179-80 (2014) (*Mobile Spectrum Holdings Report and Order*).

[16] *Twentieth Report*, 32 FCC Rcd at 8976, para. 15. The Commission is not able to provide an exact figure of the number of MVNOs that currently offer services. This is partly because, as resellers of service offered by facilities-based service providers, MVNOs are not licensees and typically do not file Section 214 applications. Furthermore, as the Commission has found in prior competition reports, "[c]omprehensive data on MVNO subscribers are generally not reported by either MVNOs or facilities-based providers that host MVNOs. Estimates of the number of MVNOs operating in the United States vary considerably. Many MVNOs are privately-held companies that do not publicly report financial or subscriber data." *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*, Sixteenth Report, 28 FCC Rcd 3700, 3739, para. 32 (2013) (*Sixteenth Report*).

[17] TracFone, TracFone Home, http://www.tracfone.com/; Prepaid Phone News, Fourth Quarter, 2017 Prepaid Mobile Subscriber Numbers by Operator (Feb. 19, 2018), https://www.prepaidphonenews.com/2018/02/fourth-quarter-2017-prepaid-mobile.html.

[18] FierceWireless, Google Unveils "Project Fi" MVNO with Sprint and T-Mobile as Partners (Apr. 22, 2015), http://www.fiercewireless.com/story/google-unveils-project-fi-mvno-sprint-and-t-mobile-partners/2015-04-22. In June 2016, Google added U.S. Cellular as a partner. FierceWireless, Google's Project Fi to Add U.S. Cellular to Partner Network (June 8, 2016), http://www.fiercewireless.com/story/googles-project-fi-add-us-cellular-partner-network/2016-06-08. Similar WiFi service is also provided by two other MVNOs - FreedomPop (https://www.freedompop.com/) and Republic Wireless (https://republicwireless.com/faqs/).

[19] FierceWireless, Comcast to Launch Wireless Service in 2017 with Verizon MVNO, 15M Wi-Fi Hotpots (Sept. 20, 2016), http://www.fiercewireless.com/wireless/comcast-to-launch-wireless-service-2017-verizon-mvno-15m-wi-fi-hotspots.

[20] FierceCable, Rutledge: Charter Has Asked Verizon to Activate MVNO Agreement (Sept. 21, 2016), http://www.fiercecable.com/cable/rutledge-charter-has-asked-verizon-to-activate-mvno-agreement.

approximately 380,000 subscribers at year-end 2017.[21] Charter began offering its service in the summer of 2018.[22]

b. Connections/Subscribers

8. To estimate the number of mobile wireless subscribers/connections,[23] this *Report* uses Numbering Resource Utilization Forecast (NRUF) data, which tracks the quantity of phone numbers that have been assigned to mobile wireless devices,[24] CTIA data, and UBS data. As shown in Figure A-1 below,[25] the number of mobile wireless connections, based on NRUF,[26] grew by approximately 3% from year-end 2016 to year-end 2017 to approximately 411 million, while CTIA estimates of mobile wireless connections grew to approximately 400 million, an increase of approximately 1%. Figure A-2 presents data on total connections by service segment based on UBS data. It shows that, in 2017, the postpaid segment accounted for more than 60% of all connections, while the prepaid segment accounted for less than 20% of all connections, and wholesale connections and connected devices accounted for the remainder. [27]

9. Figure A-3 presents data on total mobile wireless connections for the largest publicly-traded service providers operating in the United States, including an estimate of their respective market shares for 2017.[28] In addition, when measuring market share in terms of revenue, in 2017, Verizon Wireless's market share was 35.5%, compared to 32.4% for AT&T, 17% for T-Mobile, and 12.8% for Sprint.[29]

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[21] FireceWireless, Comcast's Xfinity Mobile MVNO Grows to 380,000 Customer Lines in Less than 1 Year (Jan. 24, 2018) https://www.fiercewireless.com/wireless/comcast-s-xfinity-mobile-mvno-grows-to-380-000-customer-lines-less-than-1-year.

[22] Charter Communications NewsRoom, Introducing Spectrum Mobile (June 30, 2018) https://newsroom.charter.com/news-views/introducing-spectrum-mobile/.

[23] Different sources refer to their data as connections or subscribers, and when discussing the different data, we will use the terminology most currently used by the source and, where possible, provide a definition of this term. For example, CTIA explains its use of the terms "subscribers" and "connections" as follows: "'Subscribers' is used as a term of art, and reflects the number of revenue-generating units, equally describable as 'wireless connections' – the equivalent of wireline 'lines.' The terms 'subscriber' and 'subscribership' do not denote unique individual subscribers." CTIA Wireless Industry Indices Year-End 2017, at 16.

[24] NRUF provides a measure of the number of mobile wireless connections or connected devices that have assigned telephone numbers. As the number of mobile wireless devices that lack telephone numbers increases, the NRUF data will become less accurate.

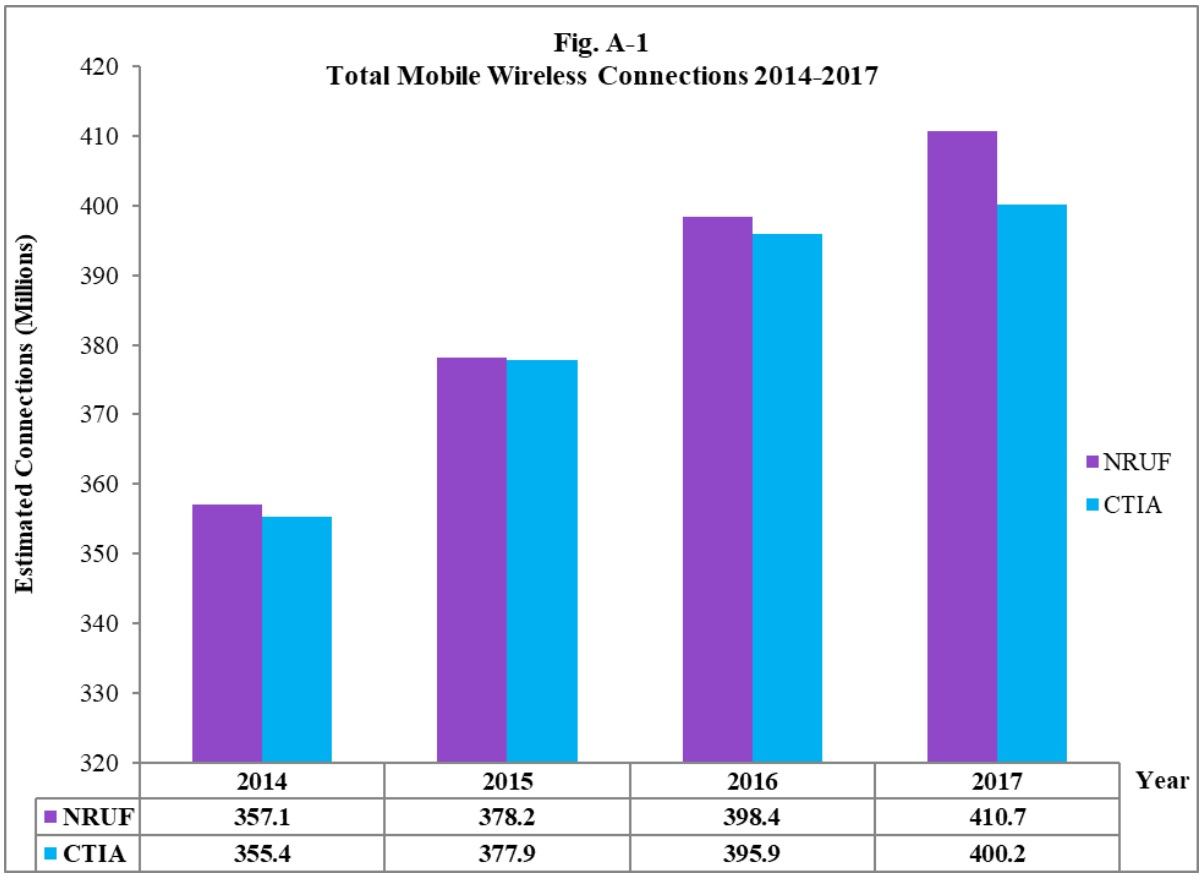
[25] For details of total mobile wireless connections over time, *see* Appendix A-1: Total Mobile Wireless Connections.

[26] We have estimated penetration rates (the number of mobile wireless connections per 100 people), using NRUF for the 172 Economic Areas (EAs) in the United States. Our estimates suggest that 2017 regional penetration rates range from 99.9% in Salisbury, MD-DE-VA to 204% in Biloxi-Gulfport-Pascagoula, MS. Note that NRUF-based penetration rates can exceed 100% because NRUF identifies the number of connected devices that have associated telephone numbers, and a single subscriber may have multiple connected devices. *See* Appendix A-2: Penetration Rates by EA.

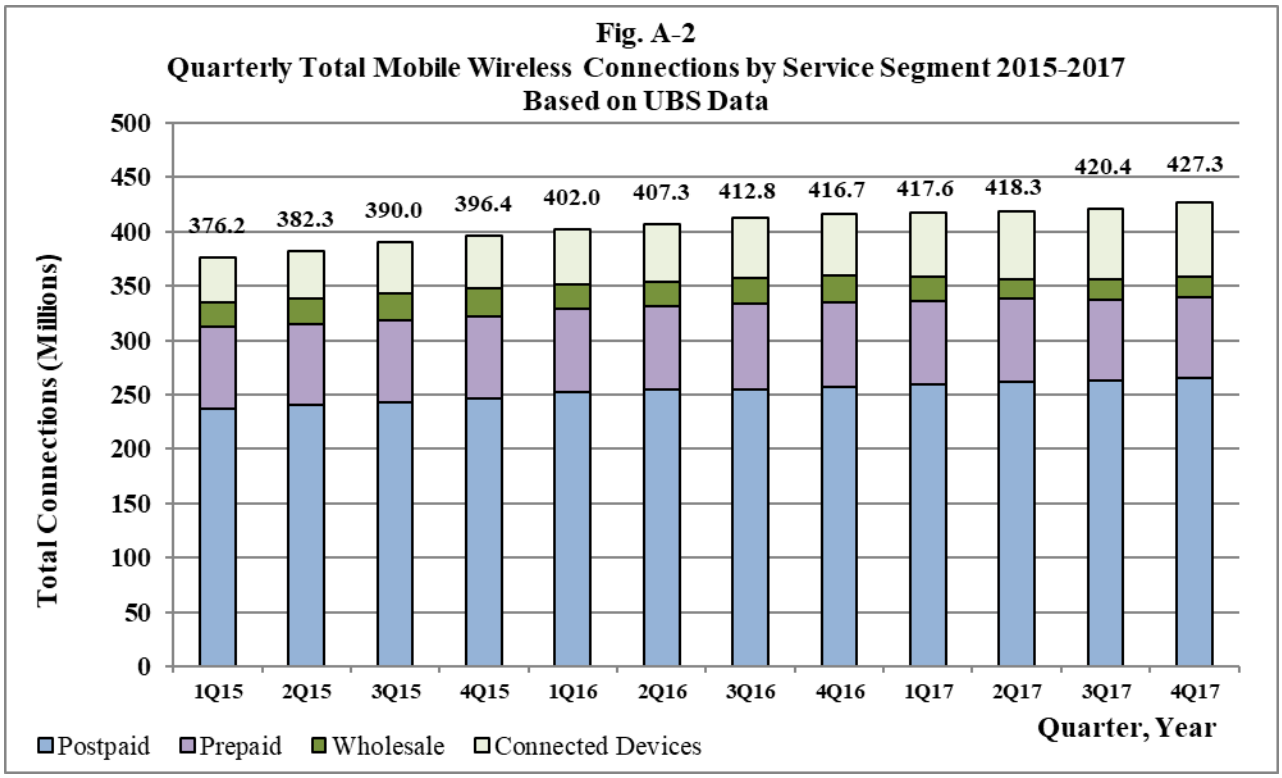
[27] Connected devices are primarily mobile, non-voice devices, including (but not limited to) Internet access devices (e.g., wireless modem cards and mobile Wi-Fi hotspots), tablets, e-readers, smart watches, and telematics systems.

[28] The size of a company, typically measured by service revenues or subscribers, relative to the total size of the industry determines its market share. *See* The MIT Dictionary of Modern Economics, at 268 (4th ed. 1992).

[29] Based on UBS data, Verizon Wireless's service revenues were $63.1 billion, compared to $57.7 billion for AT&T, $30.2 billion, for T-Mobile, and $22.7 billion for Sprint. For previous years, *see Twentieth Report*, 32 FCC Rcd at 8987-88, para. 32 and Table II.C.1. In 2017, total wireless service revenues were approximately $179 billion, a year-over-year decrease of $9.4 billion (or approximately 5%). CTIA Wireless Industry Indices Year-End 2017, at 58.



Source: NRUF, CTIA Wireless Industry Indices Year-End 2017.



Source: UBS Investment Research. UBS US Wireless 411, Version 51, Figure 17; UBS US Wireless 411, Version 59, Figure 42; UBS Wireless 411, Feb. 2017, Figure 25; UBS Data 2017.

Fig. A-3
Estimated Total Connections for Publicly Traded Facilities–Based Mobile Wireless Service Providers (in thousands): 2014–2017

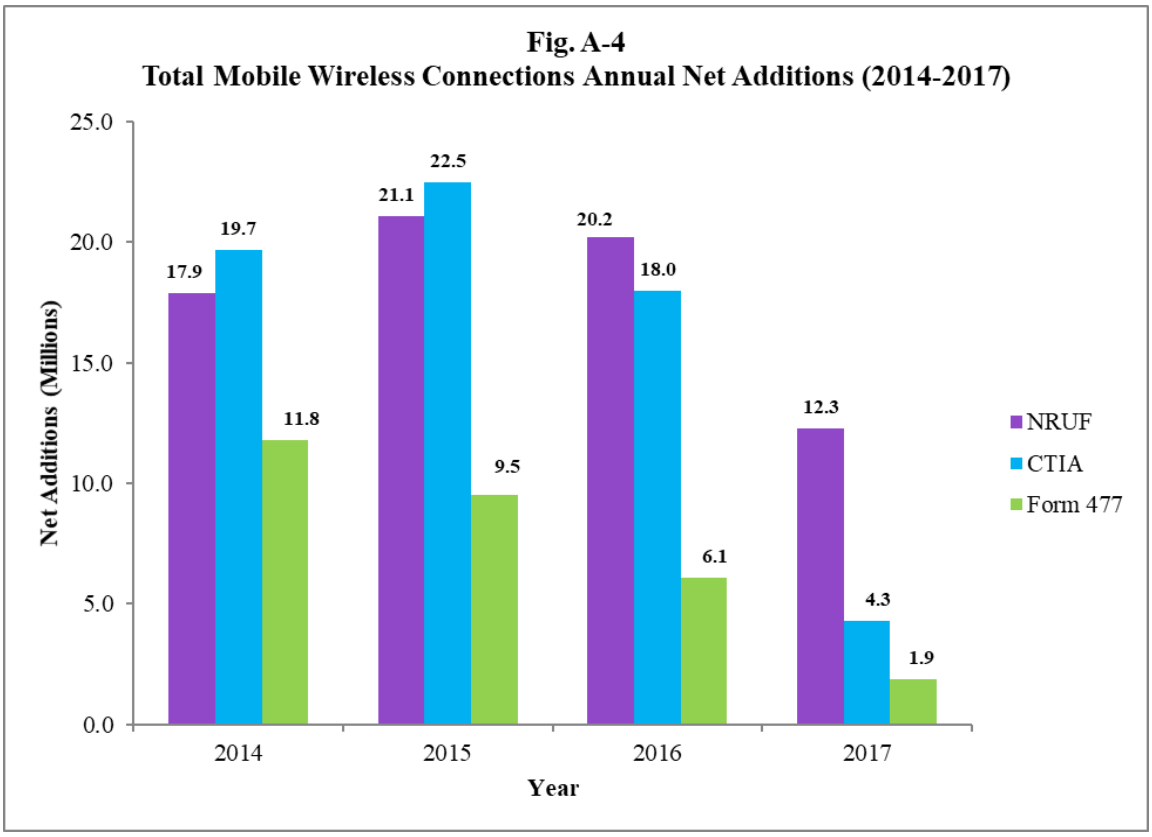
Service Providers	EOY 2014	EOY 2015	EOY 2016	EOY 2017	EOY 2017 (% Market Share)
Verizon Wireless	134,612	140,924	145,859	151,978	35.1
AT&T	120,620	128,679	134,875	146,847	33.9
T-Mobile	55,018	63,282	71,455	74,040	17.1
Sprint	55,929	58,578	59,515	54,683	12.6
U.S. Cellular	4,760	4,876	5,079	5,063	1.2
Top 5 Service Providers Total	**370,939**	**396,339**	**416,783**	**432,611**	

Source: UBS US Wireless 411, Version 51, Table 21; Version 59, Figure 53; UBS Wireless 411, Feb. 2017, Figure 33; and UBS Data 2017. Total estimated connections figure includes data only for the service providers reported in this table.

10. Estimates of the number of net additions in 2017 vary. As shown in Figure A-4, for 2017, there were approximately 12 million net additions based on NRUF data, compared with 4 million based on CTIA data. Preliminary mobile voice subscriber data as reported by service providers on Form 477 show that for 2017, net subscriber additions totaled approximately 2 million.[30] Figure A-5 below shows that postpaid net additions increased in 2017, and that the net number of connected device additions was consistently higher than prepaid additions, from 2014 through 2017. Figure A-6, based on UBS data, shows net subscriber additions by the four nationwide service providers from 2014 through 2017.

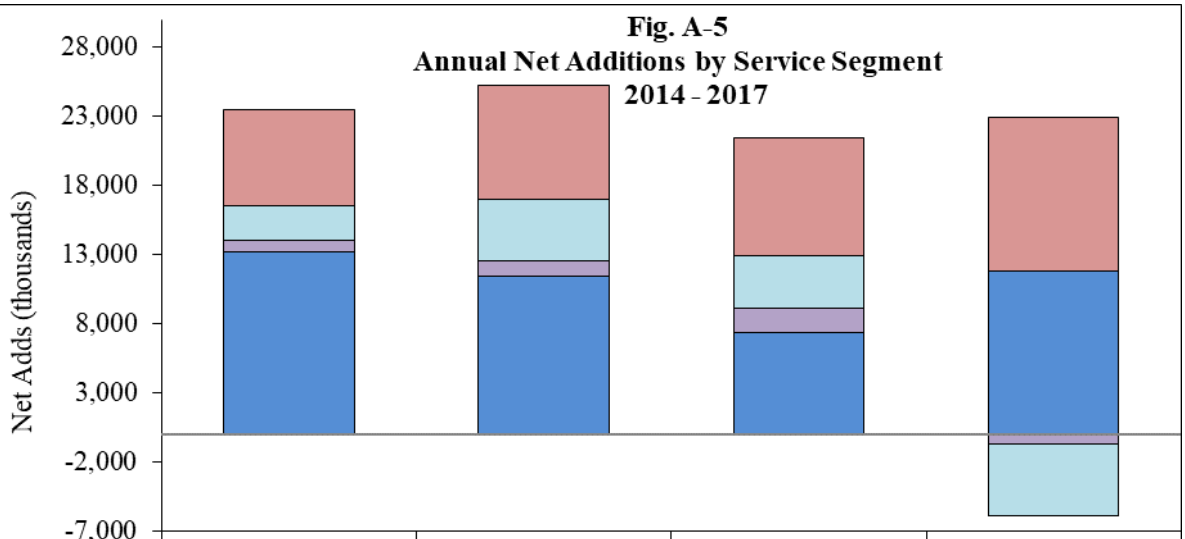
[30] Based on Form 477, the preliminary total number of mobile voice telephone subscriptions at year-end 2017 was 340.1 million, as compared to 338.2 million at year-end 2016. We again note that the year-end Form 477 data reported here are preliminary only, and are subject to corrections as appropriate by the service provider. The final data will be published in due course by the agency. *See, e.g.*, FCC, Wireline Competition Bureau, Voice Telephone Services: Status as of December 31, 2016 (Feb. 2018). https://www.fcc.gov/voice-telephone-services-report. These data do not include non-voice devices.

Fig. A-4
Total Mobile Wireless Connections Annual Net Additions (2014-2017)



Source: NRUF, CTIA Wireless Industry Indices Year-End 2017, Form 477.

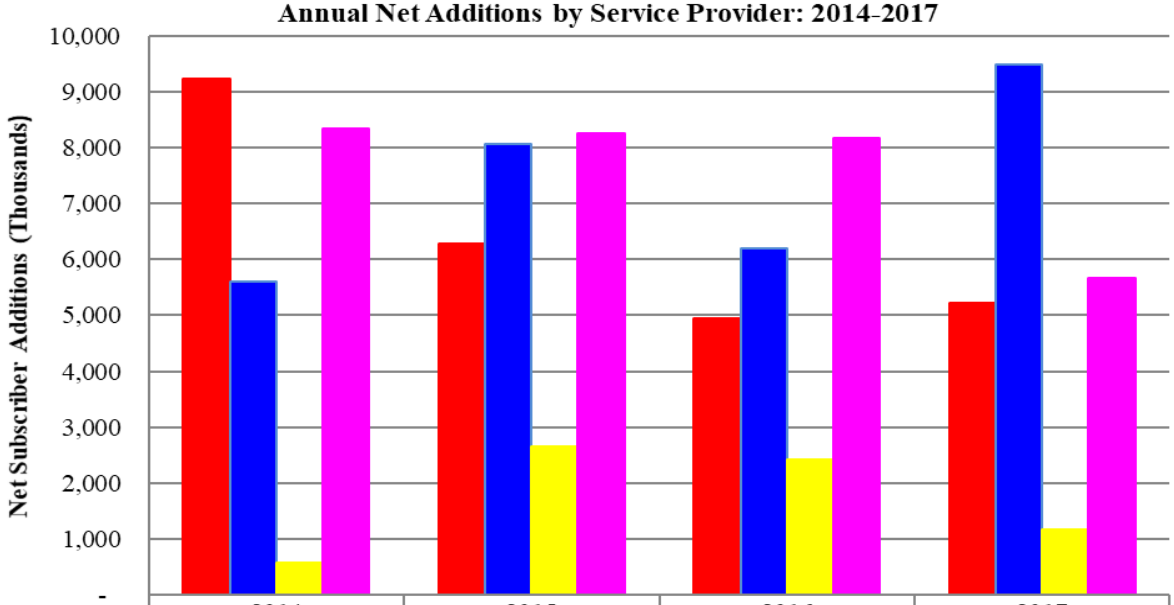
Fig. A-5
Annual Net Additions by Service Segment
2014 - 2017



	2014	2015	2016	2017
Total	23,475	25,396	21,476	17,039
Connected	6,966	8,211	8,578	11,150
Wholesale	2,465	4,466	3,838	-5,215
Prepaid	853	1,136	1,750	-685
Postpaid	13,191	11,401	7,310	11,789

Source: UBS Investment Research. UBS US Wireless 411, V. 59, Figure 42; UBS US Wireless 411, Feb. 2017, Figure 25; and UBS Data 2017.

Fig. A-6
Annual Net Additions by Service Provider: 2014-2017



	2014	2015	2016	2017
Verizon	9,235	6,276	4,955	5,222
AT&T	5,608	8,059	6,196	9,474
Sprint	575	2,649	2,411	1,173
T-Mobile	8,334	8,264	8,173	5,658

Source: UBS Investment Research. UBS US Wireless 411, Version 51, Figure 14; UBS US Wireless 411, Version 59, Figure 62; UBS Wireless 411 Feb. 2017, Figure 35; and UBS Data 2017.

c. Churn

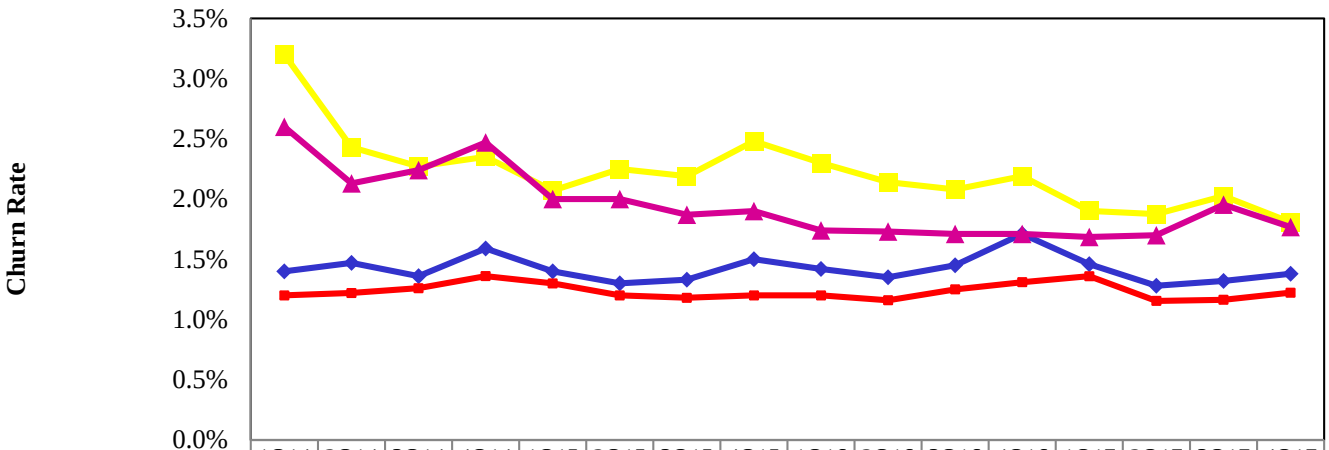
11. Churn measures the percentage of connections that are disconnected from mobile wireless service during a given time period.[31] A service provider's churn rate depends on many factors, such as the distribution of its customers between postpaid and prepaid service plans, customer satisfaction with their service provider, and switching costs.[32] High levels of industry churn can indicate that consumers are not only willing but are also able to switch easily between service providers. For 2017, CTIA reported an annual industry-wide churn rate of 15.9%, and a monthly rate of 1.3%.[33] Figure A-7 shows the churn rates for the four nationwide providers by quarter.

[31] Churn is calculated by dividing the aggregate number of wireless subscriber connections who canceled service during a time period by the total number of wireless subscriber connections at the beginning of that time period. For an annual calculation, if a service provider has an average monthly churn rate of 2%, the service provider would lose 24% of its subscribers over the course of a year. Service providers publish their monthly churn rate information as part of their quarterly filings with the SEC.

[32] *Twentieth Report*, 32 FCC Rcd at 8984, para. 26; *Sixteenth Report*, 28 FCC Rcd at 3865, para. 260.

[33] CTIA Wireless Industry Indices Year-End 2017, at 35. For prepaid services, CTIA reported an annual industry-wide churn rate of 48.3% and a monthly churn rate of 4%. *Id*. at Appendix C, 12.

Fig. A-7
Quarterly Churn Rate for Nationwide Mobile Wireless Providers
1st Quarter 2014- 4th Quarter 2017



	1Q14	2Q14	3Q14	4Q14	1Q15	2Q15	3Q15	4Q15	1Q16	2Q16	3Q16	4Q16	1Q17	2Q17	3Q17	4Q17
AT&T	1.4%	1.5%	1.4%	1.6%	1.4%	1.3%	1.3%	1.5%	1.4%	1.4%	1.5%	1.7%	1.5%	1.3%	1.3%	1.4%
Verizon Wireless	1.2%	1.2%	1.3%	1.4%	1.3%	1.2%	1.2%	1.2%	1.2%	1.2%	1.3%	1.3%	1.4%	1.2%	1.2%	1.2%
Sprint	3.2%	2.4%	2.3%	2.4%	2.1%	2.3%	2.2%	2.5%	2.3%	2.1%	2.1%	2.2%	1.9%	1.9%	2.0%	1.8%
T-Mobile	2.6%	2.1%	2.2%	2.5%	2.0%	2.0%	1.9%	1.9%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	2.0%	1.8%

Source: UBS Investment Research. UBS US Wireless 411, Version 49, Table 16. UBS US Wireless 411, Version 51, Figure 28. UBS US Wireless 411, Version 59, Figure 60; UBS US Wireless 411 Feb. 2017, Figure 35; and UBS Data 2017.

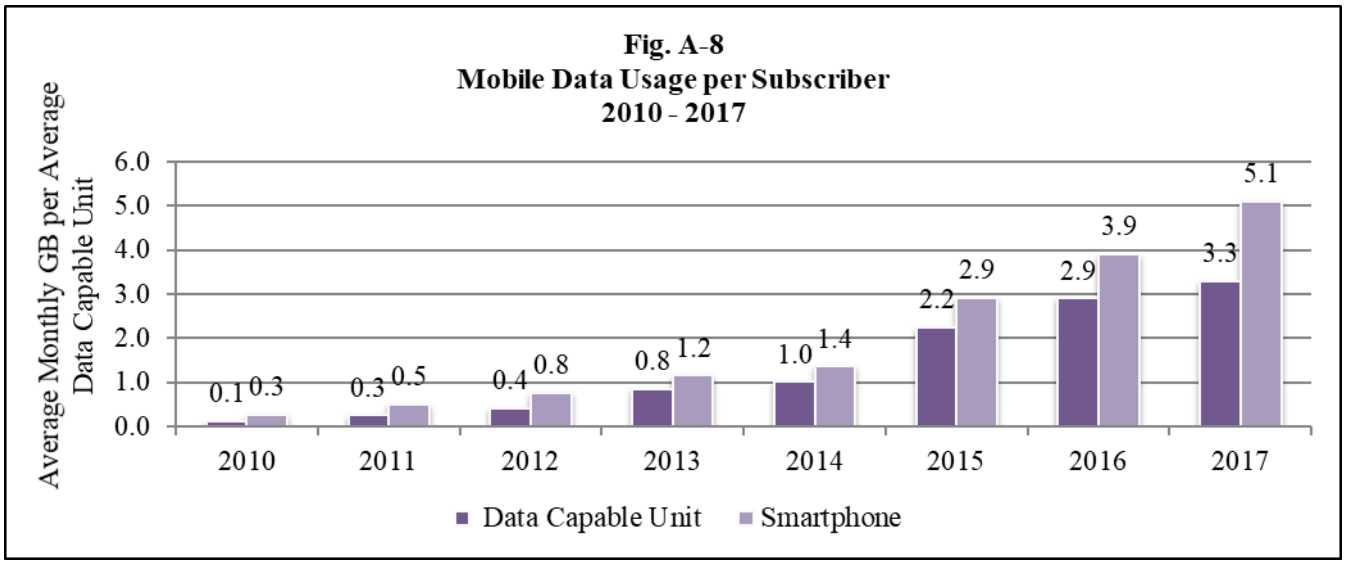
d. Data Usage

12. As shown in Figure A-8, monthly data usage per smartphone subscriber rose to an average of 5.1 GB per subscriber per month, an increase of approximately 31% from year-end 2016 to year-end 2017.[34] Figure A-9 shows that there was a corresponding drop in total annual minutes of voice use (MOUs) of approximately 21%,[35] and in total messaging traffic of approximately 9%.[36]

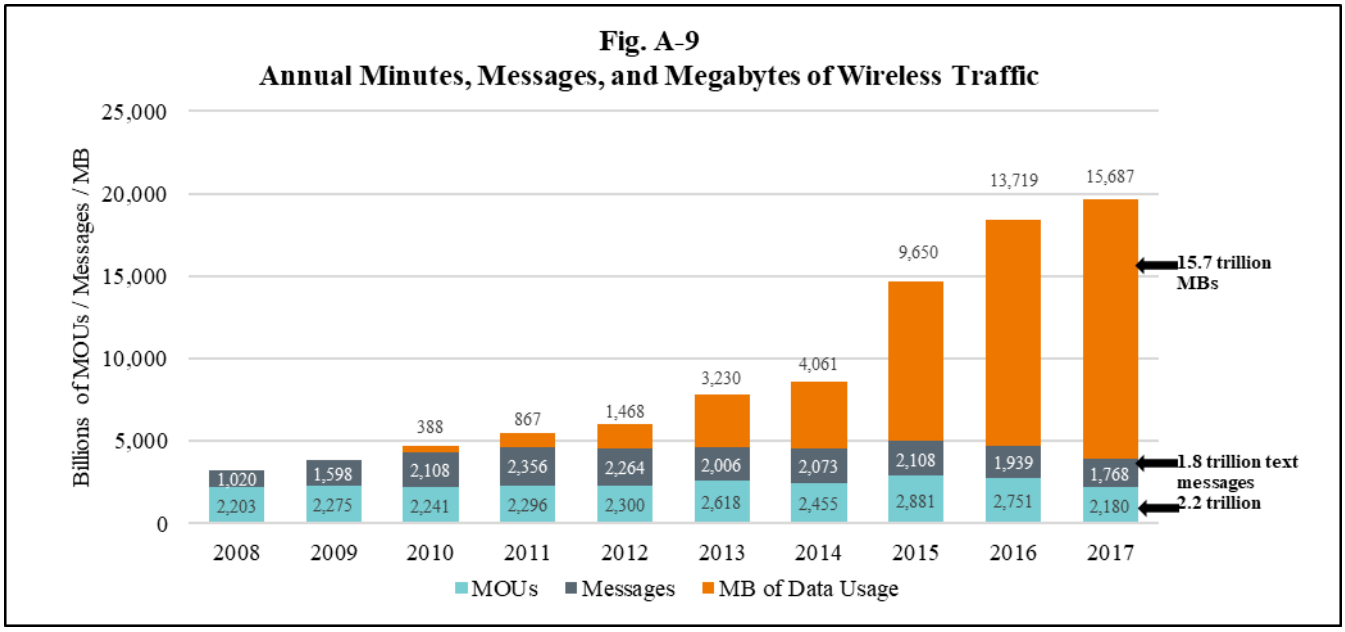
[34] *Id.* at 64, Chart 27.

[35] *Id.* at 60.

[36] *Id.* at 67. This provider-reported messaging traffic does not include traffic from over-the-top messaging applications and services, which would only appear in the total data traffic figures, thereby contributing to the total MB of data traffic. *Id.* at 13.



Source: CTIA Wireless Industry Indices Year-End 2017, at 64, Chart 27.



Source: CTIA Wireless Industry Indices Year-End 2017, at 68, Chart 31.

13. According to a Pew survey, by the end of 2017, smartphone and tablet ownership were 77% and 53%, respectively, up from 51% and 31%, in 2012.[37] As of January 2018, Pew reported that one in five American adults are "smartphone-only" Internet users—they own a smartphone, but do not have traditional fixed home broadband service.[38] U.S. Census Bureau's American Community Survey found that as of 2017, 11% percent of total U.S. households subscribed to a cellular data plan with no other type of Internet subscription.[39] According to preliminary data from the Centers for Disease Control and Prevention (CDC), from December 2014 to December 2017, the percentage of U.S. households that were

[37] Pew Research Center, Mobile Fact Sheet (Feb. 5, 2018), http://www.pewinternet.org/fact-sheet/mobile/.

[38] *Id.*

[39] U.S. Census, 2017 American Community Survey 1-Year Estimates, Types of Computers and Internet Subscriptions, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

identified as wireless-only (no landline telephone service) increased from approximately 45% to approximately 54%.[40]

2. Pricing Levels and Trends

14. The following discussion focuses on pricing developments and changes during the period covered by this *Report*. We note first that mobile service providers offer nationwide pricing plans throughout their service areas, with little disparity in monthly recurring charges between rural and non-rural markets.[41] The majority of mobile wireless subscribers in the United States are billed monthly, after service has been provided (postpaid service), while others pay for services in advance of receiving them (prepaid service).[42]

a. Postpaid Service

15. In 2017, service providers continued the trend of offering unlimited data plans, [43] with major providers adding tiers to their unlimited data plans.[44] Providers also continued not to count certain types of data towards deprioritization and data limits (T-Mobile's "Binge On" program, for example).[45] Not only did service providers compete in pricing, they also competed to offer the best combination of features with their unlimited plans.[46] Verizon Wireless, for example, introduced two new unlimited plans in August 2017, Go Unlimited and Beyond Unlimited.[47] In February 2018, U.S. Cellular offered four

[40] CDC, NCHS, Stephen J. Blumberg and Julian V. Luke, Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, July-December 2017, National Center for Health Statistics (June 2018), https://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201806.pdf.

[41] *Twentieth Report*, 32 FCC Rcd at 9002, para. 48; *Sixteenth Report*, 28 FCC Rcd at 3797, para. 137.

[42] The prepaid and postpaid versions of a given pricing plan or promotion still differ somewhat, largely because prepaid subscribers may lack the credit background or income necessary to qualify for postpaid service. To prevent credit losses and mitigate the credit risk associated with the prepaid segment, service providers require advance payment for both prepaid service and handsets. *Twentieth Report*, 32 FCC Rcd at 9005-06, para. 56.

[43] While a majority of unlimited plans are offered to postpaid subscribers, some providers now also offer unlimited to their prepaid subscribers.

[44] Postpaid subscribers who use up their plan's data allowance in a given month generally experience data deprioritization only during network congestion. *See, e.g.*, Sprint, Sprint Unlimited Data, Talk and Text Cell Phone Plans, https://www.sprint.com/landings/unlimited-cell-phone-plans/?id16=unlimited%20Freedom%20%7CAll&question_box=unlimited%20Freedom%20%7CAll; Verizon Wireless, Above Unlimited FAQs, https://www.verizonwireless.com/support/above-unlimited-faqs/. AT&T, on their Mobile Share Plus plans, offers zero overages, as well as "Rollover Data," which allows its postpaid subscribers to roll over their unused data at no additional cost. AT&T, Mobile Share Flex Pans, https://www.att.com/shop/wireless/data-plans.html; AT&T, Rollover Data, https://www.att.com/shop/wireless/rollover-data.html.

[45] *Twentieth Report*, 32 FCC Rcd at 9004, para. 52.

[46] AT&T Comments at 8.

[47] Verizon Wireless, Verizon Unlimited (Aug. 22, 2017), https://www.verizon.com/about/news/verizon-unlimited. The Go Unlimited plan offers DVD-quality streaming and hotspot speeds of 600 Kbps for $75 (1 line) per month, while Beyond Unlimited includes HD-quality streaming and mobile hotspot with up to 15 GB for $85 (1 line) per month. The terms of service of Verizon Wireless's Unlimited Plans indicate that data may be temporarily slower during any time of congestion with the GO Unlimited plan, and may decrease in times of congestion, after 22 GB of data has been used with Beyond Unlimited. See, e.g., Verizon Wireless, Go Unlimited FAQs, https://www.verizonwireless.com/support/go-unlimited-faqs/; Verizon Wireless, Beyond Unlimited FAQs, https://www.verizonwireless.com/support/beyond-unlimited-faqs/.

lines with unlimited data for $35 each.[48] Verizon Wireless added a new data plan called Above Unlimited in June 2018, that allows customers to mix and match different unlimited plans, and it includes 75 GB of LTE data, along with HD video streaming for $95 (1 line) per month.[49] Later that month, AT&T launched two new top-tier unlimited data offerings, Unlimited & More for $70 for a single line, and Unlimited & More Premium for $80 for a single line (the latter includes its new WatchTV streaming video service).[50] In July 2018, Sprint introduced two new unlimited plans: its top-tier plan, Unlimited Plus, offers 1080p video streaming, 15 GB of personal hotspot data, subscriptions to Hulu and Tidal for $70 per month for one line of service, while Unlimited Basic streams video at 480p resolution, includes 500 MB of personal hotspot service, and subscriptions to Hulu for $60 per month for one line of service.[51] In contrast, T-Mobile introduced a less expensive unlimited plan in August 2018, Essentials, which starts at $60 for the first line and includes unlimited talk, text and smartphone data.[52]

b. Prepaid Service

16. The four nationwide service providers also offer prepaid service under their own prepaid brands, in addition to selling mobile wireless service wholesale to MVNOs, which then resell service on the nationwide networks under a variety of prepaid brands. Verizon Wireless has the smallest share of prepaid subscribers among the nationwide service providers, with only one prepaid brand, Verizon Wireless Prepaid. To varying degrees, the other three nationwide service providers pursue a multi-brand prepaid strategy.[53] TracFone, the largest MVNO reseller, also has multiple prepaid brands, including Straight Talk, telcel, and SafeLink, which target different market and demographic segments such as premium, Hispanic, or low-income subscribers.[54]

17. As postpaid offerings have shifted away from term contracts and equipment subsidies, service providers have adopted pricing plans and promotions for their high-end prepaid monthly service offerings that are similar to their postpaid offerings. For example, unlimited prepaid plans were first introduced in February 2017 by Sprint's Boost Mobile, and in October 2017, Boost Mobile offered a family plan of five lines with unlimited data for $100 a month to consumers who switched service.[55] AT&T's Cricket offered new customers twelve months of unlimited data access, calls, texts and media

[48] U.S. Cellular, U.S. Cellular Offering Four Lines With Unlimited Data For $35 Each (Feb. 12, 2018), https://www.uscellular.com/about/press-room/2018/USCELLULAR-OFFERING-FOUR-LINES-WITH-UNLIMITED-DATA-FOR-35-DOLLARS-EACH.html.

[49] Verizon Wireless, Mix and match your unlimited plans (Jun. 14, 2018), https://www.verizon.com/about/news/mix-and-match-your-unlimited-plans.

[50] AT&T, AT&T Debuts "WatchTV" With 2 New Unlimited Wireless (Jun. 21, 2018), http://about.att.com/newsroom/watchtv_app_with_unlimited_wireless.html.

[51] Sprint, Sprint's Industry-Leading Unlimited Plans Just Got Even Better! New Unlimited Plans Include Features Customers Love for the Best Price (Jul. 12, 2018), https://newsroom.sprint.com/sprints-industry-leading-unlimited-plans-just-got-even-better-new-unlimited-plans-include-features-customers-love-for-best-price.htm.

[52] T-Mobile, Introducing T-Mobile Essentials: Smartphone Freedom on a Great Network at the Right Price (Aug. 6, 2018), https://www.t-mobile.com/news/introducing-t-mobile-essentials.

[53] Sprint prepaid brands include Boost Mobile, Virgin Mobile, and Assurance Wireless (under the Assurance Wireless brand, Virgin Mobile provides service to Lifeline eligible subscribers and subscribers who have lost their Lifeline eligibility and retain Assurance Wireless retail service); AT&T prepaid brands include AT&T Prepaid and Cricket; and T-Mobile prepaid brands include MetroPCS.

[54] TracFone Wireless Inc., Brands, http://www.tracfonewirelessinc.com/en/brands/.

[55] Boost Mobile, Boost Mobile Offers Unsurpassed Value in Family Plans – Five Lines with Unlimited Gigs for $100 a Month and Free Phones (Oct. 25, 2017), http://newsroom.sprint.com/boost-mobile-offers-unsurpassed-value-in-family-plans-five-lines-with-unlimited-gigs-for-100-month-and-free-phones.htm.

messages in their Unlimited 2 Plan for $40 a month in February 2018.[56] In April 2018, T-Mobile's MetroPCS offered new customers two months of unlimited data for free.[57] Generally, prepaid subscribers who reach the limit of their high-speed data allowance in a given month may continue to use their handsets for data service on an unlimited basis, but at reduced speeds.[58] For example, Cricket reduces data download speeds to a maximum of 128 Kbps after the customer's high-speed data allowance is used.[59]

c. Price Indicators for Mobile Wireless Services

18. It is difficult to directly compare prices because providers offer a variety of plans, frequently under multipart pricing schemes, which also vary in non-price terms and features, such as the consequences of reaching usage limits.[60] Figures A-10 and A-11 present monthly postpaid prices for the four nationwide service providers' standard and premium unlimited plans, including discounts for auto-pay, which are now common.[61] Figure A-12 shows the current monthly prices for major prepaid service providers. Premium plans tend to have higher thresholds of data usage before deprioritization, more 4G LTE hotspot data, increased streaming video quality, and increased international allowances compared with standard plans offered by the same provider. Unlimited service is also the primary offering of prepaid plans, though postpaid users frequently are given priority over prepaid users on a given network during times of peak congestion.[62] Further, the heaviest postpaid users may also experience deprioritized speeds during periods of peak network congestion after they have exceeded certain monthly data thresholds.[63]

[56] Cricket, Cricket Helps Make Your Tax Refund Go Further with Unlimited Data for Just $40/Month http://cricketwireless.mediaroom.com/cricket-helps-make-your-tax-refund-go-further-with-unlimited-data-for-just-40-month.

[57] T-Mobile, Switch to MetroPCS Today and get TWO Months Unlimited Data Free (Apr. 12, 2018), https://www.t-mobile.com/news/metropcs-two-months-free.

[58] *Twentieth Report*, 32 FCC Rcd at 9005, para. 55.

[59] Cricket Wireless, Mobile Broadband Information, https://www.cricketwireless.com/legal-info/mobile-broadband-information.html.

[60] It is therefore difficult to identify sources of information that track mobile wireless service prices in a comprehensive and consistent manner. In addition, data on subscribership is not available at the plan level and any average price comparison implicitly assumes uniform subscribership of all plans. *See, e.g.*, *Twentieth Report*, 32 FCC Rcd at 9006, para. 57; *Sixteenth Report*, 28 FCC Rcd at 3797, para. 137. According to analysis by Recon Analytics, the cost per MB has fallen significantly over the past decade, from $1.37 per MB in 2007 to less than half a cent per MB in 2016. FierceWireless, Industry Voices—Entner: Consumer 'Surplus' in Wireless Rises $192B in 2 Years (Aug. 14, 2017), http://www.fiercewireless.com/wireless/industry-voices-entner-consumer-surplus-wireless-rises-192b-2-years.

[61] In addition, T-Mobile incorporates taxes and fees into its advertised prices for its T-Mobile One plan. As these fees vary by locality, there is no way to fully account for the differences in pricing in Figures A-10 and A-11.

[62] MetroPCS in its Terms and Conditions indicates that "[t]o differentiate the services we sell, at times and at locations where there are competing customer demands for network resources, we give the data traffic of customers who choose T-Mobile-branded services precedence over the data traffic of customers who choose non-T-Mobile-branded services such as Metro by T-Mobile." *See* https://www.metropcs.com/terms-conditions/terms-conditions-service.html.

[63] As noted above, the average consumer uses about 5 GB of data per month, and after a certain level of data consumption (between 20 and 50 GB depending on the provider), data may be deprioritized. *See* Section II.A.1.d.

Fig. A-10
Monthly Standard Unlimited Prices for Top 4 Service Providers

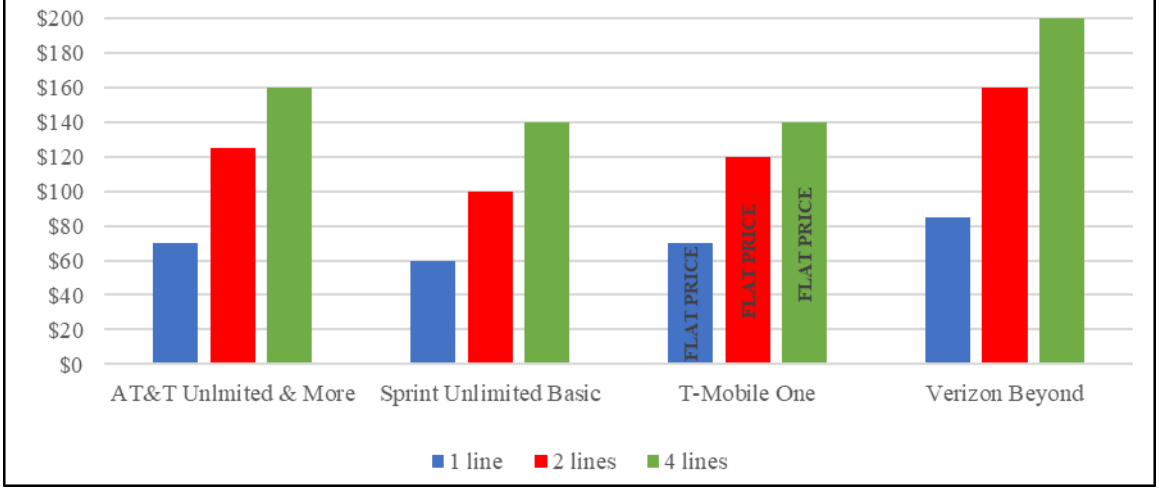
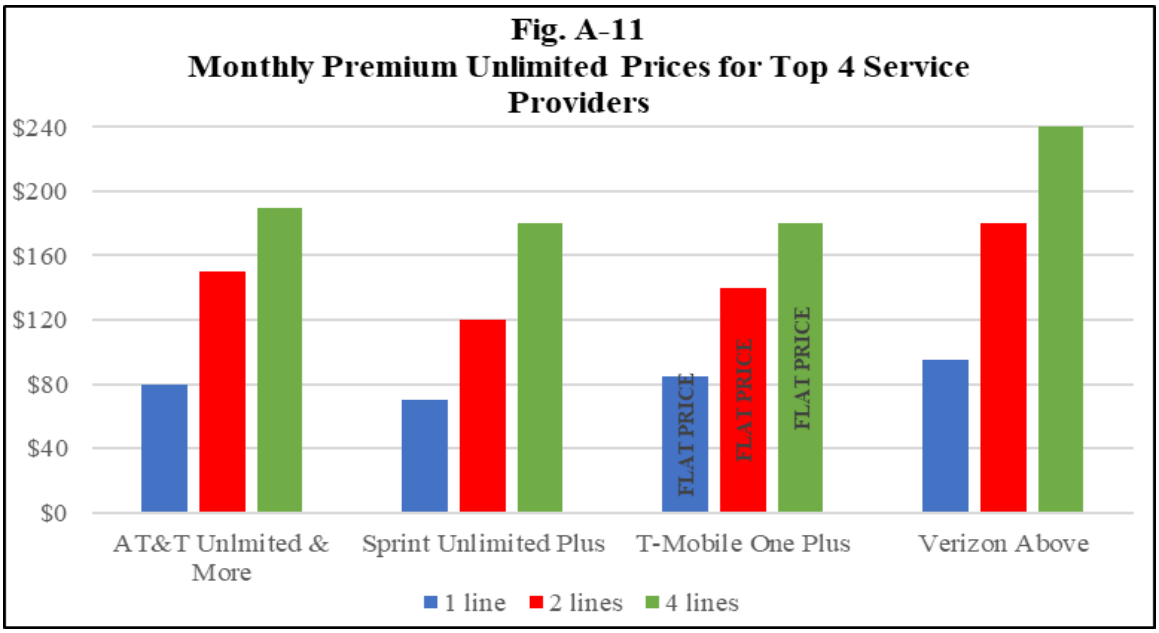
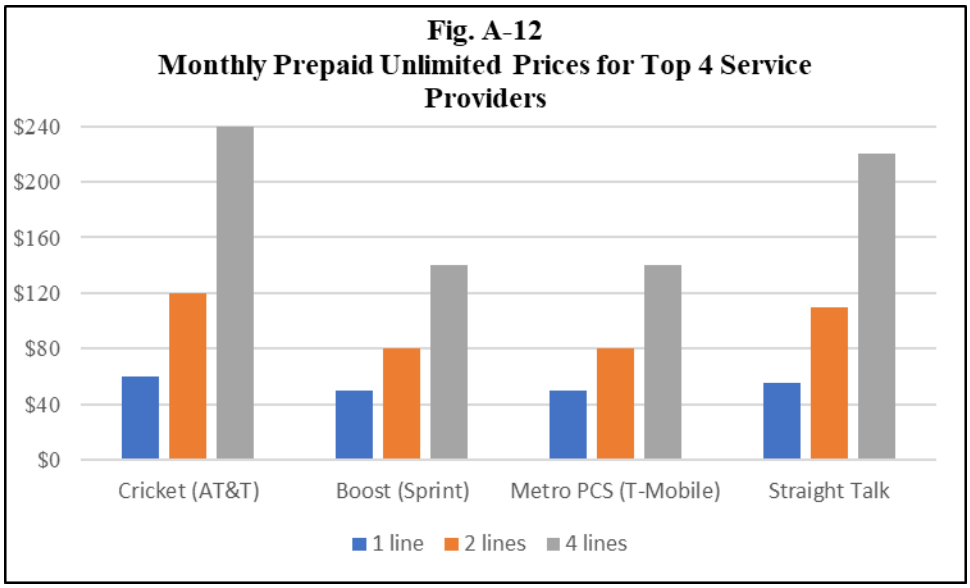


Fig. A-11
Monthly Premium Unlimited Prices for Top 4 Service Providers



Note: The prices for unlimited data plans in Figures A-10 and A-11 were taken from service providers' websites on September 1, 2018. Prices include any per line charges indicated by the service provider. Prices do not include any additional charges such as for equipment installment plans, insurance, international use, or mobile hotspots. If a service provider includes any such feature as part of its unlimited data plan without extra charge, the above price would include this feature. Further, the above prices do not include any one-time charges paid, such as activation fees and termination fees. Prices and the specifics of the plans are subject to change.



Note: The prices were taken from service providers' websites on September 1, 2018. Prices include any per line charges indicated by the service provider. Prices and the specifics of the plans are subject to change.

19. *CPI.* The Consumer Price Index (CPI) is a measure of the average change over time in the prices paid by consumers for a fixed market basket of consumer goods and services. As documented in previous *Reports*, two different pricing indicators—the Wireless Telephone Services CPI,[64] and the per-minute price of voice service—show that mobile wireless prices have declined significantly since the mid-1990s.[65] According to CPI data, the price (in constant dollars) of mobile wireless services has continued to decline: from 2016 to 2017, the annual Wireless Telephone Services CPI decreased by 11% while the overall CPI increased by 2%, and the broader Telephone Services CPI fell by 7%.[66] Further, from 2013 through 2017, the annual Wireless Telephone Services CPI decreased by approximately 17% and the Telephone Services CPI decreased by approximately 10%, while the overall CPI increased by approximately 5%.

20. *Average Revenue Per Unit.* Various measures of Average Revenue per Unit (ARPU) are frequently used as a proxy for price, particularly in industries with multiple pricing plans and complex rate structures, such as mobile wireless service.[67] As shown in Figure A-13 below, which is based on

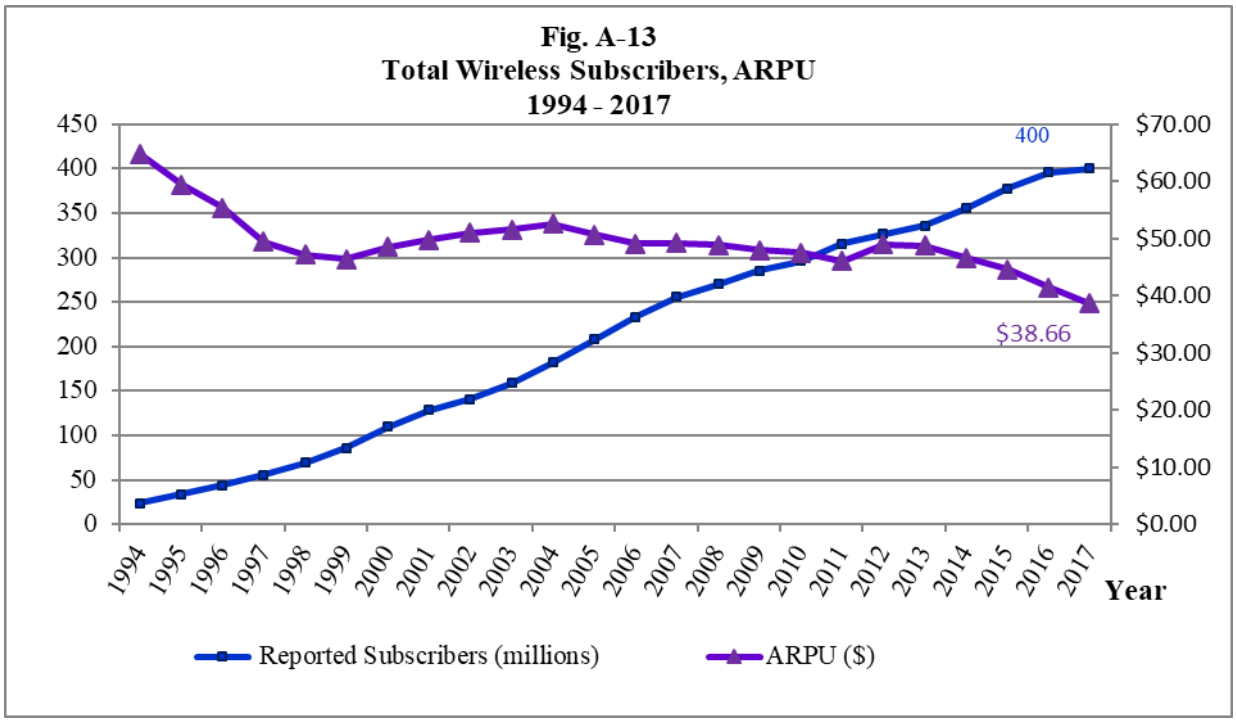
[64] All CPI figures were taken from BLS databases: Bureau of Labor Statistics, http://www.bls.gov. The index used in this analysis, the CPI for All Urban Consumers (CPI-U), represents about 87% of the total U.S. population. Bureau of Labor Statistics, Consumer Price Index: Frequently Asked Questions, https://www.bls.gov/cpi/questions-and-answers.htm. The CPI category "Telephone Services" has two components: wireless telephone services and landline telephone services. Additional information can be found at Bureau of Labor Statistics, Consumer Price Index: How the Consumer Price Index Measures Price Change for Telephone Services, https://www.bls.gov/cpi/factsheets/telephone-services.htm.

[65] *See, e.g.*, *Twentieth Report*, 32 FCC Rcd at 9008, para. 58; *Sixteenth Report*, 28 FCC Rcd at 3875, 3877, para. 265, Table 38.

[66] For changes in the CPI over time, *see* Appendix A-3: CPI.

[67] *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*, Seventeenth Report, 29 FCC Rcd 15311, 15328, para. 35 & n.52 (WTB 2014) (*Seventeenth Report*); Patrick McCloughan and Sean Lyons, *Accounting for ARPU: New evidence from international panel data*, Telecommunications Policy 30, 521-32 (2006); Eun-A Park, Krishna Jayakar, *Competition between Standards and the Prices of Mobile Telecommunication Services: Analysis of Panel Data*, TPRC 2015 (Aug. 15, 2015).

CTIA data, industry ARPU fell sharply during 2017 from $41.50 to $38.66, a decline of approximately 7%.[68] Recent changes by service providers, such as the removal of overage charges, the move toward unlimited data plans, and Equipment Installment Plans (EIPs) have all contributed to the reported decline in ARPU. Figure A-13 also shows subscribers/connections and ARPU for more than 20 years.[69]



Source: Based on CTIA Wireless Industry Indices Year-End 2017.

21. *Average Revenue Per Unit by Service Provider.* Based on UBS estimates, as seen in Figure A-14, from the fourth quarter of 2014 to the fourth quarter of 2017, ARPU declined for all service providers, with the exception of T-Mobile: AT&T's ARPU declined by approximately 19%; Sprint's ARPU declined by approximately 20%; Verizon Wireless's ARPU declined by approximately 23%; while T-Mobile's ARPU was virtually constant. Industry ARPU declined by approximately 18% over this time period.

[68] CTIA reported an industry average measure of ARPU which is calculated "based on total reported wireless service revenues for the period, divided by the average reported subscriber units during the survey period." CTIA Wireless Industry Indices Year-End 2017, at 8.

[69] For additional details on ARPUs from 1993 to 2017, *see* Appendix A-4: ARPU.

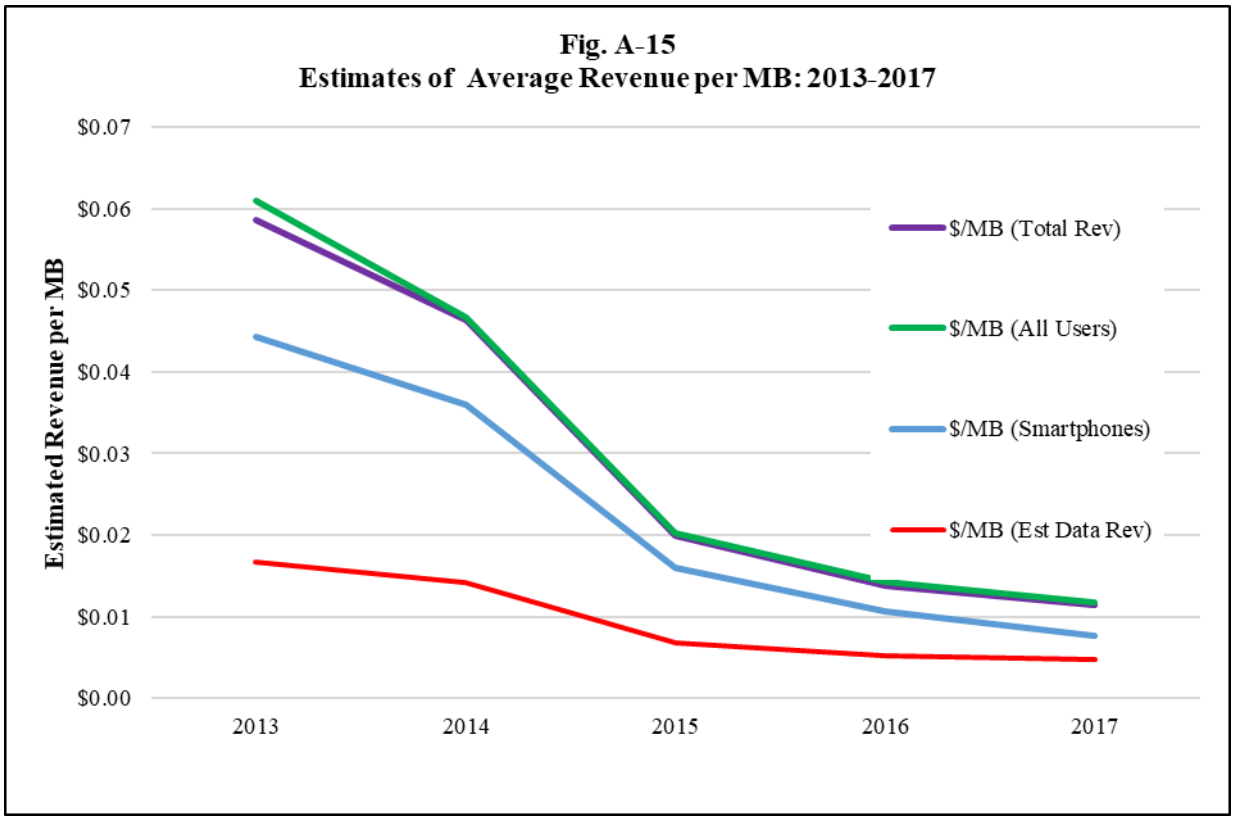
Fig. A-14
ARPU Estimates of Publicly Traded Facilities-Based Mobile Wireless Service Providers
4th Quarter 2014–4th Quarter 2017

Nationwide Providers	4Q14	4Q15	4Q16	4Q17
AT&T	$42.04	$38.78	$36.58	$34.13
Sprint	$40.44	$35.54	$32.03	$32.49
T-Mobile	$35.56	$34.53	$33.80	$35.62
Verizon Wireless	$45.52	$40.99	$37.52	$35.27
U.S. Cellular	$53.58	$49.32	$49.03	$46.89
Industry ARPU	**$42.27**	**$38.54**	**$35.93**	**$34.73**

Source: UBS Data 2017.

22. *Estimated Average Revenue per MB.* Given the variation in data plans, including shared plans, the lack of information on how much data users consume across these different plans, and the fact that revenues specific to data consumption are no longer reported by service providers, we lack the necessary information to measure precisely a true price per megabyte (MB) data used. However, by making certain assumptions,[70] we can calculate various industry-wide estimates of the average revenues per MB. Figure A-15 below shows four different estimates of the average revenue per MB, based on data from CTIA and the U.S. Census Bureau. All four estimates indicate that average revenue per MB has been declining. Specifically, as of year-end 2017, these estimates show a decrease of approximately 10% to approximately 29% compared to 2016, and a decrease of approximately 72% to approximately 83% compared to 2013.

[70] For a full discussion of the methodology used to derive $/MB, *see Twentieth Report*, 32 FCC Rcd at 9010, para. 61 & n.202.



Source: Based on data from the CTIA Wireless Industry Indices Year-End 2017 and the U.S. Census.

3. Non-Price Competition

a. Investment

23. Over the past 8 years, mobile wireless service providers in the United States have invested, based on CTIA data,[71] more than $229.5 billion in their networks,[72] which has resulted in higher data speeds, expanded network coverage, and increased network densification.[73] Based on UBS data, wireless service providers made capital investments of $28.5 billion in 2017, an increase of approximately 2.3% from the $27.9 billion invested in 2016. As shown in Figure A-16, absolute capital expenditures by AT&T and Verizon Wireless consistently have exceeded those by T-Mobile and Sprint. In 2016-17, AT&T, T-Mobile, and Verizon Wireless each had CAPEX of approximately 16.3% to 17.4% of service revenue.[74] CAPEX by Sprint, on the other hand, varied considerably over the past few years, from

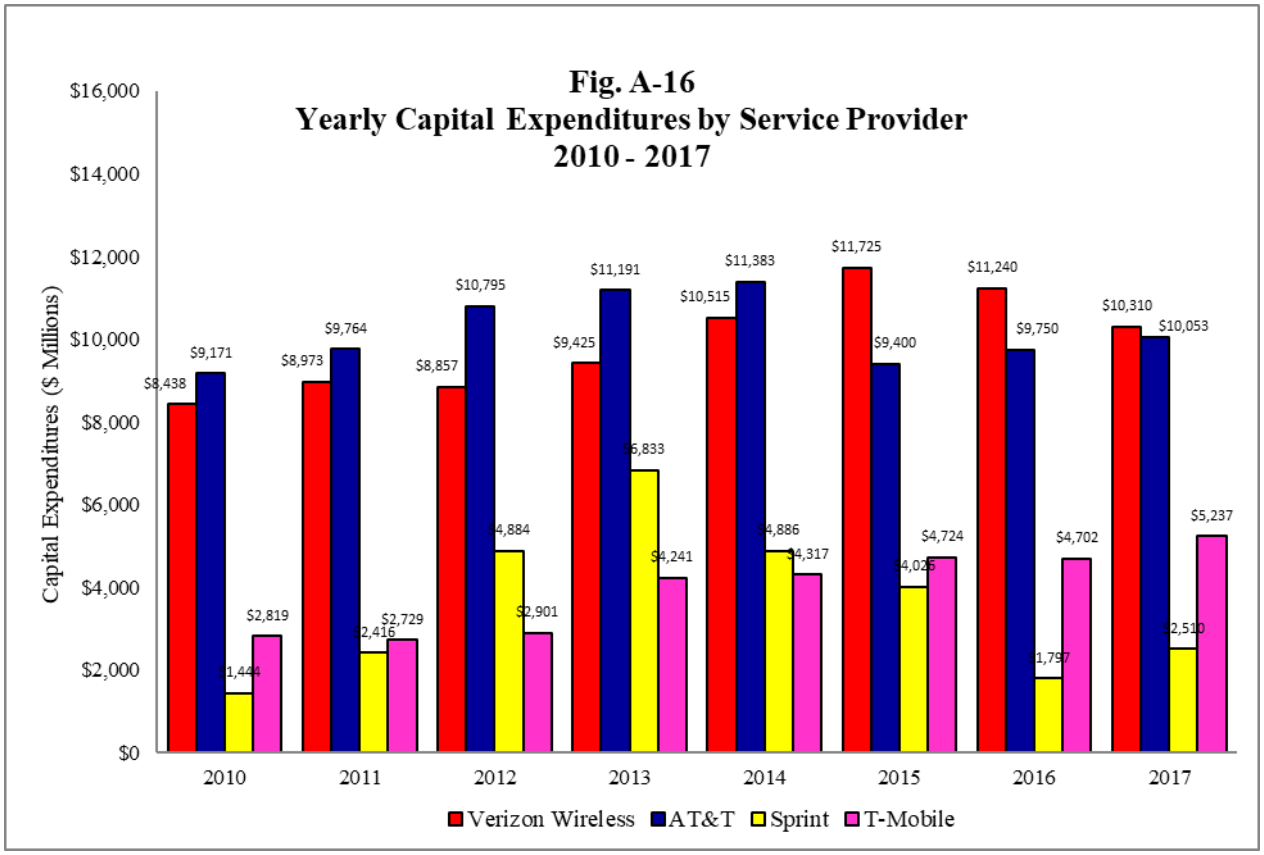
[71] According to CTIA, the capital investment reported "excludes the cost of licenses used to deliver wireless service, whether acquired at private or public auctions, or via other acquisition processes. Likewise, investment by third-party tower erectors, and non-carrier owners or managers of networks, is not tracked by nor reflected in CTIA's survey. CTIA's survey collects only historical (past data) and not projected or planned investment." CTIA Wireless Industry Indices Year-End 2017, at 47.

[72] CTIA Wireless Industry Indices Year-End 2017, at 47.

[73] The *Sixteenth Report* noted that CAPEX in system/network assets may be cyclical or "lumpy" because technological change in the mobile wireless service industry is commercially implemented in successive generations of technologies. Consequently, CAPEX may vary between periods and fluctuations in measures of CAPEX are consistent with the cyclical nature of technological adoption in the mobile wireless service industry. *Sixteenth Report*, 28 FCC Rcd at 3842, para. 215.

[74] UBS Data, Sept. 2018.

approximately 17% of service revenue in 2015, to 7.5% in 2016, before increasing to 11% in 2017.[75] The mobile wireless industry is currently in the process of preparing for the introduction of 5G services, and equipment vendors such as Ericsson reported that its "networks segment saw a 2% increase year-over-year with North American (U.S.) operators' investments in 5G driving that growth."[76]



Source: UBS US Wireless 411, Version 55, Figure 54; UBS US Wireless 411, Version 57, Figure 60; UBS US Wireless 411, Version 59, Figure 72; Wireless 411, February 2017, Figure 38; UBS Data 2017.

b. Mobile Wireless Devices, Services, and Advertising

24. Mobile wireless service providers compete by offering consumers a large variety of mobile wireless devices and differentiated services at a variety of prices.[77] In addition, they compete for customers by advertising and marketing, with marketing campaigns focusing on the quality, coverage, and reliability of their mobile broadband networks.[78] They also have promoted the advantages of their particular service plans, including unlimited plans and the prices of their plans relative to those of their rivals.[79] Some providers marketed mobile wireless service plan bundles with content offerings or device offerings: for example, Verizon Wireless advertised its unlimited plan alongside an offering for Google's

[75] *Id*.

[76] RCR Wireless, Ericsson focused on 5G in the US, its biggest market (Aug. 10, 2018), https://www.rcrwireless.com/20180810/5g/ericsson-focused-on-5g-in-the-us-its-biggest-market.

[77] *Twentieth Report*, 32 FCC Rcd at 9011, para. 62.

[78] *See id.* at 9013, para. 66; FierceWireless, The Top 5 Wireless Ads: Verizon spends $30M on Pixel 2 spots in November (Dec. 12, 2017), https://www.fiercewireless.com/wireless/top-5-wireless-ads-verizon-spends-30m-pixel-2-spots.

[79] *Id*.

Pixel 2 phone, while Sprint and AT&T both advertised their plans alongside offerings for Apple's iPhone.[80] AT&T advertised free HBO with its unlimited data plans, and T-Mobile advertised a free subscription to Netflix.[81] In 2017, Verizon Wireless spent more than $2.6 billion on advertising, down slightly from $2.7 billion in 2016; AT&T spent $3.8 billion, similar to its 2016 spending; T-Mobile spent $1.8 billion, up slightly from $1.7 billion in 2016; and Sprint spent $1.3 billion, up slightly from $1.1 billion in 2016.[82]

c. Speed of Service

25. Network speed is a key characteristic of mobile wireless performance, and the Commission has recognized the importance of accurate and timely data on wireless upload and download speeds.[83] Mobile broadband speeds experienced by consumers can vary greatly with a number of factors, including the service provider's received signal quality, cell traffic loading and network capacity in different locations, as well as the capabilities of consumers' devices.[84] Because these and other factors cause variations in mobile network performance, various methodologies are used to measure mobile network speeds. The two most prevalent methodologies rely on crowdsourced data and structured sample data. Crowdsourced data are user-generated data produced by consumers who voluntarily download speed test applications on their mobile devices while structured sample data, by contrast, are generated from tests that control for the location and time of the tests as well as for the devices used in the test.[85] This *Report* presents speed data using the Ookla Net Index data (crowdsourced), OpenSignal data (crowdsourced), and RootMetrics (structured sample).[86]

26. Figures A-17 and A-18 present the nationwide mean and median LTE download and upload speeds based on Ookla data by service provider for the second half of 2016 through the second half of 2017.[87] Figure A-19 presents the increase over time for mean and median LTE download speeds

[80] *Id*.

[81] *Id*.

[82] Verizon, 2017 Annual Report (Form 10-K) at note 14 (Feb. 23, 2018); Verizon, 2016 Annual Report (Form 10-K) at note 14 (Feb. 21, 2017); AT&T Inc., 2017 Annual Report (Form 10-K) at note 19 (Feb. 20, 2018); AT&T Inc., 2016 Annual Report (Form 10-K) at note 18 (Feb. 17, 2017); T-Mobile 2017 Annual Report (Form 10-K) at 68 (Feb. 20, 2018); T-Mobile 2016 Annual Report (Form 10-K) at 60 (Feb. 14, 2017); Sprint, 2017 Annual Report (Form 10-K) at F-17 (May 24, 2018); Sprint, 2016 Annual Report (Form 10-K) at F-16 (May 26, 2017).

[83] *See generally Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 17-199, 33 FCC Rcd 1660, 1673, para. 31 & n.92 (2018) (*2018 Broadband Deployment Report*). In addition, in the section on broadband deployment, we assess the extent to which Americans are covered by mobile LTE (based on Form 477 data at minimum advertised speeds of 5 Mbps/1 Mbps, and Ookla data at a median speed of 10 Mbps/3 Mbps or higher).

[84] For a detailed discussion of the various factors, *see Twentieth Report*, 32 FCC Rcd at 9033, para. 87; *Sixteenth Report*, 28 FCC Rcd at 3895, para. 293.

[85] For a detailed discussion of crowdsourcing and structured sample data, *see Twentieth Report*, 32 FCC Rcd at 9033-34, para. 88.

[86] The results based on the CalSPEED drive-test data gathered by the California Public Utility Commission (CPUC) (structured sample) can be found in Appendix A-5: Mobile Wireless Speeds. In addition, while speed metrics based on the FCC Speed Test (available for both Android phones and the iPhone) were reported in the *Seventeenth Report* through the *Nineteenth Report*, we did not report these metrics in the *Twentieth Report* and do not report them in this *Report* due to certain anomalies found in the underlying data. An in-depth discussion of the Measuring Broadband America Program's FCC Speed Test is available in the *Seventeenth Report. Seventeenth Report*, 29 FCC Rcd at 15467, Appendix VI., paras. 7-9; *see also* FCC, Measuring Mobile Broadband Performance, http://www.fcc.gov/measuring-broadband-america/mobile.

[87] Ookla gathers crowdsourced mobile speed data through the use of its Speedtest mobile app. Speedtest, Ookla Speedtest Mobile Apps, http://www.speedtest.net/mobile/. An in-depth discussion of the Ookla speed test is

(continued….)

for all providers, from the first half of 2016 through the first half of 2018. Based on Ookla data, Figure A-19 indicates that the median LTE download speed increased from 12.8 Mbps to 19.5 Mbps, an increase of approximately 52%, over this time period.

Fig. A-17
Ookla Speed Test--Estimated LTE Download Speeds by Service Provider, Nationwide

Service Provider	2H2016			1H2017			2H2017		
	Mean Down load Speed (Mbps)	Median Down load Speed (Mbps)	Number of Tests (’000s)	Mean Down load Speed (Mbps)	Median Down load Speed (Mbps)	Number of Tests (’000s)	Mean Down load Speed (Mbps)	Median Down load Speed (Mbps)	Number of Tests (’000s)
AT&T	22.74	16.23	2,519	23.63	16.12	2,664	23.66	15.55	2,834
Sprint	15.51	9.20	2,269	18.11	9.81	2,407	21.78	11.11	2,123
T-Mobile	23.61	16.72	3,744	26.20	18.32	3,769	30.48	21.12	3,498
Verizon Wireless	23.51	17.12	3,044	23.82	16.32	4,362	25.93	16.78	4,269

Source: Ookla SPEEDTEST intelligence data, © 2018 Ookla, LLC. All rights reserved. Published with permission of Ookla.

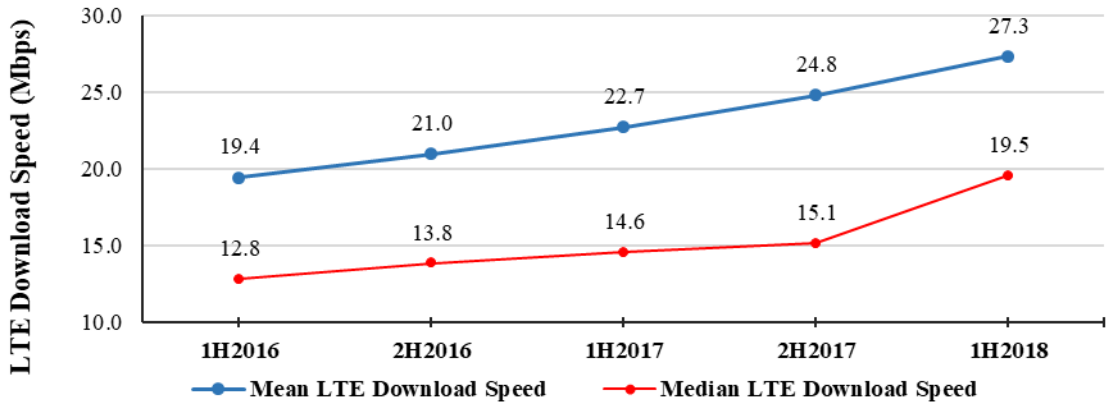
Fig. A-18
Ookla Speed Test - Estimated LTE Upload Speeds by Service Provider, Nationwide

Service Provider	2H2016			1H2017			2H2017		
	Mean Upload Speed (Mbps)	Median Upload Speed (Mbps)	Number of Tests (’000s)	Mean Upload Speed (Mbps)	Median Upload Speed (Mbps)	Number of Tests (’000s)	Mean Upload Speed (Mbps)	Median Upload Speed (Mbps)	Number of Tests (’000s)
AT&T	7.42	5.23	2,519	7.46	5.13	2,664	7.53	4.91	2,834
Sprint	4.73	3.48	2,269	4.83	3.51	2,407	3.82	2.69	2,123
T-Mobile	11.98	9.37	3,744	12.07	9.45	3,769	11.99	9.36	3,498
Verizon Wireless	8.28	4.93s	3,044	8.69	5.24	4,362	9.11	5.56	4,269

Source: Ookla SPEEDTEST intelligence data, © 2018 Ookla, LLC. All rights reserved. Published with permission of Ookla.

(Continued from previous page)
available in the *Seventeenth Report. Seventeenth Report*, 29 FCC Rcd at 15465-66, Appendix VI., paras. 1-6. The upload and download speeds were calculated by Ookla and provided to the Commission for use in this *Report*. Note that in recent years, Ookla has updated their data cleaning and aggregation rules, and thus the reported data may differ slightly from previous *Reports*.

Fig. A-19
Ookla Speed Test: Total LTE Download Speeds, Nationwide



Source: Ookla SPEEDTEST intelligence data, © 2018 Ookla, LLC. All rights reserved. Published with permission of Ookla.

27. Nationwide average LTE download speeds for the second half of 2016 through the second half of 2017 from OpenSignal are presented in Figure A-20 below.[88]

Fig. A-20
OpenSignal –Estimated LTE Download Speeds, Nationwide

Service Provider	2H2016	1H2017	2H2017
	Av. Download Speed (Mbps)	Av. Download Speed (Mbps)	Av. Download Speed (Mbps)
AT&T	13.86	12.92	13.27
Sprint	8.99	9.76	12.02
T-Mobile	16.65	17.45	19.42
Verizon Wireless	16.89	14.91	17.77
Total	13.95	14.99	16.31

Source: OpenSignal, 2018, © OpenSignal.

28. We present in Figure A-21 the mobile wireless indices within the United States for the second half of 2016 through the second half of 2017 from RootMetrics.[89]

[88] OpenSignal gathers crowdsourced mobile speed data through the use of its mobile app. OpenSignal, State of Mobile Networks: USA, https://opensignal.com/reports/2017/02/usa/state-of-the-mobile-network. In addition to user-initiated tests, OpenSignal also collects network speed measurements at a high frequency per user, https://opensignal.com/methodology. OpenSignal does not provide summary statistics for LTE upload speeds before the first half of 2018, thus only LTE download speeds are included.

[89] RootMetrics, Methodology, http://rootmetrics.com/en-US/methodology. RootMetrics performs drive tests and stationary tests in specific locations, using the leading Android-based smartphone for each network. RootScores are scaled from 0 to 100. An in-depth discussion of the RootMetrics dataset is available in the *Seventeenth Report*, 29 FCC Rcd at 15467-68, Appendix VI., paras 10-11.

Fig. A-21
RootMetrics National Speed Index Data, 2nd Half 2016--2st Half 2017

	2nd Half 2016			1st Half 2017			2nd Half 2017		
Service Provider	Speed Index	Data Index	Text Index	Speed Index	Data Index	Text Index	Speed Index	Data Index	Text Index
AT&T	89.6	94.4	95.3	91.4	95.5	95.6	92.3	95.7	96.0
Sprint	72.3	82.5	95.0	78.2	86.6	95.2	77.8	87.7	95.2
T-Mobile	87.1	90.6	89.1	90.5	93.2	89.5	90.9	93.1	91.5
Verizon Wireless	93.3	96.5	96.5	92.9	96.5	96.5	93.2	96.5	96.8

Source: RootMetrics Data, © RootMetrics. All rights reserved. Published with permission of RootMetrics.

4. Entry Conditions and Market Concentration

29. *Entry Conditions.* To evaluate the competitiveness of any market, one must consider multiple factors, including prices and trends in prices, non-price rivalry, investment, innovation, and any barriers to entry.[90] Entry conditions are important in helping to understand the degree to which incumbent firms may or may not possess market power, which is the ability to maintain prices above competitive levels. High barriers to entry reduce the number of competitors in a market and reduce the threat to incumbents of new entry.[91] Entry occurs in the context of underlying regulatory and market conditions that directly influence the total number of firms that can successfully compete. In the mobile wireless marketplace, there are both regulatory and non-regulatory barriers to entry. Regulatory barriers to entry arise from government-imposed regulations, rules, and restrictions that may impose additional costs for entrants or that may directly prohibit or limit entry. For the most part, they are related to the inputs necessary to offer mobile wireless services. Examples of regulatory barriers include spectrum policy, which affects the spectrum capacity available for mobile wireless services and regulations regarding tower and antenna siting, which affect whether and how quickly mobile wireless network can be deployed or expanded. Non-regulatory or market conditions that may determine the number of providers that can operate in the market, or may deter entry, include efficiencies of size and scale, permanent asymmetries across service providers' costs, difficulties in acquiring access to sites for network infrastructure, and capital cost requirements, such as those costs incurred in acquiring spectrum or deploying a nationwide network.

30. *Market Concentration (NRUF Data).* High market concentration levels in any market may raise some concern that a market is not competitive, although we note that this is not necessarily the case.[92] To measure mobile wireless concentration, the Commission employs the Herfindahl-Hirschman

[90] *Applications of AT&T Inc. and DIRECTV For Consent to Assign or Transfer Control of Licenses and Authorizations*, Memorandum Opinion and Order, 30 FCC Rcd 9131, 9140, paras. 19-20 (2015); *AT&T-Leap Order*, 29 FCC Rcd at 2756-57, para. 49; *Applications of AT&T Wireless Services, Inc. and Cingular Wireless Corporation*, Memorandum Opinion and Order, 19 FCC Rcd 21522, 21544-45, paras. 41-42 (2004).

[91] High economic profits encourage entry into the market, low economic profits discourage entry, and prolonged negative economic profits induce exit from the market. *See e.g.*, Hal R. Varian, *Intermediate Microeconomics: A Modern Approach*, W. W. Norton and Company, 2014, at 433-34; Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (4th ed.), Addison, Wesley, Longman, Inc., 2005, at 61, 76. *See also* George S. Ford, et al., *Competition After Unbundling: Entry, Industry Structure, and Convergence*, Federal Communications Law Journal, 2007, 59: 2, at 344.

[92] It is well understood that we can observe intense competition even with a small number of firms in the market. *See, e.g.*, Ernest Gellhorn, *Antitrust Law and Economics* (4th ed.), West Publishing, at 117 (1994) (stating "[m]arket shares are not synonymous with market power; they should mark the beginning for careful analysis, not the end of (continued….)

Index (HHI), widely used in competition analysis to measure market concentration. HHI is calculated by summing the squared market shares of all firms in the given market.[93] In this *Report*, we calculate HHIs based on the NRUF data by Economic Area (EA) to maintain continuity with past reports, and to ensure that we do not compromise the confidential information found in the NRUF data.[94] As of year-end 2014, the weighted average HHI (weighted by population across the 172 EAs in the United States) for mobile wireless services was 3,138. As of year-end 2017, the weighted average HHI for mobile wireless services was 3,106.[95] Figure A-22 shows the relationship between the HHI by EA and EA population densities. This chart indicates that HHI values tend to decline as the population density increases. The most concentrated EAs tend to be more rural, while major metropolitan areas lie in the least concentrated EAs. This likely reflects greater demand and greater cost efficiencies (per-user mobile wireless network deployment costs tend to decrease with increases in the population density) in more densely-populated areas.[96]

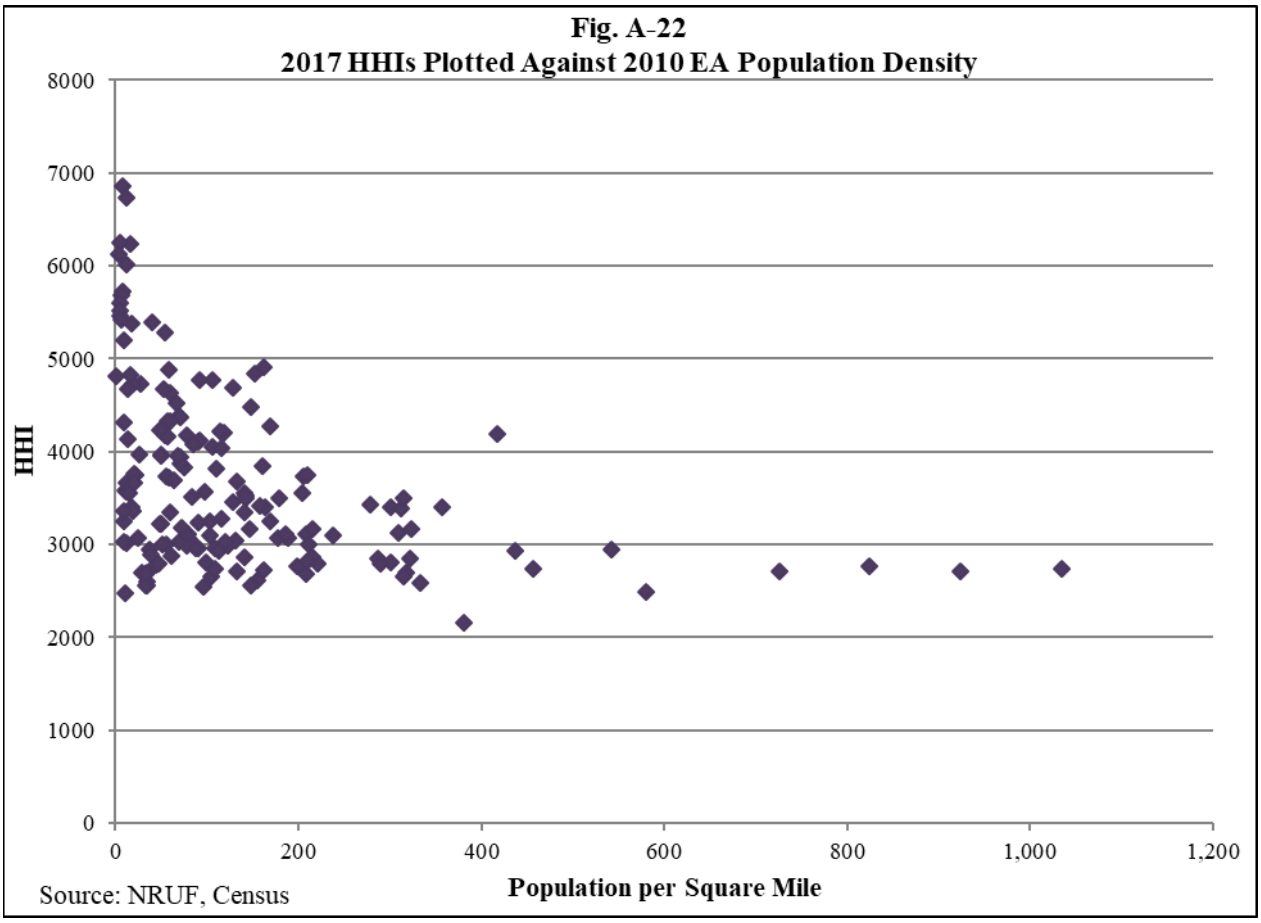
(Continued from previous page)
it."); Michael Whinston, Antitrust Policy toward Horizontal Mergers, *Handbook of Industrial Organization*, Vol. 3, ed. Mark Armstrong and Robert Porter, Elsevier (2007); John Sutton, *Sunk Costs and Market Structure*, MIT Press (1991); Joseph Farrell and Carl Shapiro, Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition, *The B.E. Journal of Theoretical Economics*, Vol.10, Issue 1, Article 9; Gregory J, Werden and Luke M. Froeb, Unilateral Competitive Effects of Horizontal Mergers in *Handbook of Antitrust Economics*, ed. Paolo Buccirossi, MIT Press (2008).

[93] To the extent that this section uses the term "markets," we do not intend it to be interpreted as synonymous with the antitrust concept of the "relevant market," which the Commission defines in the context of secondary market transactions review. *See, e.g., Applications of AT&T Inc., Leap Wireless International, Inc., Cricket License Co., LLC and Leap Licenseco, Inc. for Consent To Transfer Control and Assign Licenses and Authorizations*, Memorandum Opinion and Order, 29 FCC Rcd 2735, 2748, para. 27 (WTB, IB 2014) (*AT&T-Leap Order*).

[94] NRUF subscriber data indicate the number of assigned phone numbers that a wireless service provider has in a particular rate center (there are approximately 18,000 rate centers in the country). Rate centers are geographic areas used by local exchange carriers for a variety of reasons, including the determination of toll rates. Harry Newton, Newton's Telecom Dictionary: 19th Expanded & Updated Edition 660 (July 2003). All mobile wireless service providers must report to the Commission the quantity of their phone numbers that have been assigned to end users, thereby permitting the Commission to calculate the total number of mobile wireless subscribers. For purposes of geographical analysis, the rate center data can be associated with a geographic point, and all of those points that fall within a county boundary can be aggregated together and associated with much larger geographic areas based on counties. We note that the aggregation to larger geographic areas reduces the level of inaccuracy inherent in combining non-coterminous areas, such as rate center areas and counties.

[95] Antitrust authorities in the United States generally classify markets into three types: Unconcentrated (HHI < 1500), Moderately Concentrated (1500 < HHI < 2500), and Highly Concentrated (HHI > 2500). U.S. Department of Justice and the Federal Trade Commission, Horizontal Merger Guidelines (Aug. 19, 2010), http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf.

[96] Relatively high fixed costs in relation to the number of customers may limit the number of firms that can enter and survive in a market. *See, e.g.*, John Sutton, *Sunk Costs and Market Structure*, MIT Press (1991); Luis Cabral, *Introduction to Industrial Organization*, MIT Press, Chapter 14 (2000); Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (4th ed.), Addison, Wesley, Longman, Inc., at 41 (2005); George S. Ford, et al., *Competition After Unbundling: Entry, Industry Structure, and Convergence*, Federal Communications Law Journal, 59:2, at 332, 337 (2007).



5. Mobile Wireless Spectrum

31. Spectrum is a critical input in the provision of mobile wireless services.[97] It can affect whether, when, and where existing service providers and potential entrants will be able to expand capacity or deploy networks.[98] Incumbent service providers may need additional spectrum to increase their coverage or capacity, while new entrants need access to spectrum to enter a geographic area. Spectrum bands vary in breadth and in their propagation characteristics, and these variations have implications for how spectrum is deployed.[99] The effective supply of spectrum capacity that is available for mobile wireless service depends on several aspects of spectrum policy, including allocation and

[97] Non-spectrum inputs in the provision of mobile wireless services include cellular base stations and towers to carry transmissions and backhaul, which routes voice and data traffic from base stations to mobile switching centers. Backhaul may be provided via wireless spectrum, copper, or fiber, though copper may lack sufficient capacity for current data demands.

[98] *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6134, para. 2.

[99] Spectrum below 1 GHz (low-band spectrum) has certain propagation advantages for network deployment over long distances, and for penetrating buildings and urban canyons, while spectrum above 1 GHz (mid- or high-band spectrum) allows for the better transmission of large amounts of information. *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6135, para. 3. In this sense, low-band spectrum may be thought of as "coverage" spectrum, and higher band spectrum may be thought of as "capacity" spectrum. Service providers deploy their spectrum bands differently depending on the nature of the service, geography, density, or other factors in their network build-out. *Twentieth Report*, 32 FCC Rcd at 8992, para. 36 & n.112; *Sixteenth Report*, 28 FCC Rcd at 3789, para. 119.

licensing policies, as well as interference and technical rules.[100] Increasing the total supply of spectrum bandwidth that the Commission allocates and licenses to mobile wireless service providers can increase network capacity and reduce the degree of frequency reuse required to achieve a given level of capacity.[101] Therefore, spectrum policies affect the ability of incumbents and potential entrants to access spectrum and to build out or expand capacity. The efforts of the Commission to allocate more mid-band and millimeter wave spectrum to meet consumer demand for mobile broadband services, and to fuel innovation and investment in the mobile wireless market, are detailed in Sections III.A.2 and IV below.

32. Subject to the Commission's approval, licensees may transfer licenses, in whole or in part (through partitioning and/or disaggregation), on the secondary market.[102] In reviewing proposed transfers of control of spectrum, the Commission uses an initial spectrum screen[103] to help identify, for case-by-case review, local markets where changes in spectrum holdings resulting from the transaction may be of particular concern.[104] In the past decade, in the context of its review of secondary market transactions, the Commission periodically has determined that additional spectrum was suitable and available for mobile wireless use, and therefore subject to inclusion in the spectrum screen.[105] The current suitable and available spectrum included in the spectrum screen is shown in Figure A-23:

[100] *Sixteenth Report*, 28 FCC Rcd at 3765, para.75.

[101] Rappaport, T. S., *Wireless Communications: Principles and Practice* (2nd ed.), Prentice Hall, 2002, at 58.

[102] As part of its secondary market policies, the Commission also permits mobile wireless licensees to lease all or a portion of their spectrum usage rights for any length of time within the license term and over any geographic area encompassed by the license.

[103] The Commission includes spectrum that it finds is suitable and available for the provision of mobile wireless services. *See, e.g.*, *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6169, para. 71; *See, e.g.*, *Applications of SprintCom, Inc., Shenandoah Personal Communications, LLC, and NTELOS Holdings Corp. for Consent To Assign Licenses and Spectrum Lease Authorizations and To Transfer Control of Spectrum Lease Authorizations and an International Section 214 Authorization*, Memorandum Opinion and Order, 31 FCC Rcd 3631, 3638-39, para. 17 (WTB, IB 2016) (*Sprint-Shentel-NTELOS Order*).

[104] *See, e.g., Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6221-22, para. 225; *see also AT&T-Leap Order*, 29 FCC Rcd at 2752-53, paras. 39, 41. In the case of transfer of business units, the Commission's initial HHI screen identifies, for further case-by-case market analysis, those markets in which, post-transaction: (1) the HHI would be greater than 2800 and the change in HHI would be 100 or greater; or (2) the change in HHI would be 250 or greater, regardless of the level of the HHI. *See, e.g., Sprint-Shentel-NTELOS Order*, 31 FCC Rcd at 3639, para. 17 & n.50; *AT&T-Leap Order*, 29 FCC Rcd at 2753, para. 41 & n.140. In addition, the Commission determined in the Mobile Spectrum Holdings Report and Order that increased aggregation of below-1-GHz spectrum would be treated as an "enhanced factor" under its case-by-case review of license transfers if post-transaction the acquiring entity would hold approximately one-third or more of the currently suitable and available spectrum below 1 GHz. *See, e.g.*, *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6240, paras. 282-88.

[105] *Incentive Auction Closing and Channel Reassignment*, Public Notice, 32 FCC Rcd 2786 (WTB 2017); *Sprint-Shentel-NTELOS Order*, 31 FCC Rcd at 3637-38, paras. 15-16; *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6172-90, paras. 82-134; *Applications of AT&T Mobility Spectrum LLC, New Cingular Wireless PCS, LLC, Comcast Corporation, Horizon Wi-Com, LLC, NextWave Wireless, Inc., and San Diego Gas & Electric Company for Consent To Assign and Transfer Licenses*, Memorandum Opinion and Order, 27 FCC Rcd 16459, 16470-71, para. 31 (2012); *Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band*, Report and Order, 25 FCC Rcd 11710, 11711, para. 1 (2010); *Applications of Sprint Nextel Corporation and Clearwire Corporation for Consent To Transfer Control of Licenses, Leases, and Authorizations*, Memorandum Opinion and Order, 23 FCC Rcd 17570, 17598-99, paras. 70, 72 (2008); *Applications of AT&T Inc. and Dobson Communications Corporation for Consent To Transfer Control of Licenses and Authorizations*, Memorandum Opinion and Order, 22 FCC Rcd 20295, 20307-08, para. 17 (2007).

Fig. A-23
Spectrum Included in the Spectrum Screen[106]

Spectrum Band	*Megahertz (Amount)*
600 MHz	70
700 MHz	70
Cellular	50
SMR	14
Broadband PCS	130
AWS-1	90
AWS-3	65
AWS-4	40
H Block	10
WCS	20
BRS	67.5
EBS	89
Total Amount of Spectrum	***715.5***

6. Service Providers' Spectrum Holdings

33. Figures A-24 and A-25 below present spectrum holdings by service provider. As of August 2018, the four nationwide service providers, AT&T, Sprint, T-Mobile, and Verizon Wireless together held approximately 80% of all the spectrum included in the spectrum screen, measured on a MHz-POPs basis. Figure A-26 shows the population-weighted average megahertz spectrum holdings of licensees by frequency band.[107]

[106] We note that while 15 megahertz of AWS-3 spectrum is available on a nationwide basis (1695-1710 GHz), we will evaluate the availability of the remaining 50 megahertz of AWS-3 spectrum (1755-1780 GHz and 2155-2180 GHz) on a market-by-market basis. Further, while 112.5 megahertz of EBS spectrum is available, we discount this spectrum such that 89 megahertz is included in the screen for review of proposed transactions. *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6177-79, 6184-6187, paras. 100-102, 118-25.

[107] We consider population-weighted spectrum holdings in order to account for customer density in different geographic areas. A spectrum license in Los Angeles or New York City, for example, covers more customers than a spectrum license over the same amount of land area in White Sands, New Mexico.

Fig. A-24
Percentage Spectrum Holdings, Measured on a MHz-POPs Basis by Licensee, by Frequency Band*

	600 MHz	700 MHz	Cell.	SMR	PCS	H Block	AWS-1	AWS-3	AWS-4	WCS	BRS	EBS
Spectrum	**70 meg.**	**70 meg.**	**50 meg.**	**14 meg.**	**130 meg.**	**10 meg.**	**90 meg.**	**65 meg.**	**40 meg.**	**20 meg.**	**67.5 meg.**	**89 meg. ****
AT&T	3.8%	41.9%	44.6%	0.0%	29.1%	0.0%	16.2%	33.5%	0.0%	100.0%	0.0%	0.0%
Sprint	0.0%	0.4%	0.0%	96.5%	29.0%	0.0%	0.0%	0.0%	0.0%	0.0%	93.1%	95.7%
T-Mobile	45.3%	14.2%	0.1%	0.0%	22.3%	0.0%	41.1%	5.5%	0.0%	0.0%	0.0%	0.0%
VZW	0.0%	31.0%	47.6%	0.0%	16.6%	0.0%	39.7%	18.9%	0.0%	0.0%	0.0%	0.0%
USCC	2.6%	3.5%	4.0%	0.0%	1.1%	0.0%	0.8%	2.6%	0.0%	0.0%	0.0%	0.0%
DISH	26.2%	6.6%	0.0%	0.0%	0.0%	100.0%	0.0%	34.8%	100.0%	0.0%	0.0%	0.0%
Other	22.0%	2.3%	3.7%	3.5%	2.0%	0.0%	2.2%	4.9%	0.0%	0.0%	6.9%	4.3%

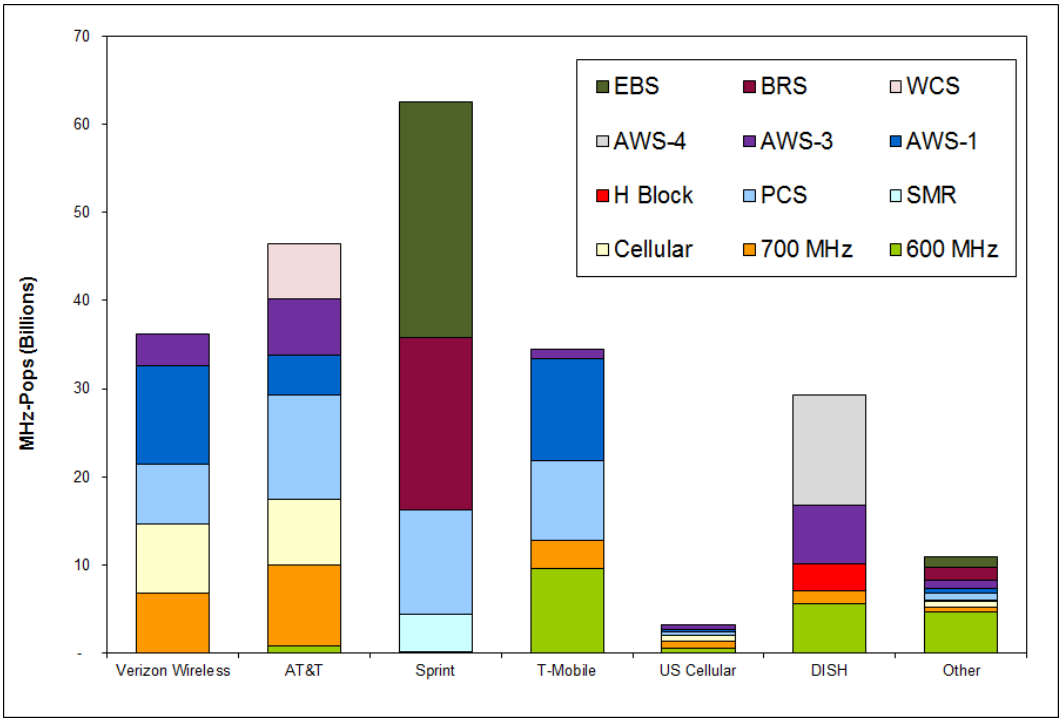
* Staff estimates as of Aug. 2018. Abbreviations for spectrum bands: Cell. (Cellular), SMR (Specialized Mobile Radio Service), PCS (Personal Communications Service), BRS (Broadband Radio Service), and EBS (Educational Broadband Service).
** In accordance with the spectrum screen in proposed secondary market transactions, only 89 megahertz of EBS spectrum is included.

Fig. A-25
Population-Weighted Average Megahertz Holdings by Licensee, by Frequency Band*

	600 MHz	700 MHz	Cell.	SMR	PCS	H Block	AWS-1	AWS-3	AWS-4	WCS	BRS	EBS
Spectrum Counted	**70 meg.**	**70 meg.**	**50 meg.**	**14 meg.**	**130 meg.**	**10 meg.**	**90 meg.**	**65 meg.**	**40 meg.**	**20 meg.**	**67.5 meg.**	**89 meg. ****
AT&T	2.6	29.4	23.6	0.0	37.9	0.0	14.6	20.3	0.0	20.0	0.0	0.0
Sprint	0.0	0.3	0.0	13.8	37.7	0.0	0.0	0.0	0.0	0.0	62.9	85.2
T-Mobile	30.8	10.0	0.0	0.0	29.0	0.0	37.0	3.3	0.0	0.0	0.0	0.0
VZW	0.0	21.7	25.2	0.0	21.6	0.0	35.7	11.5	0.0	0.0	0.0	0.0
USCC	1.8	2.5	2.1	0.0	1.4	0.0	0.7	1.6	0.0	0.0	0.0	0.0
DISH	17.8	4.6	0.0	0.0	0.0	10.0	0.0	21.1	40.0	0.0	0.0	0.0
Other	14.9	1.6	2.0	0.5	2.6	0.0	2.0	3.0	0.0	0.0	4.6	3.8

* Staff estimates as of Aug. 2018.
** In accordance with the spectrum screen in proposed secondary market transactions, only 89 megahertz of EBS spectrum is included.

Fig. A-26
Spectrum Holdings by Band Weighted by Population



Note: Staff estimates as of Aug. 2018.

7. Wireless Infrastructure

34. Wireless infrastructure facilities constitute another major input in the provision of mobile wireless services.[108] In addition to towers and other tall structures, such as lattice towers, guyed towers, monopoles, rooftops, water towers, and steeples, wireless infrastructure also includes distributed antenna systems (DAS) and small cells.[109] In order to expand or to improve coverage in existing service areas, and to accommodate newer technologies, mobile service providers historically have deployed additional cell sites. According to CTIA, cell sites in commercial use have mostly increased in the last five years, from 304,360 at year-end 2013, to 298,005 in 2014, 307,626 in 2015, 308,334 in 2016, and 323,448 at year-end 2017.[110]

[108] Another component is the backhaul connections that link a mobile wireless service provider's cell sites to the mobile switching centers that provide connections to the provider's core network, the public switched telephone network, or the Internet, carrying wireless voice and data traffic for routing and onward transmission. Backhaul facilities are generally provided by incumbent local exchange carriers (ILECs), competitive local exchange carriers (CLECs), competitive fiber and microwave wholesalers, cable providers, and independent backhaul operators. *Twentieth Report*, 32 FCC Rcd at 8997-98, para. 42 & n.135; *Sixteenth Report*, 28 FCC Rcd at 3912, para. 336.

[109] For a full description of DAS and small cells, see *Twentieth Report*, 32 FCC Rcd at 8997, para 42, n.133 & n.134.

[110] CTIA Wireless Industry Indices Year-End 2017, at 54. Because multiple cell sites can be collocated in the same "tower" site, the reported cell sites should not be equated with "towers." The reported cell sites include repeaters and other cell-extending devices (e.g., femtocells or distributed antenna systems). *Id.* at 53. Based on UBS Data 2017, the number of AT&T's cell sites increased from 67,000 at the end of 2016 to 70,300 at the end of 2017, Verizon Wireless's increased from 58,300 to 61,800, T-Mobile's increased from 59,417 to 61,457, and Sprint's stayed at 50,000. Note that the decrease in the total number of commercial cell sites in 2014 from 2013 is likely due to "a combination of consolidation and the retirement of older generation of technologies." CTIA Wireless Industry Indices Report Year-End 2014, at p. 101-102.

35. Mobile service providers increasingly have started to deploy small cells and DAS sites to fill local coverage gaps, to densify networks and increase local capacity, or to prepare for deploying their 5G network.[111] Estimates for small cell deployment by the end of 2018 range from 80,000 to 400,000.[112] Rather than building their own DAS deployments, some service providers share neutral host systems owned by third-party operators.[113] Today, there are more than 120 tower and DAS operators in the United States,[114] and a majority of towers are now owned or operated by independent tower companies rather than by mobile wireless service providers. In most cases, tower operators and property owners lease antenna, rooftop and other site space to multiple wireless service providers.[115]

36. The three largest publicly-traded neutral host providers are Crown Castle, American Tower, and SBA Communications. These three companies alone invested nearly $2.5 billion dollars in 2017, an increase of nearly 25% over 2016.[116] As of December 2017, according to one estimate, these three infrastructure providers owned or operated approximately 95,000 towers (not including DAS and small cells).[117] At the end of December 2017, they had 1.7 to 2.2 tenants per tower site and had significant capacity available for additional antennas or tenants.[118] Figure A-27 shows that, as of April 2018, there were three or more tower operators in 83% of counties nationwide, and four or more tower operators in 61% of counties.[119]

[111] *Twentieth Report*, 32 FCC Rcd at 8998, para. 43.

[112] CTIA Comments at 51 (80,000 small cells); Wireless Infrastructure Association (WIA) Comments at 7 (125,000 small cells). *See also* RCR Wireless, North American Enterprises to Deploy 400,000 Small Cells This Year (Apr. 5, 2018), https://www.rcrwireless.com/20180405/network-infrastructure/north-american-enterprises-deploy-400000-small-cells-tag23.

[113] American Tower Corporation 2017 Annual Report, at 6; *see also* Clearsky Technologies, ClearSky to Launch First American "Small Cell as a Service" Carrier Customer, http://www.csky.com/launches-first-scaas-carrier-customer/.

[114] Wireless Estimator, Top 100 Tower Companies in the U.S., http://wirelessestimator.com/top-100-us-tower-companies-list/.

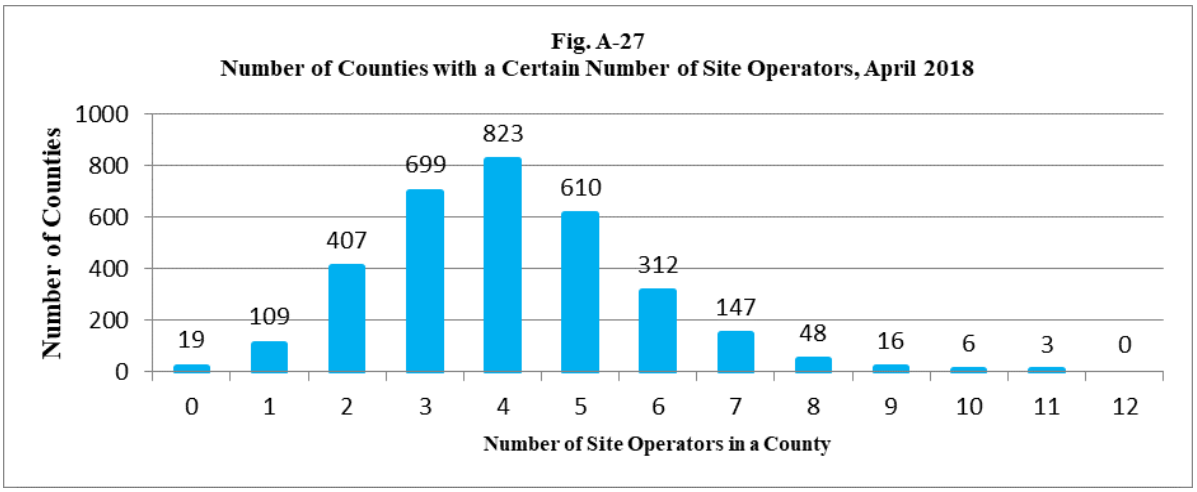
[115] *See, e.g.*, American Tower 2017 Annual Report, Part 1 at 3; *see also* Crown Castle 2017 Annual Report, Part 1, at 20; FierceWireless, Crown Castle executive sees small cells moving to multitenant scenarios, smaller markets, https://www.fiercewireless.com/wireless/crown-castle-exec-sees-small-cells-moving-to-multi-tenant-scenarios-smaller-markets; Verizon Wireless, http://www.verizonwireless.com/b2c/realestate/.

[116] WIA Comments at 2.

[117] Wireless Estimator, Top 100 Tower Companies in the U.S. (Crown Castle at 40,039, American Tower at 39,989, SBA at 14,873, and as of May 2018, not including rooftop sites, DAS and small cells), http://www.wirelessestimator.com/t_content.cfm?pagename=US-Cell-Tower-Companies-Complete-List.

[118] American Tower 2017 Annual Report, Part I, at 4 (1.9 tenants per tower), Crown Castle 2017 Annual Report, Part 1, at 18 (2.2 tenants per tower), and SBA 2017 Annual Report, Item 1, at 3 (1.7 tenants per tower).

[119] Tower site information was downloaded from 49 tower providers' websites in April 2018. Wireless Estimator, Top 100 Tower Companies in the U.S., http://www.wirelessestimator.com/t_content.cfm?pagename=US-Cell-Tower-Companies-Complete-List.



Source: 49 tower companies' data on standalone towers, rooftops, DAS, and small cells (April 2018).

8. Network Coverage

37. We measure network coverage based on Form 477 data,[120] and we use the actual area methodology, which analyzes the data on a sub-census-block level, and calculates the percentage of each census block covered by each technology.[121] Unlike the centroid methodology where a particular census block is either covered or not, the actual area methodology estimates the area of the census block covered by each service provider by technology.[122] Because we currently do not know the distribution of the population at the sub-census-block level, however, we must approximate the population covered by each technology. To do this, we assume, for purposes of this *Report*, that the population of a census block is uniformly distributed such that the fraction of the population covered in a block is proportional to the fraction of the actual area covered. We then sum the estimated covered population across blocks to estimate the total covered population within the United States. Likewise, we assume that the fraction of the road miles covered in a block is proportional to the fraction of the actual area covered.[123]

[120] For a detailed description of the Form 477 data collection, *see Twentieth Report*, 32 FCC Rcd at 9015, para. 69.

[121] The centroid methodology considers a census block covered if the geometric center point, or centroid, is covered. The methodology estimates coverage of population, land and road miles by aggregating the totals for "covered" census blocks. *Twentieth Report*, 32 FCC Rcd at 9016-17, para. 71. In practice, actual area and centroid methodologies yield similar results at the national level. *Twentieth Report*, 32 FCC Rcd at 9017-18, para. 72. We present coverage maps based on the centroid methodology in Appendix A-6: Mobile Wireless Coverage Maps. In addition, we report our results based on the centroid and actual area methodologies in Appendix A-7: Mobile Wireless Coverage.

[122] This sub-census-block analysis can tell us the unique combination of service providers serving a particular percentage of the area in a census block with a certain technology. As this analysis was done at each technology level, the set of unique combinations that it produces are valid for each individual technology but not across multiple technologies. Essentially, we can distinguish the unique percentages covered by various service providers at the sub-census-block level using a particular technology (e.g., LTE), but we do not currently know how this interplays with other technologies (e.g., with 2G or 3G technologies). Therefore, we can calculate the areas served and not served by all wireless technologies (LTE, non-LTE 4G, 3G, and 2G technologies) only at the national level.

[123] In order to fully exploit the increase in precision offered by the actual area coverage methodology, spatially accurate representations of population and road miles would be necessary. We do not have access to such information at this time for the current *Report*, however.

38. As the Commission has stated, having accurate and reliable mobile broadband deployment data is critical to policymakers as well as to consumers.[124] We observe that, while the current Form 477 deployment data is an improvement over the deployment data previously available on a national scale, questions have arisen in various contexts regarding the bases for certain filings.[125] For example, in the context of the Mobility Fund Phase II (MF-II) proceeding, the Commission determined that a separate, one-time data collection was necessary to ensure that all Form 477 filers were using a consistent standard when reporting their deployment of 5 Mbps 4G LTE services.[126] In addition, the Commission has initiated a rulemaking to consider improvements in the Form 477 data collection process.[127]

39. In this Section, we first present our estimates of mobile wireless coverage by individual service provider using any technology. Second, we present our LTE coverage estimates for the percentage of the U.S. population, land area, and road miles, by number of service providers, before turning to LTE coverage by individual service providers. Finally, we present our estimates of coverage in rural and non-rural areas, first by number of service providers, and then by individual service providers. Unless otherwise noted, we rely on Form 477 data as of December 2017 for our analysis of network coverage.

a. Overall Coverage by Individual Service Provider

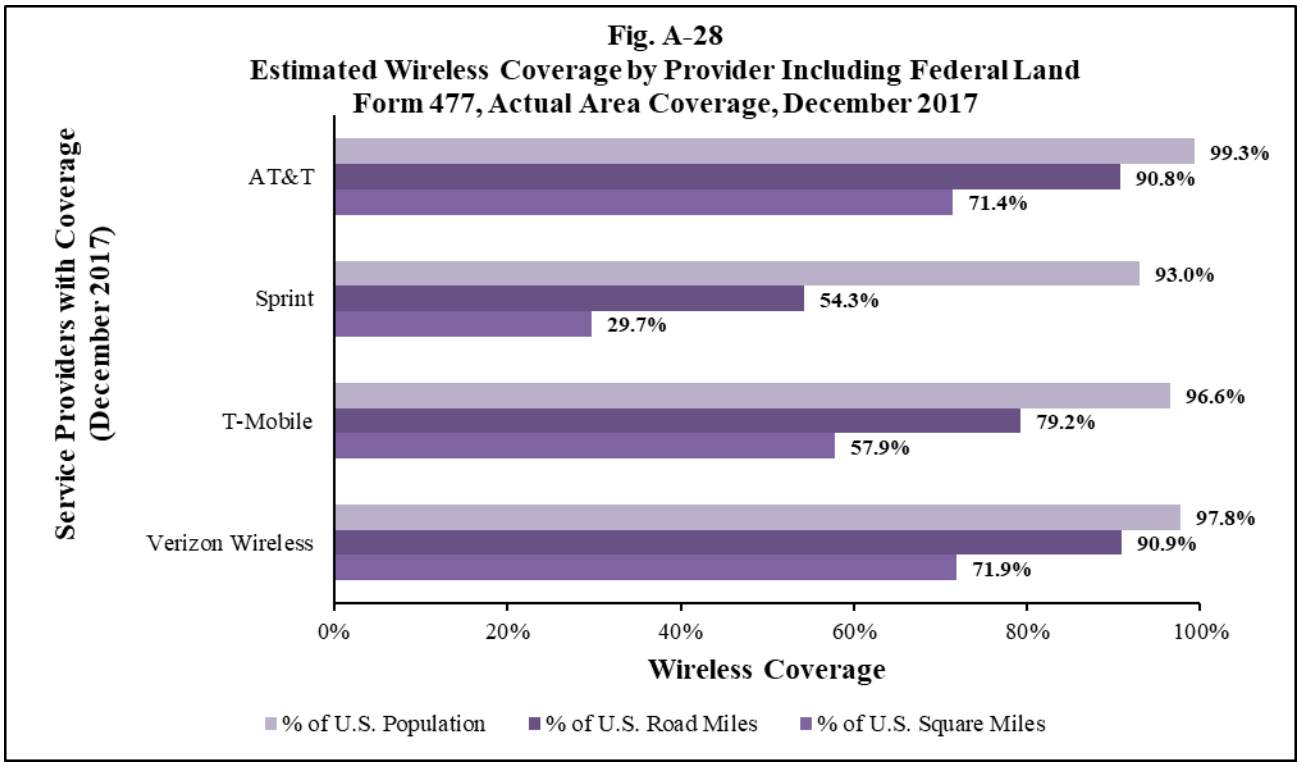
40. Figure A-28 presents estimates of mobile wireless coverage by individual mobile wireless service provider using any technology. Figure A-28 indicates that AT&T covered census blocks containing approximately 99% of the population, while the comparable approximate percentages are 98% for Verizon Wireless, 97% for T-Mobile, and 93% for Sprint. Verizon Wireless and AT&T each covered over 70% of the land area, while T-Mobile and Sprint each covered less than 60% of the land area. In terms of road miles, AT&T and Verizon Wireless covered approximately 91%, T-Mobile covered approximately 79%, and Sprint covered approximately 54%.

[124] *Modernizing the FCC Form 477 Data Program*, Further Notice of Proposed Rulemaking, 32 FCC Rcd 6329, 6331-32, para. 8 (2017) (*Modernizing the FCC Form 477 Data Program*).

[125] *Modernizing the FCC Form 477 Data Program*, 32 FCC Rcd at 6332-33, para. 10.

[126] *Connect America Fund, Universal Service Reform—Mobility Fund*, Order on Reconsideration and Second Report and Order, 32 FCC Rcd 6282, 6286, 6287, 6298, paras. 7, 10, 34 (2017) (reconsidering the Commission's decision to use the Form 477 data given the various challenges with respect to the accuracy of the Form 477 deployment data, and determining that there would be a new one-time data collection).

[127] *See generally Modernizing the FCC Form 477 Data Program*, 32 FCC Rcd 6329.

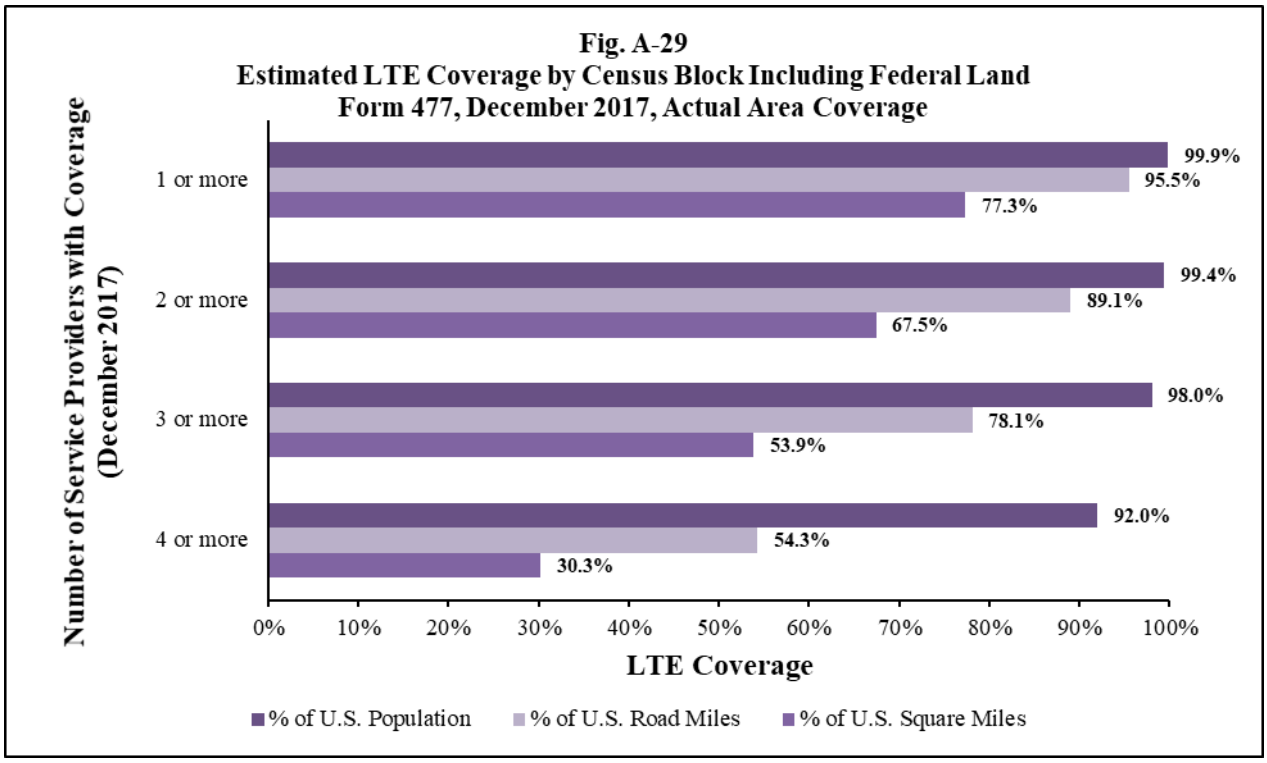


Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.

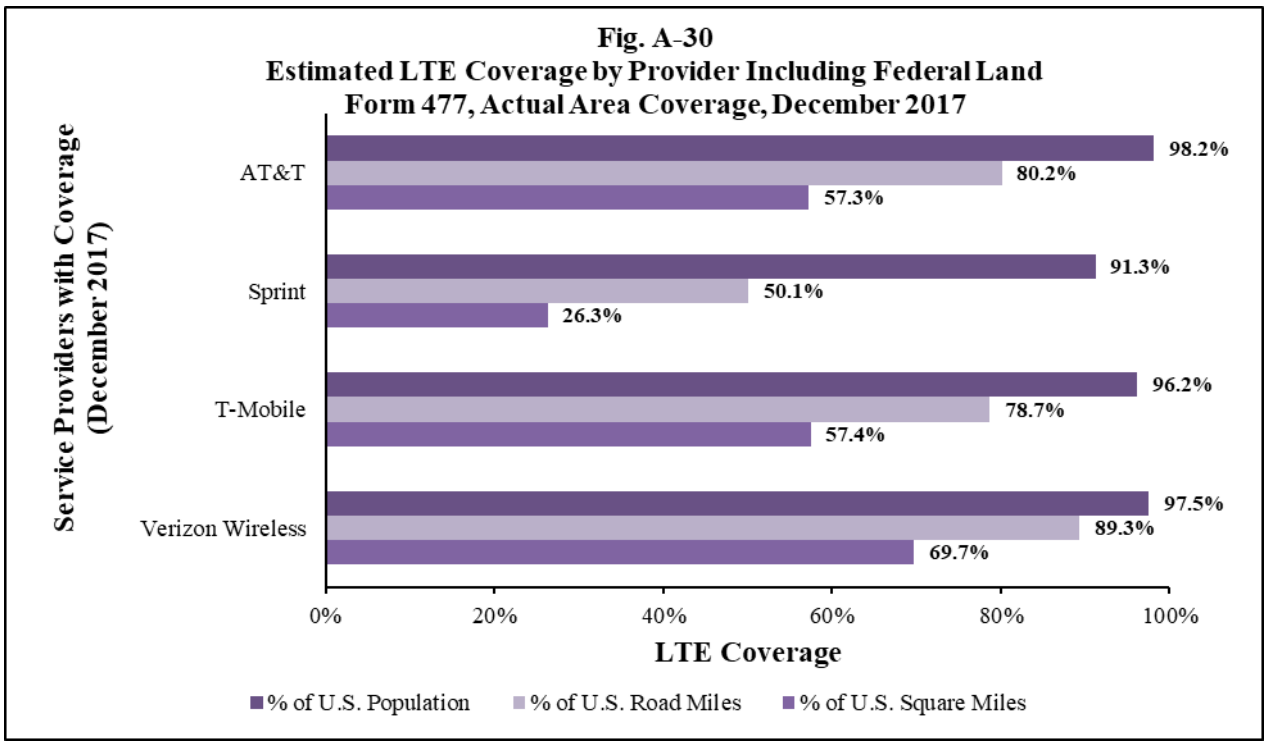
b. LTE Mobile Broadband Coverage

41. Figure A-29 presents LTE mobile broadband coverage by number of service providers. It shows that approximately 92% of the U.S. population lived in census blocks with LTE coverage by at least four service providers. These census blocks only accounted for approximately 54% of road miles and approximately 30% of the total land area of the United States, however.

42. Figure A-30 presents estimates of LTE mobile broadband coverage by individual mobile wireless service provider. It shows that Verizon Wireless and AT&T each provided LTE coverage to census blocks containing approximately 98% of the population, T-Mobile provided LTE coverage to approximately 96% of the population, while Sprint provided LTE coverage to approximately 91% of the population. In terms of road miles and land area, Verizon Wireless covered approximately 89% of road miles and 70% of the land area, AT&T covered approximately 80% of road miles and 57% of the land area, T-Mobile covered approximately 79% of road miles and 57% of the land area, and Sprint covered approximately 50% of road miles and 26% of the land area with LTE.



Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.



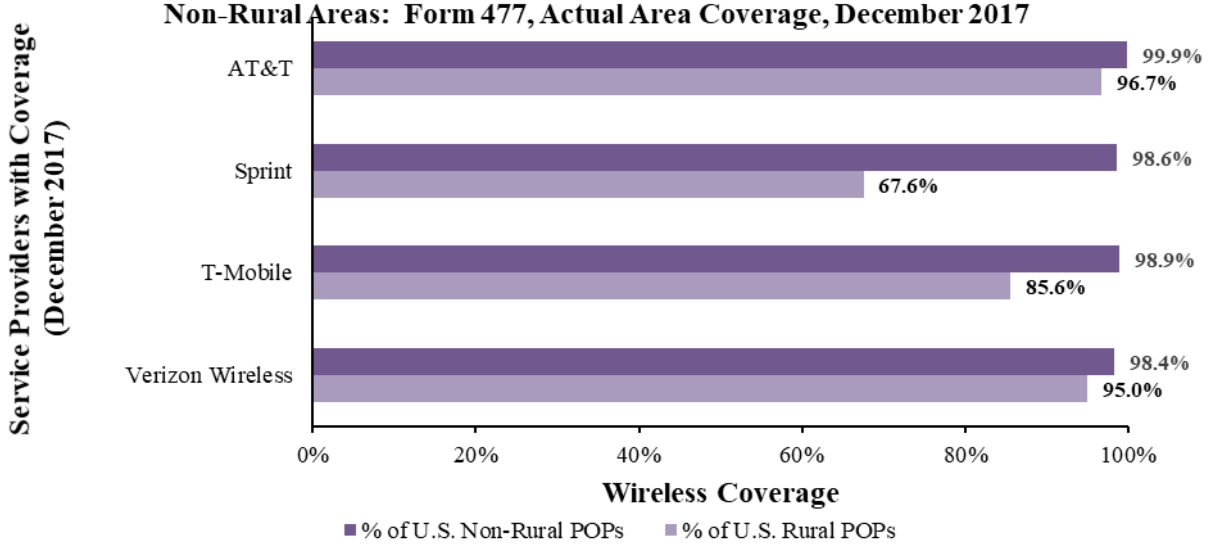
Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.

c. Rural/Non-Rural Comparisons

43. Although the Communications Act does not include a statutory definition of what constitutes a rural area, the Commission, for purposes of its analysis for the *Mobile Wireless Competition Report*, has defined a rural area as one with a population density of 100 people per square mile or less.[128] To determine whether counties are rural or non-rural, we first excluded all water-only census blocks within each county. We then divided the county population by the total geographic area of the county to determine the population density. For those counties with a population density of 100 people per square mile or less, all census blocks within those counties were considered rural. Under this definition and using 2010 U.S. Census data, approximately 56 million people, or approximately 18% of the U.S. population, live in rural counties. These counties comprise approximately 3 million square miles, or approximately 84%, of the geographic area of the United States.

44. Figure A-31 presents mobile wireless coverage (using any technology) of the rural and non-rural U.S. population by individual mobile wireless service provider. Our analysis indicates that all four nationwide service providers covered at least 97% of the non-rural population with mobile wireless service. Rural wireless coverage by service provider was more limited: AT&T covered approximately 97%, Verizon Wireless covered approximately 95%, T-Mobile covered approximately 86%, and Sprint covered approximately 68% of the rural population with wireless service.

Fig. A-31
Estimated Wireless Coverage by Provider Including Federal Land in Rural vs. Non-Rural Areas: Form 477, Actual Area Coverage, December 2017

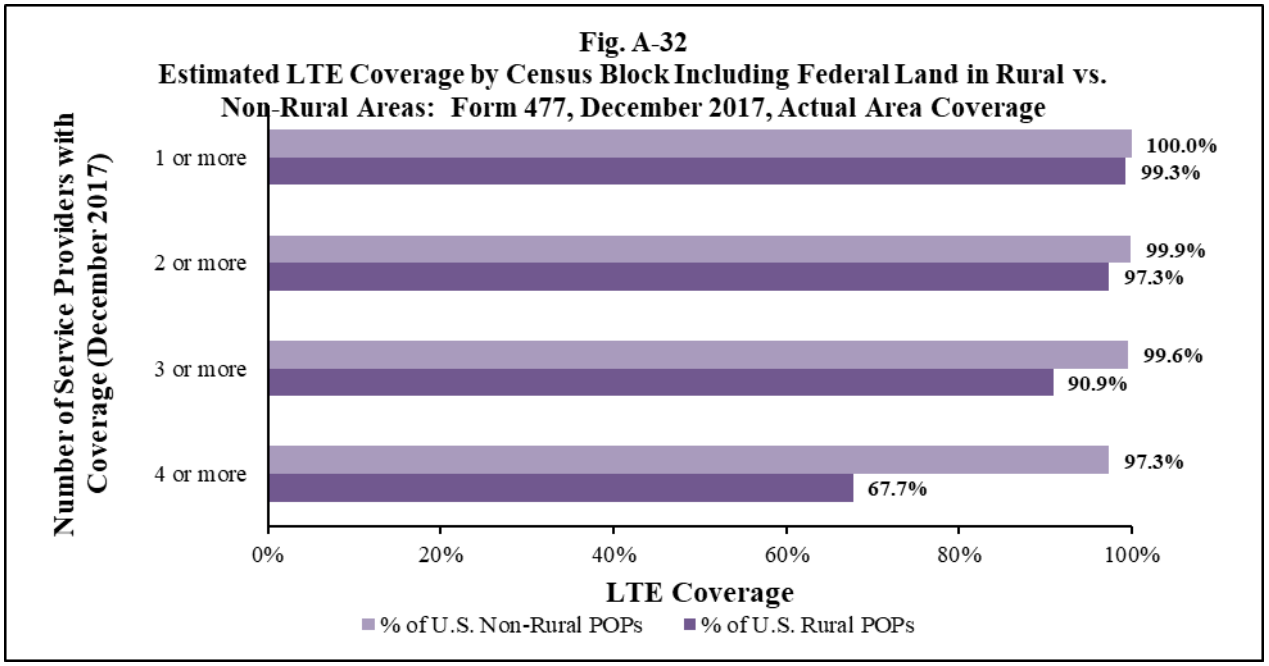


Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.

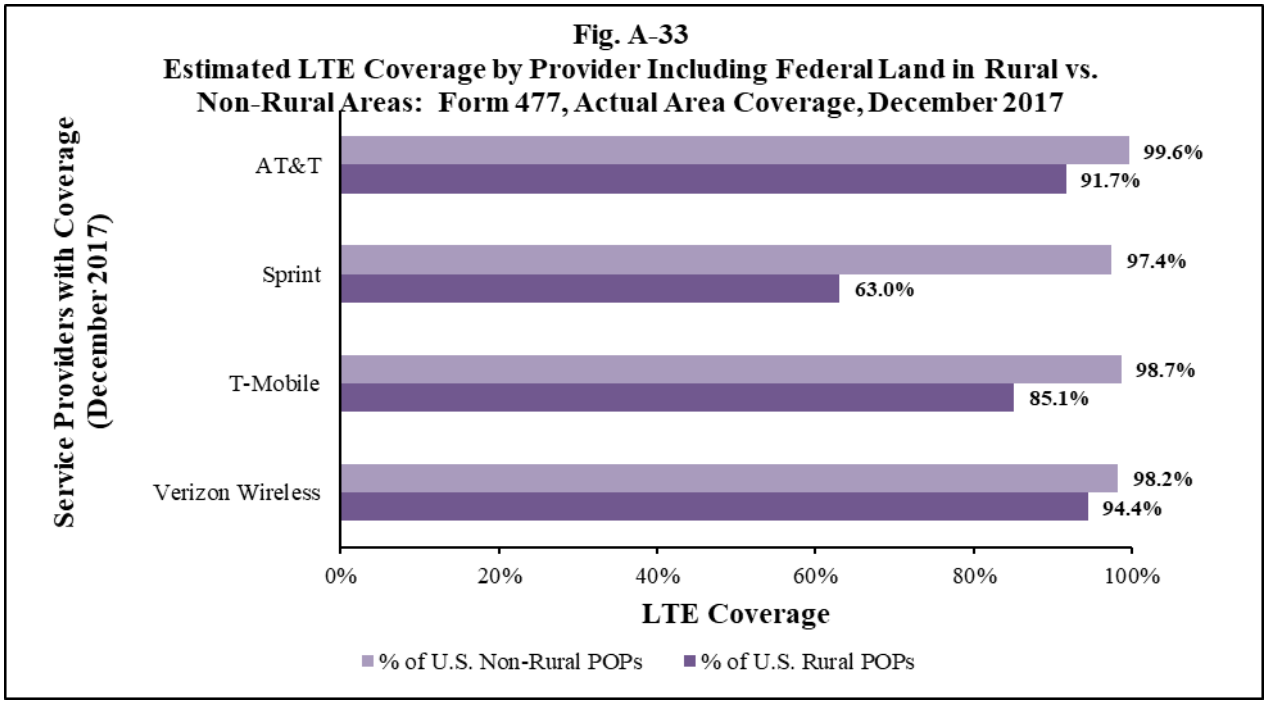
45. Figure A-32 presents LTE population coverage in rural and non-rural census blocks by number of service providers. Our estimates show that approximately 99% of the non-rural population was covered by at least three LTE service providers, while approximately 91% of the rural population had the same network coverage. Approximately 97% of the non-rural American population had LTE coverage from four or more service providers, while only approximately 68% of the rural population was covered by at least four LTE service providers.

[128] *Twentieth Report*, 32 FCC Rcd at 9000-01, para. 45; *Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum-Based Services*, Report and Order and Further Notice of Proposed Rule Making, 19 FCC Rcd 19078, 19086-88, paras. 10-12 (2004) (*2004 Report and Order*).

46. Figure A-33 presents LTE coverage by individual service provider of both the rural and non-rural U.S. population. Our estimates show that each of the four nationwide service providers covers at least 97% of the non-rural population with LTE. Regarding LTE coverage in rural areas, Verizon Wireless covered approximately 94%, AT&T covered approximately 92%, T-Mobile covered approximately 85%, and Sprint covered approximately 63% of the rural population with LTE.



Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.



Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.

B. The Video Market

47. This chapter examines participation and competition in today's video programming marketplace.[129] In the United States, consumers can access video programming content from multiple sources, only some of which are licensed or regulated by the Commission. Some video providers, like broadcast television stations, have been in the marketplace for over 70 years, whereas other providers, like online video providers, are much more recent additions to the marketplace. Below we examine the current state of the marketplace and provide data regarding competition among and between the different types of providers.

48. The major participants in the marketplace for the delivery of video programming can be divided into three categories:

- Television Broadcasters: These entities broadcast video content over the air, and consumers can receive this content via a television set connected to an antenna. Participants in this category include local television stations affiliated with broadcast networks (e.g., ABC, CBS, FOX, and NBC), independent commercial television stations, and noncommercial educational television stations. Television stations offer a set schedule of programs through the day, as well as live sporting events, news coverage, and other real-time broadcasts of events.
- Multichannel video programming distributors (MVPDs): These providers use wireline or satellite technologies to deliver video programming to consumers. MVPD packages typically include linear channels – both cable channels and retransmitted broadcast channels – and video on demand (VOD) content.[130] Traditional cable providers (e.g., Comcast, Charter, and smaller cable operators), telephone company providers (e.g., Verizon Fios), and direct broadcast satellite (DBS) providers (e.g., DISH Network and DIRECTV) are all MVPDs.
- Online video distributors (OVDs): These participants use the Internet to deliver video content to consumers.[131] In addition to providing linear video channels and VOD content, OVDs often rent and sell video content to their customers. OVDs include large companies like Netflix, Hulu, Amazon, and DISH Sling TV, as well as numerous other providers, some of which focus on small or niche audiences.

[129] In this section, we rely on a variety of publicly available sources of industry information and data including: Securities and Exchange Commission filings; data from trade association and government entities; data from securities analysts and other research companies and consultants (e.g., S&P Global, Nielsen Media Research); company news releases and websites; newspaper and periodical articles; scholarly publications; vendor product releases; white papers; and various public Commission filings, decisions, reports, and data. We make use of both individual company data and industry-wide data. In addition, the Media Bureau released a Public Notice soliciting comment for the Commission's Nineteenth Report on the Status of Competition in the Market for the Delivery of Video Programming. *Media Bureau Seeks Comment on the Status of Competition in the Market for the Delivery of Video Programming*, Public Notice, 32 FCC Rcd 6654 (2017) (*19th VCR PN*). While Congress has since eliminated the statutory obligation that the Commission produce an annual Video Competition Report, we considered comments and reply comments submitted in response to the *19th VCR PN* when preparing this *Report*. Citations to Comments and Reply Comments in this section refer to filings submitted in response to the *19th VCR PN*.

[130] Linear channels offer specific video programs at a specific time of day in a manner akin to broadcast television. VOD programs are stored electronically by the provider and can be viewed by the consumer at any time, i.e., on demand.

[131] For purposes of this section, we define OVD as "an entity that distributes video programming (1) by means of the Internet or other Internet Protocol (IP)-based transmission path; (2) not as a component of an MVPD subscription or other managed video service; and (3) not solely to customers of a broadband Internet access service owned or operated by the entity or its affiliates." *See Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Eighteenth Report, 32 FCC Rcd 568, 570 n. 4 (MB 2017) (*18th Report*).

49. We begin our discussion of the video programming marketplace by considering these three categories of providers--MVPDs, OVDs, and broadcast television stations--separately. We discuss below in turn the significant participants in each category, the business models and competitive strategies they employ, relevant performance metrics, and recent marketplace entry and exit. In discussing MVPDs, we will also report on the Commission's most current data on the prices charged by cable operators to consumers, as well as the most current data regarding the retransmission fees paid by cable systems to broadcast stations. We then address intermodal competition--that is, competition between participants in different categories--by looking at the similarities and differences between the video services offered by members of each group, consumer response and behavior, and subscribership trends. Finally, we discuss selected marketplace factors that are relevant to competition in the video marketplace.

1. MVPDs

50. An MVPD is an entity that sells packages of cable and broadcast channels to consumers. MVPDs include traditional cable providers (e.g., Comcast, Charter), DBS providers (e.g., DISH Network, DIRECTV), and telco providers (e.g., AT&T U-verse, Verizon Fios). MVPDs typically offer both linear cable and broadcast channels, as well as video-on-demand programs. Because households typically subscribe to only one MVPD, video competition between MVPDs generally can be viewed as "winner-take-all"--an MVPD either wins the household or loses out to a rival MVPD.

51. *Availability to Consumers.* Cable MVPDs generally exist in non-overlapping franchise areas and, as a result, do not compete directly with one another for the same subscriber, so most consumers have access to only one cable MVPD. Where cable overbuilders exist (for example, RCN or Wide Open West) consumers have access to more than one cable MVPD. Ordinarily, there is not more than one such overbuilder in a particular geographic area.[132] Telephone company MVPDs rarely compete with one another for the same subscribers; however, they almost always overbuild areas already served by at least one cable company. DIRECTV and DISH Network have national footprints and almost all consumers nationwide have access to both DBS MVPDs. Until recently, DBS MVPDs competed with one another and with every cable and telephone company MVPD. This changed with the merger of AT&T and DIRECTV in July 2015, which eliminated competition between AT&T U-verse and DIRECTV. Although most consumers have access to three competing MVPDs (two DBS MVPDs and a cable MVPD),[133] some consumers also have access to a competing telephone company MVPD, for a total of four MVPDs. We estimated that 17.9% of housing units had access to four MVPDs in 2015.[134] The number may be declining as buildout of wireline MVPD networks by telephone companies has slowed in recent years,[135] but we lack reliable data.

52. *Subscribership.* At the end of 2017, seven MVPDs each had over one million video subscribers. These include four cable companies (Comcast, Charter, Cox, and Altice), DISH Network (a DBS MVPD), Verizon Fios (a telephone company MVPD), and AT&T (a combined telephone company MVPD and DBS MVPD).[136] Twelve cable MVPDs and four telephone company MVPDs each had over

[132] The available data do not permit us to calculate how many homes have access to two cable MVPDs. However, S&P Global estimates that cable overbuilders have more than 1 million video subscribers nationwide. S&P Global, Cable TV Investor at 7 (Feb. 28. 2017).

[133] We assume that cable MVPDs are available to approximately 99% of housing units and DBS is available to all housing units although we recognize that in reality physical features (e.g., tall buildings, terrain, and trees) prevent some housing units from receiving DBS signals. *See Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Sixteenth Report, 30 FCC Rcd 3253, 3264-65 and Table 1 (MB 2015) (*16th Report*).

[134] *18th Report*, 32 FCC Rcd at 577, para. 21.

[135] *See infra* para. 69.

[136] S&P Global, Top Cable MSOs (last visited June 15, 2018).

100,000 and fewer than one million video subscribers.[137] In addition, many small cable and telephone company MVPDs serve significantly smaller numbers of customers.

53. MVPDs as a group have been losing subscribers since 2013.[138] Figure B-1 provides data for MVPD video subscribers for 2016 and 2017. Collectively, MVPDs lost about 3.6 million video subscribers over the period. Cable MVPDs lost 986,000 subscribers; DBS MVPDs lost 1,693,000 subscribers; and telephone company MVPDs lost 903,000 subscribers.

Fig. B-1

MVPD Video Subscribers (in thousands)[139]

	2016	2017	Net Change
Cable	**52,845**	**51,859**	**-986**
Comcast	22,508	22,357	-151
Charter	17,236	16,997	-239
Cox	3,932	3,852	-80
Altice	3,709	3,582	-127
Other Cable	5,459	5,071	-388
DBS	**33,181**	**31,488**	**-1,693**
DIRECTV	21,012	20,458	-554
DISH Network	12,170	11,030	-1,140
Telephone Company	**11,529**	**10,626**	**-903**
Verizon Fios	4,694	4,619	-75
AT&T U-verse	4,281	3,658	-623
Frontier	1,145	961	-184
Other Telephone	1,409	1,388	-21
MVPD Total	**97,556**	**93,973**	**-3,583**

54. Figure B-2 shows the relative shares of MVPD subscribers for cable, DBS, and telephone companies. While the total number of MVPD subscribers declined from 99.7 million in 2015, to 97.6 in 2016, to 94.0 million in 2017, cable's relative share increased, the share for telephone companies decreased, and the share for DBS changed little.[140]

[137] *Id*. The twelve cable MVPDs were Mediacom, Wide Open West, Cable One, RCN, Atlantic Broadband, Midcontinent Communications, Armstrong Utilities, Service Electric Cable TV, Blue Ridge Cable Technologies, WaveDivision Holdings, GCI Liberty, and Buckeye Broadband. The four telephone company MVPDs were CenturyLink, Consolidated Communications, Cincinnati Bell, and Frontier Communications. *Id*.

[138] S&P Global, U.S. Multichannel Industry Benchmarks (last visited Sept. 28, 2018).

[139] S&P Global, Cable TV Investor at 4 (Mar. 27, 2018). S*ee also* Leichtman Research Group, LRG Research Notes at 3-4 & 6 (1Q 2018), http://www.leichtmanresearch.com/research.html#notes.

[140] S&P Global, U.S. Multichannel Industry Benchmarks (last visited June 15, 2018).

Fig. B-2
Percentage of MVPD Subscribers[141]

Year	Cable	DBS	Telephone
2015	53.5	33.2	13.1
2016	54.1	34.0	11.8
2017	55.2	33.5	11.3

55. *Video Revenue*. Video revenues for the largest MVPDs are shown in Figure B-3. According to S&P Global, video revenue from cable, DBS, and telephone company MVPDs peaked in 2016 at $117.7 billion, fell to $116.1 billion in 2017, and is projected to fall to $113.2 billion in 2018.[142] Although the bulk of MVPD video revenue comes from subscriptions, MVPDs also earn revenue by selling advertising. S&P Global reports that cable MVPDs earned net ad revenue of $4.2 billion in 2016 and $3.9 billion in 2017.[143]

Fig. B-3

MVPD Video Revenue (in millions)[144]

	2016	2017	Percentage Change
AT&T	$36,460	$36,728	0.7%
Comcast	$22,357	$23,129	3.5%
Charter	$16,390	$16,641	1.5%
DISH Network	$15,212	$14,391	-5.4%

a. Business Models and Competitive Strategies

56. MVPDs often seek to differentiate themselves from one another to gain an advantage over competitors. For example, they may differentiate based on equipment technology, pricing, discounts for new subscribers, responses to increased programming costs, bundles, differing sizes of video packages, TV Everywhere[145] rights, integration of OVD services with MVPD packages, Wi-Fi hotspots,[146] and digital technology.[147] MVPDs also have different strategies for owning their own content

[141] *See id*. Throughout this section, percentages provided may not sum to exactly 100 due to rounding.

[142] Tony Lenoir, *Multichannel Trends: 10-year video revenue outlook anticipates continued drift away from 2016 peak*, S&P Global (Sept. 27, 2018).

[143] *Id*.

[144] AT&T, 2017 Annual Report at 20; Comcast, SEC Form 10-K for the year ended December 31, 2017 at 39 (Comcast 2017 10-K); Charter, SEC Form 10-K for the year ended December 31, 2017 at 4 and 35; DISH Network, SEC Form 10-K for the year ended December 31, 2017 at 62 (DISH Network 2017 10-K).

[145] *See infra* para. 64.

[146] Some MVPDs have built Wi-Fi Networks that enable subscribers to access content on mobile devices outside their homes. A consortium called Cable Wi-Fi, comprised of Cox, Altice, Charter, and Comcast, has built over 500,000 hotspots typically located in high-traffic areas like businesses, hotels, restaurants and malls. *See, e.g.*, Spectrum, *Cable WiFi Internet access is brought to consumers through a collaboration among U.S. Internet service providers*, https://www.spectrum.com/content/spectrum/residential/microsites/cablewifi/cablewifi.html. Cable Wi-Fi allows Internet subscribers of these companies to access the hotspots of other consortium members. *Id*.

and for offering alternative OVD services for consumers who do not subscribe to an MVPD's traditional video services. We discuss some of the most relevant of these issues further below.

57. *Channel Packages.* Today, the major MVPDs offer hundreds of linear channels, and there is often substantial overlap in the channels offered by competing MVPDs. Providers rarely offer exclusive channels,[148] and all of the large MVPDs traditionally have offered consumers access to all the major broadcast and cable networks, as well as a similar selection of premium channels. As a result, from the perspective of linear programming, most consumers view MVPDs as good substitutes because they can replace one MVPD with another, without losing popular channels, provided the household has access to a competing MVPD.

58. *VOD Programming*. MVPDs often distinguish themselves by offering varying amounts of VOD content, which gives subscribers access to a vast library of television shows and movies. This library of programming available "on demand" offers subscribers another way to consume video programming besides the linear channels. The average number of VOD movies and TV episodes offered by major MVPDs reached 77,570 selections per month at the end of 2017,[149] but there was wide variance among providers. For example, Verizon Fios offered 160,000 VOD titles per month, Cox 100,000, DISH Network 47,000, Charter 35,000, and DIRECTV 30,000.[150]

59. *Packages and Pricing*. To attract and retain customers, MVPDs offer a variety of channel packages at different prices. Although the channel packages offered by one company are never exactly the same as the channel packages offered by another company, competitive forces pressure MVPDs to offer comparable channel packages at similar prices. [151] Traditional MVPD channel packages include a large number of channels and cover a wide variety of genres and interests. For example, Comcast offers three packages with channel counts ranging from about 140 to more than 260, priced from $59.99 to $84.99 per month.[152] Similarly, DISH Network offers packages with channel counts ranging from 190 to more than 290, priced from $59.99 to $89.99 per month.[153]

60. In response to competition from OVDs, slow growth in household incomes, and increasing programming costs, some MVPDs have begun offering smaller video packages (sometimes called "skinny" channel packages), which typically include a limited selection of channels, often focusing

(Continued from previous page)

[147] Wireline MVPDs continue to free up bandwidth in their systems by transitioning analog channels to digital. According to S&P Global, Comcast, Cox, and Mediacom were all-digital in 2016. S&P Global, Cable TV Investor at 4-5 (Feb. 28, 2017). Charter expects to finish transitioning systems it acquired from Time Warner Cable and BrightHouse in 2019. *Id.*

[148] The NFL Sunday Ticket, offered exclusively by DIRECTV, is perhaps the most well-known exception to this observation.

[149] S&P Global, Cable TV Investor at 3-4 (Feb. 23, 2018).

[150] *Id*.

[151] Many factors potentially affect the value of a video package including the specific networks and movie channels included in the package, the advanced services included in the package (e.g., HD, DVR, VOD, and TV Everywhere), rental of set-top boxes, and fees for local stations and regional sports. Similarly, MVPD video services differ by equipment, number of connected TVs, length of contract, and additional fees. *See e.g.*, Brendan Hesse, *DISH Network Versus DIRECTV*, Digital Trends (May 12, 2017), https://www.digitaltrends.com/home-theater/dish-network-versus-directv/. *See also*, Trevor Wheelwright, *Verizon Fios vs Comcast XFINITY*, Reviews.org (June 16, 2017), http://www.reviews.org/comparisons/verizon-fios-vs-comcast-xfinity/.

[152] Comcast, *XFINITY Deals*, https://www.xfinity.com/learn/offers?lob=tv,internet (last visited June 27, 2018).

[153] DISH Network, *Satellite TV Packages*, https://www.dish.com/programming/packages/ (last visited June 27, 2018).

on specific subscriber interests, such as sports, children's entertainment, or movies.[154] Examples of such video packages include Verizon Fios's Custom TV-Action & Entertainment with 62 channels and Custom TV-Sports & News with 57 channels.[155] Packages start at $64.99 per month.[156] Similarly, DIRECTV's Select All Included package provides more than 150 channels for $40.00 per month.[157]

61. *Prices for New and Existing Subscribers*. The prices discussed above are generally applicable to new subscribers. Typically, the prices prominently displayed to consumers on MVPD websites, in mailings, or in television advertisements are for new subscribers, and are often for a limited time (e.g., six months, one year, or two years), with the subscription rate increasing thereafter.

62. Offering discounts to new subscribers is a common pricing strategy. MVPDs offer substantial savings to new subscribers for a short period of time because the potential revenue stream over the long term is substantial. According to S&P Global, adding and terminating subscriber accounts is expensive, so the goal of every MVPD is to maximize the length of time an account is active at the same location through subscriber retention.[158] DISH Network explains that the company incurs significant upfront costs to acquire subscribers and strives to "provide outstanding customer service to increase the likelihood of customers keeping their pay-TV service over longer periods of time."[159] Once the promotional period is over, MVPD subscribers generally can expect their monthly bills to increase. While MVPDs display prices for service upgrades on their websites, options for lowering an existing subscriber's monthly bill, for example by downgrading or cancelling services, are harder to find. Existing subscribers sometimes find that MVPDs offer lower ongoing prices over the phone than are available on provider websites.[160]

63. *Bundling.* MVPDs often offer better deals to consumers who purchase video services as part of a bundle that includes some combination of video, Internet, voice, and mobile wireless services.[161] Often the price of a bundle of video, telephone, and Internet service is only marginally different from the price of Internet service alone.[162] Analysts suggest that the strategy of bundling services to subscribers

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[154] S&P Global, Cable TV Investor at 1 (July 31, 2015); S&P Global, Cable TV Investor at 3 (July 29, 2015). *See also* Joe Flint, *Why Does the Cable-TV Bundle Exist Anyway?*, Wall St. J. (June 8, 2015), http://www.wsj.com/articles/why-does-the-cable-tv-bundle-exist-anyway-1433807825.

[155] Verizon, *Fios Custom TV | Verizon Official Site*, https://fios.verizon.com/fios-custom-tv-package.html. (last visited Sept. 24, 2018).

[156] Verizon, *Fios TV Plans, Custom | Verizon Official Site*, https://www.verizon.com/home/fiostv/ (last visited Sept. 24, 2018).

[157] DIRECTTV, *DIRECTTV Packages – Build Your Own*, https://www.directv.com/DTVAPP/pepod/configure.jsp#package-section (last visited Oct. 1, 2018).

[158] Keith Nissen, *Most US Households Remain Loyal to Multichannel TV Service Provider*, S&P Global (Apr. 25, 2016). *See also*, Ian Kingwill, *What is the Cost of Customer Acquisition vs Customer Retention?* (March 3, 2015), https://www.linkedin.com/pulse/what-cost-customer-acquisition-vs-retention-ian-kingwill.

[159] DISH Network 2017 10-K at 6.

[160] *See* e.g., Christopher Elliot, *How To Negotiate A Lower Cable Bill Without Cutting The Cord*, Huffington Post (March 15, 2017), http://www.huffingtonpost.com/entry/how-to-negotiate-a-lower-cable-bill-without-cutting_us_58c7f5d9e4b0d06aa65804be; *See* e.g., Emily Guy Birken, *How to Negotiate Your Way to a Lower Cable Bill*, Moneyning, http://moneyning.com/budgeting/how-to-negotiate-your-cable-bill/.

[161] *18th Report*, 32 FCC Rcd at 589-90, paras. 51-54.

[162] *See* Ashley Rodriguez, *Internet-TV Bundles Like Sling TV Aren't Saving Cord-cutters Money Off Cable*, Quartz (Jan. 18, 2018), https://qz.com/1182312/internet-tv-bundles-like-slingtv-arent-saving-cord-cutters-money-off-cable/; Rani Molla, *Americans Are Still Paying for Cable Because It's Bundled With Their Internet*, Recode (Mar. 20, 2018), https://www.recode.net/2018/3/20/17139756/reasons-americans-us-pay-cord-cable-tv, (Molla) ("For many, (continued….)

has a positive effect on customer retention as the household is reliant on the MVPD for multiple services.[163] In a recent survey, 56% of MVPD subscribers responded that a top reason for keeping the video service was because it was bundled with Internet service.[164]

64. *TV Everywhere*. Many MVPDs offer connected video services, referred to as "TV Everywhere," which allow consumers to access cable and broadcast channels and VOD programming on a variety of Internet-connected devices both inside and outside the home.[165] S&P Global maintains that MVPDs offer TV Everywhere at no extra charge in order to provide incentives for consumers to subscribe to higher channel packages.[166] There are significant differences in the number of TV Everywhere programs offered by the largest MVPDs. For example, in early 2018, S&P Global determined that Verizon FIOS offered 6,375 TV Everywhere movie titles, whereas Charter offered 293.[167]

65. *Video Services for Consumers Who Do Not Subscribe to an MVPD.* Some MVPDs offer online video services separate from their MVPD service. DISH Network led the way in the marketplace with the introduction of Sling TV in February 2015, offering a package of linear programming channels similar to a traditional pay-TV program package. AT&T followed with DIRECTV Now in November 2016 and WatchTV in June 2018. These online video services are examined more fully in our discussion of OVDs below. While DBS MVPDs have begun offering these services, wireline MVPDs have hesitated to offer channel packages that rely for delivery on facilities owned by other providers.[168] For example, Comcast's Instant TV service is available only to Comcast Internet subscribers.[169] And Charter's Spectrum TV Stream has similar restrictions.[170]

66. *Impact of Programming Costs*. In general, programming costs for MVPDs have increased in recent years, resulting in increased costs for MVPD subscribers. S&P Global estimates that programming costs per subscriber were $52.68/month in 2017, up from $48.81 in 2016.[171] In response to increased programming costs, many MVPDs have added "broadcast fees" and "regional sports fees" to monthly billing statements to pass those costs through directly to consumers and cover a portion of the increased programming costs without appearing to raise the rate of the television service.[172]

(Continued from previous page)
the cost they'd have to pay for internet alone isn't much less than they would pay for [TV, telephone, and internet] individually…").

[163] *See* Jeffrey Prince and Shane Greenstein, *Does Service Bundling Reduce Churn?*, 23 J. of Economics & Management Strategy 839-75 (Winter 2014) (finding that bundling reduces subscriber churn); Jeffrey Prince, *The Dynamic Effects of Triple Play Bundling in Telecommunications*, Time Warner Cable, Research Program on Digital Communications (Winter 2012) (arguing that firms bundle video, Internet, and voice services to reduce subscriber churn).

[164] *See* Molla (noting that according to a March 2018 Deloitte survey, 56% of Americans cite service bundling as a reason for subscribing to their MVPD).

[165] TV Everywhere uses an authentication process to ensure that users subscribe to an MVPD. The process requires users to select their MVPD service provider and then provide a user ID and password.

[166] S&P Global, Cable TV Investor at 2 (Jan. 27, 2017).

[167] S&P Global, Cable TV Investor at 7-8 (Feb. 23, 2018).

[168] S&P Global, Cable TV Investor at 8-10 (Apr. 26, 2018).

[169] S&P Global, Cable TV Investor at 6 (June 2018).

[170] *Id*.

[171] S&P Global, Cable TV Investor at 17-20 (Apr. 26, 2018).

[172] *See* e.g., James K. Willcox, *Your Cable Bill Probably Went Up More Than You Think*, Consumer Reports (May 9, 2018), https://www.consumerreports.org/tv-service/your-cable-bill-probably-went-up-more-than-you-think/. *See also* S&P Global, Cable Program Investor at 2-4 (Apr. 23, 2018).

67. *Ownership of Content.* Some MVPDs have ownership interests in cable, broadcast, and regional sports networks that allow them to vertically integrate their ownership of a distribution network with ownership of video programming. For example, Comcast owns a dozen cable channels, including the NBC Sports Network, USA, E!, Syfy, MSNBC, CNBC, Bravo, Oxygen, and the Golf Channel; regional sports networks in Baltimore/Washington, Boston, Chicago, Philadelphia, Portland (Oregon), Sacramento, and San Francisco; the NBC and Telemundo broadcast networks; 11 NBC-affiliated broadcast stations, 17 Telemundo-affiliated broadcast stations; and Universal Pictures.[173] When acquiring NBC Universal, Comcast explained that, in part, its acquisition of programming assets was designed to facilitate offering expanded VOD and TV Everywhere services.[174] More recently, AT&T acquired Time Warner, which included the Warner Bros Studios, as well as the HBO, Turner, and CNN channels.[175] When announcing plans to merge, AT&T explained that ownership of Time Warner content would accelerate innovation in the mobile environment and improve targeted advertising.[176]

b. Recent Entry and Exit

68. In general, competition in the video delivery marketplace is enhanced by entry of new facilities-based providers and when existing providers upgrade their video delivery systems.[177] When existing MVPDs merge or cease operations, competition may decrease.[178] When two MVPDs with non-overlapping footprints merge, the number of MVPDs available to customers does not change, but the transaction may still produce public interest benefits or harms.[179]

69. Most MVPD entry and expansion in the past decade has come from telephone companies building fiber networks to compete with cable companies for video, Internet, and phone services. Telephone companies had been extending their wireline MVPD networks to additional households. This activity appears to have slowed recently. For example, in 2015, following its acquisition of DIRECTV, AT&T began encouraging customers to use DIRECTV, rather than AT&T's wireline U-verse, for video services.[180] Similarly, Google Fiber stopped its buildout in 2016,[181] and CenturyLink stopped expanding and promoting Prism TV in 2018.[182]

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[173] Comcast 2017 10-K at 5-8.

[174] *Applications for Consent to the Transfer of Control of Licenses, General Electric Company, Transferor, to Comcast Corporation, Transferee, Applications and Public Interest Statement* (filed Jan. 28, 2010), https://ecfsapi.fcc.gov/file/7020394237.pdf.

[175] Press Release, AT&T, AT&T Completes Acquisition of Time Warner Inc. (June 15, 2018), http://about.att.com/story/att_completes_acquisition_of_time_warner_inc.html.

[176] Press Release, AT&T, AT&T to Acquire Time Warner (Oct. 22, 2016), http://about.att.com/story/att_to_acquire_time_warner.html. *See also* Jason Lynch, *AT&T and Time Warner's CEOs Explain the Benefits of Their $85 Billion Merger*, Adweek (Oct. 24, 2016), https://www.adweek.com/tv-video/att-and-time-warners-ceos-explain-benefits-their-85-billion-merger-174224/.

[177] *18th Report*, 32 FCC Rcd at 582, para. 34.

[178] *Id.*, at 583, para. 37.

[179] *Id.*

[180] S&P Global, Cable TV Investor at 10-12 (Feb. 28, 2017).

[181] Chris Mills, *What's happening to Google Fiber?*, BGR (Jan. 31, 2018), https://bgr.com/2018/01/31/google-fiber-availability-new-cities-nope/; Jeff Kagan, *What Ever Happened to Google Fiber?*, E-commerce Times (June 14, 2018), https://www.ecommercetimes.com/story/85391.html.

[182] Daniel Frankel, *CenturyLink No Longer Working to Expand Prism TV Service*, FierceCable (Apr. 10, 2018), https://www.fiercecable.com/cable/centurylink-no-longer-working-to-expand-prism-tv-service; Karl Bode, *CenturyLink Drops TV Services, May Ditch Residential Broadband*, DSL Reports (Apr. 13, 2018), http://www.dslreports.com/shownews/CenturyLink-Drops-TV-Services-May-Ditch-Residential-Broadband-141598.

c. Report on Cable Industry Prices

70. In the context of this discussion of MVPDs in the video marketplace, we report on the average rates charged by cable operators for basic cable service and other cable programming, as well as cable equipment to access such programming,[183] as required by Section 623(k) of the Communications Act of 1934, as amended by the Cable Television Consumer Protection Act of 1992 (Cable Act)[184] and the Consolidated Appropriations Act of 2018.[185] Consistent with the statute, the Commission is required to compare the rates of operators subject to effective competition to the rates of operators not subject to effective competition under a statutorily defined standard (herein after referred to as "effective competition").[186] In addition, section 110 of the STELA Reauthorization Act of 2014 requires the Commission to report on retransmission consent fees paid by cable systems to broadcast stations or groups.[187] The following presents an overview of the Commission's findings as of January 1, 2017, and fulfills these statutory directives.[188]

[183] 47 U.S.C. § 522(5) (defining cable operator). Cable operators include operators of traditional coaxial and fiber cable systems, municipalities, and telephone companies including Verizon Fios. DBS providers and AT&T U-verse systems are not registered with the Commission, and thus these systems' prices are not included, although DBS and AT&T U-verse are competitors for purposes of assessing effective competition. "Service tier" refers to a cable service for which a separate rate applies. *Id.* § 522(l7). Operators must provide a separately available "basic cable service" to which customers must subscribe before accessing any other tier of service. *Id.* § 543(b)(7). "Other cable programming" service means any video programming other than programming offered with the basic service or programming offered on a per channel or per program basis. *Id.* § 543(l)(2). Section II, Part C defines other cable programming for the purpose of the Report.

[184] Section 623(k), adopted as Section 3(k) of the Cable Act, Pub. L. No. 102-385, 106 Stat. 1460, codified at 47 U.S.C. § 543(k).

[185] The RAY BAUM'S Act requires, among other things, that the Commission include in a single report the information formerly submitted to Congress as the annual report on cable industry prices required by section 623(k) of the Communications Act. RAY BAUM'S Act, sections 401-404. The prior annual reports provided statistical data on the average rates for basic cable service, other cable programming service, and equipment, as well as a comparison of the average rates of cable systems that the Commission has found are subject to effective competition with those of systems that the Commission has found are not subject to effective competition. In addition, the annual report includes information related to retransmission consent fees for broadcast stations, as discussed further below.

[186] Commission findings of effective competition generally are made in reference to a "cable community identifier" (CUID). The Commission assigns a unique CUID to each operator for each community the operator serves. As discussed in Appendix B-1, the Commission recently changed its process and presumption for determining effective competition. In 2015, the Commission adopted a rebuttable presumption that cable operators in all cable communities are subject to effective competition. *Amendment to the Commission's Rules Concerning Effective Competition, Implementation of Section 111 of the STELA Reauthorization Act*, Report and Order, 30 FCC Rcd 6574 (2015). As a result of this change, operators in nearly all communities are now subject to effective competition. Rates of an operator subject to effective competition are not subject to regulation by a local franchising authority (LFA). 47 U.S.C. § 543(a)(2); 47 CFR § 76.905(a). An LFA may elect to regulate the rate of basic service of an operator not subject to effective competition. *Id.*

[187] Section 110 of the STELA Reauthorization Act of 2014 (STELAR). *See* Pub. L. No. 113-200, 128 Stat. 2059 (2014) enacted December 4, 2014 (H.R. 5728, 113th Cong.). Specifically, STELAR instructs the Commission to include in its now-biennial report on cable industry prices "the aggregate average total amount paid by cable systems in compensation under section 325 [of the Communications Act of 1934, as amended,]" and to report such information "in a manner substantially similar to the way other comparable information is published" in the report. 47 U.S.C. § 543(k)(2), as amended.

[188] The Commission's complete report, containing additional data, information, and findings, is attached at Appendix B-1.

71. *Average price over all communities (regardless of effective competition standing).* Over the 12 months ending January 1, 2017, the average monthly price paid by subscribers who take only basic cable service grew by an average of 5.2%, to $25.06. The average price for expanded basic cable service (the next level of service above the basic tier) rose by 3.2% over the same one-year period to $75.21. Over the five years ending January 1, 2017, the price of expanded basic service rose, on average, by 4.1% annually. Average price per channel (price divided by the number of channels offered with expanded basic service) fell by 10.1% to 49 cents per channel over the 12 months ending January 1, 2017. Over the last five years, price per channel has decreased, on average, by 0.8% annually. For comparison, the rate of general inflation measured by the Consumer Price Index (all items) rose by 2.5% over the 12 months ending January 1, 2017, and at an average annual rate of 1.4% over the last five years.

72. *Average price in the communities with a finding of effective competition (effective competition communities) compared to price in communities without a finding of effective competition (noncompetitive communities).* On January 1, 2017, the average price of basic service was more than 50% higher in effective competition communities than in noncompetitive communities. However, the increase in the average price of basic service was smaller in effective competition communities than in non-effective competition communities. Specifically, over the 12 months ending January 1, 2017, the average price of basic service in effective competition communities rose by 5.2% to $25.17. In noncompetitive communities, the average price of basic service grew by 9.8%, to $16.61. The differences between these groups in both absolute price levels and in the change in prices over time likely reflect a complicated mix of factors, with operators providing different service offerings in reaction to competition and regulation.

73. On January 1, 2017, the average price of expanded basic service in effective competition communities was about 3% lower than the average price of expanded basic in the noncompetitive communities. Over the 12 months ending January 1, 2017, the average price of expanded basic service in effective competition communities rose by 3.2% to $75.19. In noncompetitive communities, the average price of expanded basic service grew by 3.6%, to $77.24. In contrast to the average price of expanded basic service, the average price per channel was higher in effective competition communities (49 cents per channel) than in noncompetitive communities (39 cents per channel). Although operators in noncompetitive communities charged slightly more for expanded basic service than operators in effective competition communities, they offered more channels. Operators in effective competition communities offered an average of 195 video channels, while operators in noncompetitive communities offered an average of 212 channels.

74. *Average price in effective competition subgroups compared to price in noncompetitive communities.* As in prior years, we divided operators subject to effective competition into subgroups. Compared to the noncompetitive communities, the average price of basic service was higher in every effective competition subgroup and the difference was statistically significant in all subgroups except the rival subgroup. Compared to the average price of expanded basic service charged in noncompetitive communities ($77.24), the average prices charged by incumbent operators and rival operators of such services were each about 6% lower ($72.87 and $72.40 respectively). These differences are statistically significant. Looking at the other effective competition subgroups, the average price charged by operators of small systems was $71.73 (7.1% lower); the average price charged by operators of midsize systems was $75.35 (2.4% lower); and the average price charged by operators of large systems was $76.25 (1.3% lower). The difference between the small systems subgroup and the noncompetitive group is statistically significant but the other two differences are not statistically significant.[189]

[189] The subgroups are defined as follows: incumbent operators are the original cable service operator in effective competition communities that are served by at least two wireline MVPDs; rival operators are later entrants in effective competition communities that are served by at least two wireline MVPDs; and all effective competition communities are divided by number of subscribers into those served by small, medium, or large systems. The sample for noncompetitive communities is drawn separately from the 118 communities that have successfully

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75. *Broadcast retransmission consent compensation fees.* From 2015 to 2016,[190] total retransmission consent fees paid by cable systems to television broadcast stations increased, on average, by 31.8% per year.[191] Similarly, these same fees calculated on a per-subscriber basis increased on average by 30%, rising from $55.82 to $72.59 over the same period. Average monthly retransmission consent fees per subscriber per broadcast station increased by about 25% annually increasing from $0.50 to $0.63 from 2014 to 2016. Over the period 2013-2016, the compound average annual increase in retransmission consent fees was 42.3%, and the compound average annual increase in fees calculated on a per-subscriber basis was 37.8%.

2. OVDs

a. Business Models and Competitive Strategies

76. An OVD is an entity that distributes video programming to consumers over the Internet, not as a component of an MVPD subscription, and not solely to customers of an ISP owned or operated by the entity or its affiliates.[192] OVDs employ a wide variety of strategies and business models to attract and retain viewers, as reflected in the different approaches that OVDs take regarding the size and variety of their video libraries and the decisions they make regarding ownership of content. Other differences may include whether the OVD offers a linear programming service that includes cable and broadcast channels, whether it sells or rents movies and TV shows, its pricing and geographic availability, and what devices the service supports.

77. *Video Libraries and Ownership of Content*. In contrast to MVPDs, which rarely compete in terms of exclusive content, many OVDs differentiate themselves by offering original and exclusive content.[193] Some OVDs offer large libraries with thousands of movies and TV shows from many media companies covering many genres. Others offer smaller libraries focusing on content from specific media companies, networks, or genres. Although most OVD content is not original--it first appeared in theaters or on broadcast or cable networks--some OVDs negotiate exclusive streaming rights to attract consumers seeking specific movies and TV shows.

78. Some OVDs had ownership interests in content when they launched. For example, Hulu is a joint venture of Walt Disney, Comcast, and AT&T, and Sony owns Crackle. Other OVDs, like Netflix and Amazon Prime, launched without ownership interests in content but subsequently included original content in their offerings. Although final numbers are not yet available, analysts expect that in 2018, Netflix will spend $6 billion on content acquisition, an increase of more than $1 billion over the $4.7 billion it spent in 2017.[194] Analysts also indicate that of the $8 billion Netflix is expected to spend

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rebutted the presumption of effective competition. We provide more detail on the sampling groups and subgroups in Appendix B-1.

[190] The data for retransmission consent fees are collected somewhat differently than the rest of the data in the report. Retransmission data are collected for complete years, whereas all the rest of the data are collected as of a certain date (January 1). As a result, the retransmission consent fee data are for the *complete years* 2015 and 2016 (the latest two years for which annual retransmission consent data were available at the time of the 2017 survey), whereas the other data in the survey, by contrast, are snapshots as of January 1, 2016, or January 1, 2017.

[191] More recent estimates show that growth in retransmission consent fees has slowed. From 2016 to 2017, S&P Global estimates that total retransmission consent fees paid to television stations increased by 17.7%. S&P Global, U.S. TV station industry total revenue projections, 2006-2023 (accessed December 7, 2017).

[192] *See supra* note 131. Although online video includes both professional and amateur content, our focus is on content similar to the programming offered by cable and broadcast networks.

[193] S&P Global, Internet & OTT Industry Overview: Over-the-Top Video at 9 (April 2017).

[194] Deana Myers, *Netflix Content Spend Projected to Rise 29% This Year, Hit $2B-plus on Originals* S&P Global (March 28, 2018).

on content in 2018, approximately $2.1 billion will be spent on developing original programming, with the remainder invested in content acquisition and licensing costs.[195] According to the Chief Content Officer for Netflix, the company's shift to original content "is driven by more favorable economics—as opposed to licensing TV shows and films owned by Hollywood studios—and the expectation that big media companies would eventually put more weight into their own streaming-subscription services."[196] Netflix also has explained that its decision to own content was driven by the belief that content owners like Disney would raise prices or pull licensing deals and start their own online video services.[197]

79. Similarly, after spending $3.7 billion on content in 2017,[198] Amazon is expected to increase content spending to $5.1 billion in 2018, with $1 billion directed toward original programming.[199] Amazon has explained that its investment in original content is designed to lure consumers to Amazon Prime and drive merchandise sales.[200] Hulu spent $2.5 billion in 2017 and plans to spend approximately $3.1 billion in 2018. Of that total, Hulu's spending on original content is expected to total $219 million.[201]

80. OVDs focusing on offering original or exclusive VOD content may view themselves as supplements to MVPD services with every consumer a potential customer.[202] Many consumers appear to view these OVDs as supplements and subscribe to more than one. In the summer of 2018, Leichtman Research Group estimated that among households that subscribe to an OVD offering VOD content, 63% subscribe to more than one.[203]

81. *Cable and Broadcast Channels*. Apart from OVDs specializing in live sports, most OVDs traditionally offered libraries of video content available on-demand for consumer viewing. A significant recent development in the Internet delivery of video services has been the increasing number of entities offering online packages of linear cable and broadcast channels. S&P Global now refers to these entities as "virtual multichannel" providers because they offer linear content similar to traditional

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[195] *Id.* In May 2018, the Chief Content Officer for Netflix suggested even more significant spending on original content. Todd Spangler, *Netflix Content Chief Says 85% of New Spending Is on Originals*, Variety (May 14, 2018), https://variety.com/2018/digital/news/netflix-original-spending-85-percent-1202809623/ ("Netflix is sharply steering its new content spending toward original projects, with around 85% of new spending going to original TV shows, films and other productions, according to chief content officer Ted Sarandos.").

[196] *Id.*

[197] *See* Ashley Rodriguez, *Netflix is Preparing for a Future Where Its Content is Mostly Its Own*, Quartz (July 17, 2018), https://qz.com/1329821/netflix-is-preparing-for-a-future-where-it-has-mostly-originals/. *See also* Nick Statt, *Netflix plans to spend $8 billion in 2018 to help make its library 50 percent original*, The Verge (Oct. 16, 2017), https://www.theverge.com/2017/10/16/16486436/netflix-original-content-8-billion-dollars-anime-films.

[198] Deana Myers, *Amazon Content Spend up Nearly 40% This Year, $1 Billion in Originals*, S&P Global (Apr. 5, 2018).

[199] *Id.*

[200] Jeffrey Dastin, *Exclusive: Amazon's internal numbers on Prime Video, revealed*, Reuters (Mar. 15, 2018), https://www.reuters.com/article/us-amazon-com-ratings-exclusive/exclusive-amazons-internal-numbers-on-prime-video-revealed-idUSKCN1GR0FX.

[201] Deana Myers, *Hulu Content Spend on Significant Upward Path*, S&P Global (Feb. 1, 2018).

[202] *See* Ashley Rodriguez, *Amazon Prime Video is still just a complement to Netflix, study finds*, Quartz (June 27, 2018), https://qz.com/1315838/amazon-prime-video-is-still-just-a-complement-to-netflix-study-finds/. *See also* Jayson Derrick, *Study: Netflix, Hulu, Amazon Prime Are More Complementary Than Competitive*, Benzinga (Feb. 3, 2018, https://www.benzinga.com/tech/18/02/11107959/study-netflix-hulu-amazon-prime-are-more-complementary-than-competitive.

[203] Press Release, Leichtman Research Group, 69% of U.S. Households Have an SVOD Service (Aug. 27, 2018), https://www.leichtmanresearch.com/69-of-u-s-households-have-an-svod-service/.

MVPDs.[204] Leichtman Research Group refers to these entities as "online pay TV providers" and discusses them alongside MVPDs.[205] Leichtman considers the Internet as simply another delivery technology akin to coaxial cable, DBS, and fiber.[206] Entities providing online packages of cable and broadcast channels have also been referred to as "virtual MVPDs" and this is the term we will use.[207]

82. Virtual MVPDs like Sling TV, DIRECTV NOW, Hulu Live TV, YouTube TV, and PlayStation Vue offer packages of broadcast and cable channels similar to the small and medium-sized channel packages offered by MVPDs.[208] Layer3 TV offers a large channel package similar to the full channel lineups that MVPDs offer.[209] Virtual MVPDs offering similar packages of cable and broadcast channels may see themselves as potential substitutes to traditional cable, telco, or satellite delivered MVPDs, and thus may view competition as winner-take-all with most consumers subscribing to only one provider. On the other hand, no two virtual MVPDs offer exactly the same channels,[210] and consumers with strong preferences for specific channels may not view all virtual MVPDs as good substitutes for one another. In particular, some virtual MVPDs do not offer access to all local broadcast stations or regional sports networks. In addition to channel offerings, consumers comparing virtual MVPDs also take account of prices and features like access to a digital video recorder (DVR) in the cloud.[211]

83. *Sale and Rental*. While some OVDs offer access to a library of video programming for a set monthly subscription, others offer video content for sale and rental. Online video sales allow consumers to purchase a digital copy of a video program for a one-time fee. The program is then downloaded and stored either locally (e.g., on a hard drive) or remotely via a cloud storage service. Purchased and downloaded videos can be viewed repeatedly and whenever the consumer chooses. Online video rentals allow consumers to download a digital copy but require the consumer to start watching within a set period (e.g., 30 days) and finish watching within a set period (e.g., 24 hours). Once the program has been watched or the rental period has expired, the consumer can no longer view the program.

84. *Pricing*. Some OVDs offering VOD content are fully supported by advertisements and provide unlimited viewing of a catalog of video programs for free. Others require users to pay a monthly subscription fee to access their content. The fees for such services range from $4.99 per month to $14.99 per month.[212] Subscription prices for virtual MVPDs offering packages of cable and broadcast channels range from $15 per month to $80 per month depending on the package selected.[213] Our review of some

[204] S&P Global, Cable TV Investor at 3 (June 2018).

[205] Leichtman Research Group, Research Notes 1Q 2017, http://www.leichtmanresearch.com/research.html#notes.

[206] *Id*.

[207] Carl Wienschenk, *vMVPD Satisfaction: Despite the Technical Shortcomings, Subscribers are Warming to Pay-TV Alternatives*, Telecompetitor (Aug. 16, 2017), http://www.telecompetitor.com/vmvpd-satisfaction-despite-the-technical-shortcomings-subscribers-are-warming-to-pay-tv-alternatives/.

[208] S&P Global maintains that virtual MVPDs "continue to add live stations, strengthening their position as cable alternatives." Peter Leitzinger, *VSP & OTT Live Station Streams Bring on New Affiliates*, S&P Global (July 31, 2017).

[209] Henry T. Casey, *What Is Layer3 TV and How Does It Work?*, Tom's Guide (Dec. 13, 2017), https://www.tomsguide.com/us/layer3-faq-price-specs-t-mobile,news-26259.html.

[210] David Katzmaier, *All the Live TV Streaming Services Compared: Which has the Best Channel Lineup?*, CNET (July 26, 2018), https://www.cnet.com/news/live-tv-streaming-services-channel-lineups-compared/.

[211] Ali Choukeir, *VSP Channel Comparison Exposes Interesting Contrasts*, S&P Global (June 12, 2017).

[212] Ali Choukeir, *Economics of Internet: Profile: Netflix (U.S.)*, S&P Global (April 10, 2018).

[213] Ali Choukeir, *Economics of Internet: State of US Online Video: Virtual Multichannel*, S&P Global (July 23, 2018).

OVDs specializing in sports showed season prices ranging from a low of $4.99/month for Major League Soccer to a high of $199.99/season for the National Basketball Association.

85. In contrast to MVPDs, which offer new customers multi-month discounts, OVDs rarely offer lower prices to new customers as an inducement to subscribe.[214] Many OVDs, however, offer a free trial period that gives consumers an opportunity to explore the provider's content library and test the service on various devices.[215] When the free trial period is over, OVDs typically offer service on a month-to-month basis, charging both new and old customers the same price for service that can be cancelled at any time.[216]

86. *Geographic Availability*. Although traditional OVDs offering video content are available nationwide to anyone with an Internet connection, OVDs offering linear packages of cable and broadcast channels may differ in their geographic reach. Availability may be based on contractual arrangements with cable networks, broadcast stations, and other content owners.[217] Availability may also require building, or contracting with, content distribution networks (CDNs) to enhance the speed and quality of video content delivered to consumers.[218] Layer3 TV delivers its video service over existing wireline facilities, leasing the necessary capacity from local broadband providers.[219]

87. *Supported Devices*. OVDs further differentiate their services by the number of devices that can be connected to the service at the same time.[220] Moreover, not all devices work with all online services. For example, the Apple TV streaming device did not include an app for Amazon Prime until the end of 2017,[221] and the Google Chromecast streaming device currently does not have an app for Amazon Prime.[222] Notably, Amazon, Google, Apple, and Sony are each both OVDs and manufacturers of Internet-connected devices, and each has its own business plan for whether and how to make its OVD content accessible on devices manufactured by rival entities. S&P Global maintains that entities that provide both video services and devices "can give a service an edge in terms of search, discovery and app placement."[223]

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[214] S&P Global, Cable TV Investor at 2 (Sept. 29, 2017).

[215] *Id*.

[216] *See, e.g.*, DIRECTV NOW, *DIRECTV NOW Packages & Pricing*, https://www.directvnow.com/tv-packages (last visited July 9, 2018).

[217] *See, e.g.*, *YouTube TV Expands to 14 New Markets, Partners with Sinclair Stations*, CNBC (Aug. 17, 2017), https://www.cnbc.com/2017/08/17/youtube-tv-expands-to-14-new-markets-partners-with-sinclair-stations.html.

[218] Content distribution networks speed transmission and reduce latency by storing cached versions of video data in geographic locations closer to the consumer. CDNetworks, *How Content Delivery Networks Work* (April 13, 2015), https://www.cdnetworks.com/en/news/how-content-delivery-networks-work/4258.

[219] Bernie Arnason, *IP Video Provider Layer 3 TV Partners with Muni Broadband Provider for Hosted Video*, Telecompetitor (Mar. 13, 2017), http://www.telecompetitor.com/ip-video-provider-layer-3-tv-partners-with-muni-broadband-provider-for-hosted-video/.

[220] Ali Choukeir, *Economics of Internet: State of US Online Video: Virtual Multichannel*, S&P Global (July 23, 2018).

[221] Thomas Ricker, *Amazon Prime Video Comes to Apple TV, Finally*, The Verge (Dec 6, 2017), https://www.theverge.com/2017/12/6/16741136/download-amazon-prime-video-apple-tv.

[222] Parker Hall, *Watch Amazon Video on Your Chromecast — No Fire TV Stick Needed*, Digital Trends (Aug. 7, 2018), https://www.digitaltrends.com/home-theater/how-to-watch-amazon-instant-video-on-chromecast-or-android-tv/.

[223] S&P Global, Internet & OTT Industry Overview: Over-the-Top Video at 13 (April 2017).

b. Select Providers

88. The following OVD providers were selected to illustrate the strategies and business models discussed above.[224]

- Amazon: Amazon offers a large library of subscription-based video programming on demand, including a growing amount of original content.[225] Amazon Prime members pay $12.99 per month or $119 per year and receive access to Prime Video as part of the membership.[226] Prime Video may also be purchased as a standalone service for $8.99 per month.[227]
- Netflix: Netflix offers a large library of subscription-based video programming and a rapidly growing amount of original content.[228] Three streaming plans are available: a basic plan for one screen in standard definition (SD) for $7.99 per month; a standard plan for two screens in high definition (HD) for $10.99 per month; and a premium plan for four screens in HD/UHD 4K for $13.99 per month.[229]
- Hulu: Hulu is a joint venture co-owned by Walt Disney, Comcast, and AT&T.[230] Hulu's video library includes many current-season TV shows and 20 original series.[231] In 2017, the company introduced Hulu Live TV, which provides 50 programing channels as well as access to video on demand.[232] Hulu offers four plans: the VOD library with commercials for $7.99 per month; the VOD library without commercials for $11.99 per month; the VOD library with commercials and Live TV for $39.99 per month; and the VOD library without commercials and Live TV for $43.99 per month.[233]
- YouTube: Google's YouTube offers an ad-supported video library with a wide variety of content, including user-created videos, professionally produced video content, music videos

[224] The description of offerings is as of summer 2018, but notably OVD business models continue to evolve. For example, Amazon initially offered video sales and rentals and later added subscription-based VOD content. Hulu initially offered ad-supported VOD content, then moved to subscription-based VOD content, and has now added a subscription-based package of channels. *See* Ali Choukeir, *Economics of Internet: Profile: Hulu*, S&P Global (Feb. 22, 2017).

[225] Marshall Honorof, *What Is Amazon Prime?*, Tom's Guide (June 29, 2018), https://www.tomsguide.com/us/what-is-amazon-prime,news-18041.html.

[226] Amazon, Amazon Prime, https://www.amazon.com/Amazon-Prime-One-Year-Membership/dp/B00DBYBNEE (last visited Aug. 1, 2018).

[227] *Id*.

[228] Netflix, *How Does Netflix Work?*, https://help.netflix.com/en/node/412 (last visited July 5, 2018). Todd Spangler, *Netflix Eyeing Total of About 700 Original Series in 2018*, Variety (Feb. 27, 2018), https://variety.com/2018/digital/news/netflix-700-original-series-2018-1202711940/.

[229] Netflix, *Netflix Plans, Pricing & Signup*, https://www.netflix.com/signup/planform (last visited July 5, 2018). In addition to online video, Netflix offers plans that deliver DVDs to customers via mail. Netflix, *Rent Movies and TV Shows on DVD and Blu-ray*, https://dvd.netflix.com/ (last visited July 5, 2018).

[230] Luke Bouma, *Hulu's Ownership Just Changed & Will Change Again Soon*, Cord Cutters News (June 15, 2018), https://www.cordcuttersnews.com/hulus-ownership-just-changed-will-change-again-soon/.

[231] Hulu, *Stream TV and Movies Live and Online*, https://www.hulu.com/welcome. (last visited July 5, 2018).

[232] *Id*.

[233] John-Michael Bond, *Hulu No Commercials vs Hulu Limited Commercials: What's the Difference?*, The Daily Dot (July 30, 2018), https://www.dailydot.com/upstream/hulu-no-commercials-limited-commercials-plan/.

and clips from TV shows and movies.[234] YouTube Premium offers the same content without ads plus some original content for $11.99 per month.[235] In 2017, the company introduced YouTube TV, which provides 60 channels with VOD for $40 per month.[236]

- iTunes: Apple's iTunes offers sale and rental of over 100,000 movies and TV shows.[237]
- PlayStation Vue: Sony's PlayStation Vue offers four subscription-based channel packages along with access to video programming on demand. "Access" provides popular channels for $44.99 per month; "Core" includes sports channels for $49.99 per month; "Elite" adds movie channels for $59.99 per month; and "Ultra" adds access to premium channels for $79.99 per month.[238]
- Sling TV: DISH Network's Sling TV offers subscription-based channel packages with access to video programming on demand. Sling Orange offers 29 channels for $25/month, Sling Blue offers a different mix of 42 channels for $25/month, and Sling Orange plus Sling Blue cost $40/month.[239] Additional packages (e.g., sports, news, kids) can be added for an additional $5/month.[240]
- DIRECTV NOW: AT&T's DIRECTV NOW offers four subscription-based channel packages along with VOD. Live A Little provides 60+ channels for $40 per month, Just Right provides 80+ channels for $55 per month, Go Big offers 105+ channels for $65 per month, and Gotta Have It provides 125+ channels for $75 per month.[241]
- Layer3 TV:[242] T-Mobile's Layer3 TV offers 200 HD-only linear broadcast and cable channels for $75/month and is available in Chicago, Washington D.C., Los Angeles, and Dallas.[243] To provide service, Layer3 TV leases capacity from backbone and last mile broadband providers and requires use of a set-top box.[244]
- Cable and Broadcast Networks: Most premium cable networks, formerly available only as part of a traditional MVPD subscription, now offer subscription-based cable channels over the Internet. In addition to multiple linear programming streams, these networks also provide

[234] YouTube, *YouTube*, https://www.youtube.com/ (last visited Oct. 16, 2018).

[235] YouTube, *YouTube Premium*, https://www.youtube.com/red (last visited Oct. 16, 2018).

[236] YouTube, *YouTube TV: Watch & DVR Live Sports, Shows & News*, https://tv.youtube.com/welcome/ (last visited July 5, 2018).

[237] Apple, *iTunes – Video – Apple*, https://www.apple.com/itunes/video/ (last visited July 5, 2018).

[238] PlayStation Vue, *Watch Live Streaming TV*, https://www.playstation.com/en-us/network/vue/ (last visited Aug. 1, 2018).

[239] Sling TV, *Live TV Streaming Services*, https://www.sling.com/ (last visited Aug. 1, 2018).

[240] *Id*.

[241] DIRECTV NOW, *DIRECTV NOW Packages & Pricing*, https://www.directvnow.com/tv-packages (last visited Aug. 1, 2018).

[242] We discuss Layer3 TV in the OVD section as a virtual MVPD, but Layer3 TV could also be viewed as an MVPD as it is delivered over a closed broadband network. Bernie Arnason, *IP Video Provider Layer3 TV Partners with Muni Broadband Provider for Hosted Video*, Telecompetitor (Mar. 13, 2017), http://www.telecompetitor.com/ip-video-provider-layer-3-tv-partners-with-muni-broadband-provider-for-hosted-video/.

[243] Layer3 TV, *Layer3 TV – A T-Mobile Company – all HD & 4K Cable TV*, https://layer3tv.com/ (last visited July 5, 2018).

[244] Jessi Hempel, *Layer3 TV's Crazy Plan to Take on Comcast and Reinvent Cable*, Wired (Apr. 10, 2016), https://www.wired.com/2016/04/layer3-tv/.

access to a library of programming. For example, HBO NOW costs $14.99/month, SHOWTIME costs $10.99/month, and STARZ costs $8.99/month.[245] Currently, CBS is the only major broadcast television network to offer a subscription-based broadcast channel online with VOD and original content.[246] CBS All Access costs $5.99/month or $9.99/month without commercials.[247] Other broadcast networks offer ad-supported video on demand focused primarily on their prime-time programming.

- Sports Leagues: Most major U.S. professional sports leagues such as Major League Baseball (MLB), the National Basketball Association (NBA), the National Hockey League (NHL), and Major League Soccer (MLS) offer subscription-based streaming of live games. Sports packages typically enable subscribers to follow single teams or all teams within a league. MLB offers MLB.TV Single Team for $89.99/season and MLB.TV All Teams for $115.99/season.[248] NFL offers NFL Game Pass for $99.99/season.[249] NBA offers NBA Team Pass for $119.99/season and NBA League Pass for $199.00/season.[250] NHL offers Single Team Pass for $109.99, Monthly Pass for $24.99, and All Access for $139.99.[251] And ESPN+ offers MLS Live for $4.99/month.[252]

c. Recent Entry and Exit

89. The OVD marketplace continues to expand and change. Significant recent entrants into the OVD marketplace include DIRECTV NOW, which launched in 2016, and YouTube TV and Hulu Live TV, which launched in 2017. As discussed above, these virtual MVPDs offer packages of cable and broadcast channels similar to packages offered by traditional MVPDs, as well as access to video programming on demand. Recent, more niche, subscription-based entrants offering VOD content include History Vault, STARZ, and MyOutdoorTV, which launched in 2016, and BritBox, Boomerang, and Hallmark Movies Now, which launched in 2017.[253] Turner Classic Movies launched FilmStruck in November 2016 but announced in October 2018 that the service would be shut down.[254] CenturyLink Stream, a live OTT streaming service, exited the marketplace in March 2018.[255]

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[245] HBO NOW, *How to Order HBO*, https://www.hbo.com/order (last visited July 6, 2018); SHOWTIME, *Order SHOWTIME Now*, http://www.sho.com/order-showtime (last visited July 6, 2018); John-Michael Bond, *How to Watch Starz Online*, The Daily Dot (Jan. 25, 2018), https://www.dailydot.com/upstream/watch-starz-online/.

[246] CBS, *Stream Live TV Sports & News with Free Trial of CBS All Access*, https://www.cbs.com/all-access/ (last visited July 6, 2018).

[247] *Id*.

[248] MLB.TV, *MLB.TV Subscription*, https://www.mlb.com/live-stream-games/subscribe (last visited July 6, 2018).

[249] NFL Game Pass, NFL Game Pass, https://gamepass.nfl.com/packages (last visited July 6, 2018).

[250] John-Michael Bond, *NBA League Pass vs Team Pass*, The Daily Dot (Nov. 11, 2017), https://www.dailydot.com/upstream/nba-league-pass-team-pass/.

[251] NHL.TV, *Subscribe | NHL.com*, https://www.nhl.com/subscribe (last visited Oct. 5, 2018).

[252] ESPN+, *ESPN+ Stream Live Sports*, https://watch.espnplus.com/soccer/ (last visited Aug. 1, 2018).

[253] S&P Global, Internet Media & OTT Industry Presentation, Q1 2018 at 11 (April 2018).

[254] Steven Zeitchik, *The Highest-quality Streaming Service Ever Created is Shutting Down. It Could be a Very Bad Omen for Fans*, The Washington Post (Oct. 26, 2018), https://www.washingtonpost.com/business/2018/10/26/highest-quality-streaming-service-ever-created-is-shutting-down-it-could-be-very-bad-omen-fans/?noredirect=on&utm_term=.1fc5e42e440d.

[255] Karl Bode, *CenturyLink Drops TV Service, May Ditch Residential Broadband*, DSLReports (Apr. 13, 2018), http://www.dslreports.com/shownews/CenturyLink-Drops-TV-Services--May-Ditch-Residential-Broadband-141598.

3. Broadcast Television Stations

90. As noted above, the Commission licenses broadcast television stations consistent with the Communications Act.[256] While licenses were formerly granted pursuant to comparative hearings among interested applicants, presently broadcast licenses are awarded by auction; however, the Commission has not auctioned a license for any new full power commercial television stations since 2011. While the majority of broadcast television station licensees are part of larger companies that are involved in other industries, some large owners, such as Sinclair Broadcast Group, Inc., Tribune Media Co., TEGNA, Inc., Media General/Nexstar Broadcasting Group, Inc., and Gray Television, Inc., focus almost exclusively on the broadcast industry.[257]

91. Commercial television broadcast stations essentially serve two distinct sets of customers: consumer audiences and advertisers. While fees received from MVPDs for the right to retransmit the signals of the broadcast stations have increased in recent years, broadcasters continue to derive revenues primarily by selling time to advertisers during their broadcasts. The amount of revenue generated depends largely on the size and demographic characteristics of the audiences that broadcasters reach. Accordingly, broadcasters seek to provide content that will attract viewers and maximize their audiences.

92. Individual commercial stations compete primarily with other commercial broadcast stations within their local markets (Designated Market Areas or DMAs) for audiences and advertising revenue.[258] Other media, including competing video providers; local, regional, and national cable networks; and Internet sites, also earn advertising revenues by attracting audiences within the geographic areas they serve. A broadcast station's advertising revenues depends on viewership of its television programs, regardless of whether consumers receive the station's signal over the air or via an MVPD.

93. As shown in Figure B-4 below, the number of broadcast television stations has remained relatively stable in recent years.

[256] In this section we focus on full-power broadcast television stations. In addition to these stations, the Commission licenses Class A and low-power televisions stations, as well as television translators, which are used to increase the geographic reach of their associated main station.

[257] S&P Global, *Broadcast Industry Overview: US TV and Radio Stations* (2017) at 44. TV station "pure-play" group, is a general term for a company that derives over half of its revenues from broadcast TV. Sinclair and Tribune Media are examples of companies that own digital assets and TV networks but are still considered TV station pure-play groups.

[258] The Nielsen Company assigns each broadcast television station to a designated market area (DMA). The DMA boundaries and DMA data are owned solely and exclusively by Nielsen. Nielsen, *Nielsen DMA Maps*, http://www.nielsen.com/intl-campaigns/us/dma-maps.html. Each DMA is a group of counties that form an exclusive geographic area in which the home market television stations hold a dominance of total hours viewed. There are 210 DMAs, covering the entire continental United States, Hawaii, and parts of Alaska. DMAs with large populations tend to have more full-power stations, and DMAs with smaller populations usually have fewer stations and tend to rely more on multicasting and/or Low Power Television Stations to make available all of the major broadcast networks (e.g., ABC, CBS, FOX, NBC, CW, and myNetworkTV).

Fig. B-4
Number of Broadcast Television Stations[259]

	2015	2016	2017	2018
Commercial UHF	1,031	1,033	1,013	990
Commercial VHF	356	351	364	359
Non-Commercial	395	394	390	412

94. The over-the-air reach of a broadcast television station is determined largely by the height of the transmission tower and the power of the transmitter.[260] Buildings, hills, and other objects, however, may interfere with over-the-air signals. As discussed in more detail below, many television broadcasters use digital transmission technologies to offer multiple program streams (multicast channels) to consumers in an effort to provide more programming and features to consumers.[261]

95. MVPDs offering service within a DMA typically carry the local broadcast television stations assigned to the DMA, rebroadcasting the stations' signals to all the MVPDs' subscribers. In part this is because broadcast stations typically hold exclusive rights to broadcast the programming of their affiliated network in a market. Thus, unlike cable networks that are available nationwide, most broadcast television stations are retransmitted by MVPDs only within the station's assigned DMA. Rebroadcast of television stations by online virtual MVPDs follows a similar pattern--subscribers located in a DMA receive local broadcast television stations from the same DMA.

a. Business Models and Competitive Strategies

96. *Distribution and Delivery*. Broadcast television stations reach consumers by broadcasting signals directly over the air to homes, as well as through carriage agreement with MVPDs and OVDs, which retransmit the signals of stations to households subscribing to their services. As such, broadcasters are in the business of both content distribution and content delivery. When broadcasters negotiate with MVPDs and OVDs for carriage of their programming, they are in the business of content distribution--similar to cable networks. When broadcasters deliver programming using their free over-the-air service, they are in the business of content delivery--similar to facilities-based MVPDs.[262]

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[259] *See* FCC, Licensed Broadcast Station Totals as of September 30, 2018, https://docs.fcc.gov/public/attachments/DOC-354386A1.pdf (September 30, 2018 Broadcast Station Totals); FCC, Licensed Broadcast Station Totals as of December 31, 2017, https://docs.fcc.gov/public/attachments/DOC-348570A1.pdf; FCC, Licensed Broadcast Station Totals as of December 31, 2016, https://apps.fcc.gov/edocs_public/attachmatch/DOC-342889A1.pdf; FCC, Licensed Broadcast Station Totals as of December 31, 2015, https://apps.fcc.gov/edocs_public/attachmatch/DOC-337189A1.pdf. Figures for 2015-2017 are as of December 31. Figures for 2018 are as of September 30. VHF stations operate on channels 2-13, while UHF stations operate on channels 14-51.

[260] To receive signals from all local broadcast stations, the antenna may need to be able to receive both VHF channels and UHF channels. Some antennas provide good reception of VHF or UHF channels, but not both. FCC, *Antennas and Digital Television*, https://www.fcc.gov/consumers/guides/antennas-and-digital-television.

[261] Digital broadcasting technology also allows broadcasters to use part of their licensed digital spectrum to provide non-broadcast "ancillary or supplementary" services (such as subscription video services, data transfer, or audio signals). 47 U.S.C. § 336(a)(2); 47 CFR § 373.624(c). If stations choose to provide such ancillary or supplementary services, they must remit a fee to the Commission of 5% of the gross revenues received from such services. 47 U.S.C. § 336(e); 47 CFR § 73.624(g). Revenue from ancillary and supplementary services remains an insignificant portion of total station revenue. In 2016, total revenue from these services was approximately $200,000, and the Commission collected approximately $10,000 in fees from this revenue. In 2017, total revenue from these services was approximately $25,000, and the Commission collected approximately $1,200 in fees from this revenue.

[262] Although we discuss the wider business of broadcasters, our *Report* focuses on competition in the market for the delivery of video programming. We therefore consider most closely the role played by the over-the-air broadcast service.

Additionally, most commercial broadcast stations also produce some of their own programming content, typically news or local sports and events, in addition to acquiring programming from affiliated broadcast networks or from syndicators.

97. *Advertising*. A broadcast station sells advertising time based on the number or percentage of households in a market viewing the broadcast station's programming. Revenue from advertising accounts for the largest share of television broadcasters' revenue. In 2016 and 2017, respectively, broadcasters earned about 67% of total revenue ($20.7 billion) and 62% of total revenue ($19.1 billion) from advertising sales.[263] Fees obtained from MVPDs and virtual MVPDs for the retransmission of the station's signal make up the second largest category of broadcast stations revenue.[264]

98. Broadcast television stations usually sell all the advertising time during the blocks of time containing programming produced by the station itself (most importantly local newscasts), but divide the advertising time with broadcast networks when network programming is shown.[265] Local advertisers generally purchase advertising time directly from a station's local sales staff.[266] In contrast, national advertisers generally work with national advertising sales representative firms to purchase advertising time on broadcast television stations.[267]

99. Broadcast advertising rates vary by time of day, with prime time (the hours between 7 PM – 11 PM) being the most expensive.[268] Political cycles, both federal and local, have a significant impact on broadcast advertising revenue, with even numbered years bringing in more revenue than odd numbered years.[269] Generally, advertising rates are determined by a station's overall ability to attract viewers in its market area and its ability to attract viewers among particular demographic groups that an advertiser may be targeting.[270] Specifically, advertising rates depend upon factors such as: (1) the size of a station's market; (2) a station's overall ratings; (3) a program's popularity among targeted viewers; (4) the number of advertisers competing for available time; (5) the demographic makeup of the station's market; (6) the availability of alternative advertising media in the market; (7) the presence of effective sales forces; (8) the development of projects, features, and programs that tie advertiser messages to programming; and (9) the level of spending commitment made by the advertiser.[271]

100. *Retransmission Consent Fees.* Many television broadcast stations generate revenue by granting MVPDs the right to carry their signal. Pursuant to Section 325 of the Act, MVPDs may not

[263] S&P Global, Total TV Station Industry Revenue Projections, June 2017 (2017 S&P Global TV Revenues).

[264] *Id.*

[265] Harold L. Vogel, *Entertainment Industry Economics* (8th ed. 2011) at 317, n. 29.

[266] Nexstar SEC Form 10-K for the year ended December 31, 2017 at 15 (Nexstar 2017 10-K).

[267] *Id*.

[268] For a discussion of broadcast network's primetime programming and the advertising rates of the top-four broadcast networks, *see 2014 Quadrennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, Second Report and Order, 31 FCC Rcd 9864, 9954-58, paras. 222-28 (2016) (*2014 Quadrennial Second Report and Order*).

[269] Steve Passwaiter, *2018 Campaign Ad Spend Will be in the Billions*, The Cook Political Report (Sept. 22, 2017), https://www.cookpolitical.com/analysis/national/political-advertising/2018-campaign-ad-spend-will-be-billions. *See also* Kate Kaye, *2016 Political Broadcast TV Spend Down 20%, Cable Up 52%*, AdAge (Jan. 3, 2017), http://adage.com/article/media/2016-political-broadcast-tv-spend-20-cable-52/307346/.

[270] *See, e.g.*, Nexstar 2017 10-K at 15; Gray Television SEC Form 10-K for the year ended December 31, 2017 at 4 (Gray 2017 10-K).

[271] Nexstar 2017 10-K at 15.

retransmit a local television broadcaster's signal without the station's express permission.[272] If a station elects retransmission consent, the broadcaster and MVPD negotiate a carriage agreement, which often includes monetary or other types of compensation to the television broadcaster.[273] In 2016 and 2017, respectively, broadcasters earned about 25% of their revenue ($7.9 billion) and 30% of their revenue ($9.3 billion) from retransmission consent fees.[274]

101. As shown in Figure B-5 below, advertising provides the largest amount of revenue, but its overall revenue share decreased significantly between 2016 and 2017. During the same time period, the share of overall revenue attributable to retransmission consent fees increased by a similar percentage.

Fig. B-5
Broadcast Television Station Industry Gross Revenue Trends (in millions)[275]

Revenue Source	2016		2017	
	Revenue	**Percentage**	**Revenue**	**Percentage**
Advertising	$20,738	67%	$18,973	61%
Network Compensation	<$1	<1%	<$1	<1%
Retransmission Consent	$7,980	25%	$9,374	31%
Digital/Online	2,117	7%	$2,329	8%
Total	**$30,835**	**100%**	**$30,676**	**100%**
Percentage Change in Revenue from Previous Year		**12.9%[276]**		**-0.5%**

102. *Programming.* Broadcast stations compete with one another, as well as with cable networks and OVDs, for viewing audiences primarily on the basis of program popularity.[277] Broadcast television stations that are owned or affiliated with a broadcast network typically market themselves based largely on their affiliation, program popularity, and local news.[278]

103. Programming from major broadcast networks, which is aired by local television broadcast affiliates, often attracts large audiences. Such programming includes prime time entertainment programming, including sit-coms, dramas, and news/variety shows and sporting events, such as the Olympics, National Football League (NFL) games, Major League Baseball (MLB) games, and the

[272] 47 U.S.C. § 325(b). Every three years, commercial television stations must elect either the right to grant consent for the MVPDs in their DMA to retransmit their station's signal or the right to receive mandatory carriage by those MVPDs. *Id.* § 325(b)(3)(B); 47 CFR §§ 76.56(b), 76.64.

[273] 47 U.S.C. § 325(b)(3)(C); 47 CFR § 76.64; *see also 16th Report*, 30 FCC Rcd at 3274-76, paras. 44-46. Television stations that are carried pursuant to must-carry receive no compensation from MVPDs for signal carriage.

[274] S&P Global, Total TV Station Industry Revenue Projections, June 2017 (2017 S&P Global TV Revenues).

[275] S&P Global, *U.S. TV Station Industry Total Revenue Projections, 2008-2023 (Jun. 2018).*

[276] This figure represents the percentage change from 2015, when total broadcast station industry gross revenue was $27,312,000. *Id.*

[277] Gray 2017 10-K at 10; Sinclair Broadcast Group, Inc SEC Form 10-K for the year ended December 31, 2017 at 19 (Sinclair 2017 10-K).

[278] Nexstar 2017 10-K at 15; Gray 2017 10-K at 8.

Academy Awards.[279] Broadcast networks often schedule their most popular programming during February, May, July, and November, when Nielsen measures television audiences for all DMAs, which serve as a basis for developing advertising rates.[280]

104. Many broadcast television stations differentiate themselves from both other stations and cable channels by offering local news, exclusive news stories, investigative reporting, regional and local sports, and coverage of community events.[281] In 2017, the average television station aired 5.6 hours of local news per weekday, down slightly from 2016.[282] Although local news is becoming more available from other sources, local broadcast television stations remain the most viewed source and the most preferred source for emergency news.[283]

105. In addition to broadcast network and local news programming, broadcast television stations negotiate with national program distributors and syndicators to be exclusive providers of first-run and rerun content in their DMAs.[284] Syndicated programming often represents a long-term financial commitment.[285] Stations usually purchase syndicated programming two to three years in advance and sometimes must make multi-year commitments.[286] An average broadcast television station spends an estimated 26.8% of its expenses on acquiring syndicated programming.[287]

106. As noted above, many broadcast television stations provide additional programming choices by offering multicast channels in both high definition (HD) and standard definition (SD). Multicast streams often carry newer networks such as Me-TV (with 164 digital multicast affiliates), This-TV (with 83 digital multicast affiliates), and Grit (with 130 digital multicasting affiliates).[288]

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[279] Sinclair 2017 10-K at 12. The network affiliation agreements, generally exclusive for each of the 210 DMAs, provide affiliates with the right to air network programming first. The contracts may run from two to ten or more years. The Commission's right-to-reject rule grants an affiliate the right to: (1) reject or refuse network programs which the station reasonably believes to be unsatisfactory, unsuitable, or contrary to the public interest, and (2) substitute a program which, in the station's opinion, is of greater local or national importance. 47 CFR § 73.658(e).

[280] Nielsen refers to these months as "sweep months." *See* Nielsen Media Research, Glossary of Media Terms, Sweeps, http://www.nielsenmedia.com/glossary/.

[281] Nexstar 2017 10-K at 9; Gray 2017 10-K at 9; Sinclair 2017 10-K at 19. Nexstar states that it strives to increase the audience share of its stations by providing extensive local sports coverage and active sponsorship of community events. In 2017, Nexstar earned approximately 35% of its net advertising revenues from local broadcast advertising. Nexstar 2017 10-K at 9.

[282] Robert Papper, *RTNDA Research: Local news by the numbers* RTDNA (June 2018). This RTNDA/Hofstra survey was conducted in fourth quarter 2017 and presents the national average hours of news for all stations. https://www.rtdna.org/article/rtdna_research_local_news_by_the_numbers_2018.

[283] NAB Comments at 11-12.

[284] *See e.g.*, Nexstar 2017 10-K at 16; Sinclair 2017 10-K at 20; Gray 2017 10-K at 10. Cable networks occasionally acquire programs that might otherwise be offered to stations. For example, Twentieth Century Fox TV and Twentieth TV negotiated the first cable syndication and VOD deal of *The Simpsons* to FXX for all past and future episodes, within the time period of the deal, for approximately $750 million. Cynthia Littleton, *'The Simpsons' Lands $750 Mil Cable Syndication, VOD Pact with FXX*, Variety (Nov. 15, 2013), http://variety.com/2013/tv/news/the-simpsons-lands-750-mil-cable-vod-syndication-pact-with-fxx-1200837036/.

[285] Syndicated programming can impose financial risks on stations. Broadcast stations cannot predict whether a particular show will be sufficiently popular to enable it to sell enough related advertising time to cover the costs of the program. A station may have to replace a poorly performing program before it has recovered the costs of obtaining it. Sinclair 2017 0-K at 24; Gray 2017 10-K at 21.

[286] Sinclair 2017 10-K at 24.

[287] National Association of Broadcasters, *Television Financial Report*, at iv (2017).

[288] S&P Global, TV Station Multi-Platform Report-Update (Oct 2017).

Broadcasters have increased the number of multicast channels.[289] There were 6,109 broadcast channels in January 2017, up from 5,905 in February 2016, as this trend of broadcasting multicast streams expands.[290] The revenue generated by multicasting is not large, but it is growing.[291]

107. In addition, most broadcasters offer HD programming. As of the end of 2017, 1,116 (91.0%) of full-power stations were broadcasting in HD, up from 954 stations at the end of 2016.[292] All of the multicast channels and HD programming provided by broadcasters is available via over-the-air service, which households can receive by attaching an antenna to any digital television set. As of 2016, 106.5 million U.S. TV households, or 96% of such households, had sets capable of displaying and/or receiving digital signals, including HD broadcast signals.[293] This figure is up from 102.1 million U.S. television households, or 88% of such households, in 2015.[294]

108. Broadcasters also make use of websites, apps, and social media to extend access to broadcast programming, especially news.[295] According to the NAB, "[i]t is now routine for TV stations' websites to offer news video, live streaming and, increasingly, to live stream their newscasts."[296] Recent developments by many companies, including Internet service providers and Internet website operators, have expanded and are continuing to expand the variety and quality of broadcast and non-broadcast video programming available to consumers via the Internet. For example, broadcasters have expanded their use of Facebook, Twitter, Instagram, and Snapchat, especially for breaking news.[297] In addition, Internet companies have developed business relationships with companies that have traditionally provided syndicated programming, network television, and other content. As a result, additional programming continues to become available through non-traditional methods, which can directly impact the number of TV viewers, and thus indirectly impact station rankings, popularity, and revenue.[298]

109. As of April 2018, 79% of all TV households received broadcast programming via an MVPD,[299] down from 80% at the end of 2016 and 83% at the end of 2015.[300] The downward trend in MVPD subscriptions has been accompanied by growth in the number of households relying on over-the-air broadcast service. In 2018, 16.6 million TV households (13.9%) relied exclusively on over-the-air broadcast signals,[301] up from 15.7 million TV households (13.2%) in 2017,[302] and 13.3 million TV households (11%) in 2016. [303] While broadcast stations may lose retransmission fees as a result of

[289] NAB Comments at 15.

[290] *Id*.

[291] *Id*. at 16.

[292] S&P Global, TV Station Multiplatform Analysis Update, Oct. 2017; S&P Global, TV Station Multiplatform Analysis Update, Jan. 2016.

[293] Nielsen, *2017 Universe Estimate Report* (Nielsen 2017 Universe Estimates).

[294] *Id*.

[295] NAB Comments at 12-15.

[296] *Id.* at 13.

[297] *Id*.

[298] Gray 2017 10-K at 10; Sinclair 2017 10-K at 13-14.

[299] Nielsen, 2018-2019 Advanced National TV Household Universe Estimates.

[300] S&P Global, U.S. Multichannel Industry Benchmarks (last visited Dec. 13, 2017).

[301] Nielsen, 2018-2019 Final Universe Estimates Report.

[302] Nielsen, 2017 Final Universe Estimates Report.

[303] Nielsen, 2016 Final Universe Estimates Report.

increased reliance on over the air signals, they may gain advertising revenue from increased viewing of broadcast programming and a stronger connection to consumers.

110. *Ownership of Content*. Some large broadcast television station groups have ownership interests in content. The Boston Consulting Group contends that content exclusivity allows a company to differentiate itself and attract consumers.[304] Accenture notes that several broadcasters have made a strategic shift to content production, generating revenue from international licensing deals and both global and local syndication.[305] This has provided protection from slowing growth in advertising revenues.[306]

111. For example, Disney, which owns ABC, also owns the Disney cable channels, television and movie studios, and a majority interest in ESPN.[307] In 2018, Disney entered into an agreement to acquire assets from Fox, including the FX Networks, National Geographic Partners, Fox's interests in Hulu, Fox's film production business (Twentieth Century Fox, Fox Searchlight Pictures, and Fox 2000 Pictures) and Fox's television creative units (Twentieth Century Fox Television, FX Productions, and Fox21).[308] Similarly, CBS Corporation's ownership interests include CBS Television Network, The CW (a joint venture between CBS Corporation and Warner Bros. Entertainment), Network Ten Australia, CBS Television Studios, CBS Studios International, CBS Television Distribution, CBS Consumer Products, CBS Home Entertainment, CBS Interactive, CBS Films, Showtime Networks, CBS Sports Network, Pop (a joint venture between CBS Corporation and Lionsgate), Smithsonian Networks, Simon & Schuster, CBS Television Stations, CBS EcoMedia, and CBS Experiences.[309] Univision has ownership interests in the Univision broadcast network and 11 cable networks,[310] and Hearst Television Inc. has ownership interests that include A+E Networks, Lifetime, Cosmopolitan TV, and a minority interest in ESPN.[311]

b. Recent Entry and Exit

112. From time to time, the Commission makes construction permits for new full power television stations available via auction. In 2004, however, the Commission froze the allotment or auction of such permits.[312] This freeze remains in effect. Accordingly, entities typically enter the television broadcasting industry by purchasing one or more existing stations. Recently, however, station transactions have involved mergers and deals between entities already in the television broadcasting business. Such transactions show a trend towards increased consolidation in the industry.

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[304] Boston Consulting Group, The Value of Digital Content: 2016 at 12.

[305] Accenture, The Future of Broadcasting V: 2016 at 3.

[306] *Id*.

[307] The Walt Disney Company, SEC Form 10-K for the Year Ended September 30, 2017.

[308] Press Release, The Walt Disney Company, 21st Century Fox And Disney Stockholders Approve Acquisition By Disney (July 27, 2018), https://www.thewaltdisneycompany.com/21st-century-fox-and-disney-stockholders-approve-acquisition-by-disney/; Press Release, The Walt Disney Company, The Walt Disney Company Signs Amended Acquisition Agreement To Acquire Twenty-First Century Fox, Inc., For $71.3 Billion In Cash And Stock (June3 20, 2018), https://www.thewaltdisneycompany.com/the-walt-disney-company-signs-amended-acquisition-agreement-to-acquire-twenty-first-century-fox-inc-for-71-3-billion-in-cash-and-stock/. Disney also acquired the Fox Sports Regional Networks from 21st Century Fox, but a consent decree between the U.S. Department of Justice, Disney, and 21st Century Fox requires Disney to sell those assets to a third-party buyer. *Id*.

[309] CBS Corporation, *About CBS Corporation*, https://www.cbscorporation.com/about-cbs/.

[310] Univision Communications Inc., *Portfolio*, https://corporate.univision.com/portfolio/.

[311] Hearst, *About Us*, http://www.hearst.com/about.

[312] *Freeze on the Filing of Certain TV and DTV Requests for Allotment or Service Area Changes*, Public Notice, 19 FCC Rcd 14810 (MB 2004).

113. In 2016, 156 stations were sold for a total of $5.3 billion, or an average of $34 million per station.[313] In 2017, 561 stations were sold for a total of $4.9 billion or an average of $8.9 million per station.[314] The largest completed transaction was Nexstar Media Group's acquisition of Media General (79 stations, totaling $4.6 billion).[315] Other notable transactions included Tegna/Midwest Communications (one station, totaling $303 million)[316] and Sinclair Broadcast Group/Cunningham Broadcasting Corporation and Bonten Media (31 stations, totaling $240 million).[317] In addition, in May 2017, Sinclair Broadcasting announced the acquisition of Tribune Media, but that transaction was subsequently terminated in August 2018.[318] In June 2018, a merger valued at $3.6 billion between Gray Television, Inc. and Raycom Media Inc., two mid-sized television broadcast companies, was announced, which remains pending. [319]

4. Intermodal Competition

114. While the various providers discussed above are similar in the sense that they offer video programming to consumers, there are significant differences in the products they offer, the geographic availability of their services, and how consumers view their products. For example, consumers may view video services as substitutes when they offer the same or similar content, but consumers may view video services as supplements when they offer exclusive or dissimilar content. Consumers frequently subscribe to multiple OVDs (Netflix, HBO, Hulu),[320] but typically to only one MVPD (cable, DBS, or telco).[321] Some consumers supplement OTA television viewing with one or more OVDs.[322] Consumer views on the competitive nature or substitutability of video programming providers depends on factors such as available content, prices, the number of advertisements, the ability to watch content on different devices in different locations, user interfaces, and the need for and cost of broadband access at sufficient speeds for video delivery. Whether consumers view video services as substitutes or supplements depends on the relative values they assign to these and other features.

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[313] S&P Global 2017 TV Station Databook at 2.

[314] *Id*.

[315] *Id*.

[316] Press Release, Tegna Inc, Tegna to Acquire Midwest Television Inc. Broadcasting Stations in San Diego, Ca. (Dec. 18, 2017), http://www.tegna.com/tegna-to-acquire-midwest-television-inc-s-broadcasting-stations-in-san-diego-ca/.

[317] Press Release, Sinclair Broadcasting Group, Inc., *Sinclair Closes on acquisition of Bonten Media Group, Holdings Inc.* (Sep 7, 2017), http://sbgi.net/pr-news/sinclair-closes-on-acquisAtion-of-bonten-media-group-holdings-inc/.

[318] Press Release, Tribune Media), Tribune Media Terminates Merger Agreement with Sinclair Broadcast Group Inc. Files Lawsuit for Breach of Contract (Aug. 8, 2018), http://investors.tribunemedia.com/2018-08-09-Tribune-Media-Terminates-Merger-Agreement-with-Sinclair-Broadcast-Group-Inc-Files-Lawsuit-For-Breach-of-Contract.

[319] Press Release, Raycom Media, Gray and Raycom to Combine in a $3.6 Billion Transaction (Jun. 25, 2018), https://www.raycommedia.com/gray-and-raycom-to-combine-in-a-3-6-billion-transaction/.

[320] *See supra* para. 80 and note 203. *See also* Ian Olgeirson and Deana Myers, *Comparing OTT and multichannel video metrics*, S&P Global (Nov. 13, 2018) ("[o]nline video subscriptions, by unit count dwarf the figures for traditional and virtual multichannel packages, which are much more likely to be limited to a single subscription per household than the mix-and-match internet alternatives.").

[321] *See id.* S&P Global projects that approximately 1.1 million households and businesses subscribe to more than one MVPD in 2018. The number has been steadily declining and is projected to continue shrinking. Ian Olgeirson, Neil Barbour, and Ali Choukeir, *Traditional multichannel tested by virtual, online and over-the-air in outlook*, S&P Global (June 19, 2018).

[322] *See, e.g.*, Press Release, Parks Associates, One in five U.S. broadband households use a digital antenna to access live TV (Mar. 15, 2018), https://www.parksassociates.com/blog/article/pr-03152018.

115. MVPDs, OVDs, and television broadcasters compete with each other in several main respects. For example, consumers looking for video services can obtain: (1) linear channel packages augmented by VOD content from MVPDs or virtual MVPDs, (2) broadcast channels using the free over-the-air broadcast service, (3) premium and sports channels from MVPDs and direct-to-consumer online offerings, and (4) free and subscription VOD content from OVDs. Consumers typically compare video services based on key factors (price, devices, necessary equipment, channel lineups) and select the video service, or services, that best fit their preferences.[323] Below, we discuss prominent aspects of intermodal competition among MVPDs, OVDs, and broadcast stations. We also discuss the similarities and differences among the video services that these entities provide and consider the extent to which services may be viewed by the marketplace as substitutes or supplements. Finally, we examine intermodal competition via a comparison of subscribership and revenue figures.

116. *Channel Packages*. As discussed above, an important recent trend in the video marketplace is the increasing convergence and overlap in the types of services offered by MVPDs and OVDs. Perhaps most importantly, OVDs have begun providing virtual MVPD services, as discussed above.[324] As a result, many consumers may increasingly view MVPDs and virtual MVPDs as substitutes, especially for small and medium channel packages.[325] Similarly, MVPDs have begun offering OVD-like services, including TV Everywhere and virtual MVPD options of their own for consumers who have Internet access but have eschewed a traditional MVPD subscription.

117. *Prices*. Price is a significant consideration when consumers compare video options.[326] The inflation-adjusted price of MVPD video service increased 74%, from an average of $698.30 per year in 2000 to $1,211.58 in 2017.[327] Of course, the service received by consumers has also been enhanced during the same period, so the value to consumers may be commensurate with the price increase.[328] That said, inflation-adjusted average income grew only 4.7% over the 17-year period.[329] These trends, according to S&P Global, have lowered the affordability of MVPDs' video service and increased the popularity of online video services.[330] Although prices for virtual MVPD subscriptions are generally lower than prices for traditional MVPD packages, most virtual MVPDs raised prices in 2018.[331] In addition, prices for the largest OVDs offering VOD content also increased in the past year.[332]

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[323] Leichtman Research Group, Research Notes: 1Q 2017, http://www.leichtmanresearch.com/research/notes03_2017.pdf, ("consumers are increasingly cobbling together services that provide an experience that works best for their household in terms of content, viewing options, and cost").

[324] *See supra* paras. 81-82.

[325] Marshall Honorof, *Best and Worst Cable TV Alternatives in 2018*, Tom's Guide (Mar. 30, 2018), https://www.tomsguide.com/us/best-cable-replacements,review-4387.html; James K. Willcox, *Video Streaming Services That Will Let You Cut Cable TV*, Consumer Reports (Apr. 17, 2018), https://www.consumerreports.org/streaming-video-services/video-streaming-services-that-let-you-cut-cable-tv/.

[326] Jefferson Graham, *Cutting the Cord Could Cost as Much as Cable*, USA Today (Mar. 9, 2017), https://www.usatoday.com/story/tech/talkingtech/2017/03/08/cutting-cord-could-cost-much-cable/98894132/. Makeda Easter, *Cutting the Cord Doesn't Necessarily Mean Cutting the Cost*, Los Angeles Times (Mary 20, 2017), http://www.latimes.com/business/la-fi-tn-cord-cutting-20170520-htmlstory.html.

[327] S&P Global, Cable TV Investor at 10-12 (Apr. 26, 2018).

[328] *Id.*

[329] *Id.*

[330] *Id.*

[331] Ali Choukeir, *Economics of Internet, State of US Online Video: Virtual Multichannel*, S&P Global (July 23, 2018). *See also*, Jared Newman, *DirecTV Now, Sling TV, and PlayStation Vue Price Hikes: The Cost of More*

(continued….)

118. As discussed, MVPDs usually offer lower prices to new subscribers and lower prices for long-term contracts.[333] In contrast, virtual MVPDs and OVDs offering VOD content usually offer the same price to new and existing subscribers on a month-to-month basis, which can be cancelled at any time.[334] Initiating and terminating service from an OVD, which can be achieved online in moments, is significantly easier than initiating or terminating service from an MVPD, which sometimes requires a visit to the home. This flexibility as compared to traditional MVPDs has been a significant feature of online service providers. In addition, consumers can use free trials to explore content and test services on their devices in and outside their home.[335] Because OVDs make it easy to sign up and cancel, some consumers make use of a free trials or a month subscription to watch one or two programs, then cancel the service.[336] OVDs with small libraries appear especially susceptible to short-term subscribers.[337]

119. *Content*. MVPDs typically hold significant content assets, and both OVDs and television broadcasters have followed suit by seeking to own more content.[338] Several MVPDs have ownership interests in cable, broadcast, and regional sports networks, which allows them to vertically integrate their ownership of content and content distribution networks.[339] Because MVPDs typically make their networks and content available to OVDs and competitive MVPDs, exclusive content is not typically a point of competition between MVPDs.[340] In addition to drawing new customers to their services, OVDs indicate that providing original content makes more economic sense than licensing content from third parties and protects against the future expectation that existing content holders will place content on their own streaming platforms or increase licensing fees substantially.[341] Unlike MVPDs, some OVDs like Netflix and Amazon that own significant VOD content have not, as yet, licensed their content to competitors.[342] Broadcast television station groups appear to be increasing their content ownership as well, using content exclusivity to differentiate themselves from their competitors, attract viewers, and generate content licensing revenues.[343]

(Continued from previous page)
Bloated Bundles, TechHive (July 5, 2018), https://www.techhive.com/article/3286204/streaming-services/directv-now-sling-tv-playstation-vue-price-hikes.html.

[332] Jeremy Bowman, *If Netflix Can Raise Prices, So Can Amazon Prime*, The Motley Fool (May 12, 2018), https://www.fool.com/investing/2018/05/12/if-netflix-can-raise-prices-so-can-amazon-prime.aspx.

[333] S&P Global, Cable TV Investor at 6 (June 22, 2017).

[334] *Id*.

[335] Brian Fung, *Meet the Sometime-streamers: TV Watchers Who Sign up for One Show, Then Cancel*, The Washington Post (Aug. 29, 2017), https://www.washingtonpost.com/news/the-switch/wp/2017/08/28/meet-the-sometime-streamer-tv-watchers-who-sign-up-for-one-show-then-cancel/?utm_term=.e2094a89e475.

[336] Hayley Tsukayama and Sintia Radu, *Freedom from Cable TV Isn't Free: Flood of Streaming Options Complicates Cord-cutting*, The Washington Post (Aug. 12, 2017), https://www.washingtonpost.com/business/economy/freedom-from-cable-isnt-free-flood-of-streaming-services-will-make-cutting-the-cord-more-complicated/2017/08/11/01f9ade0-7d1f-11e7-a669-b400c5c7e1cc_story.html?utm_term=.2a158d87963e.

[337] *Id*.

[338] *See supra* paras. 67, 77-80, 110-111.

[339] *See supra* para. 67.

[340] *See supra* para. 57.

[341] *See supra* paras. 77-80.

[342] Caitlin Petrakovitz, *Everything You Need to Know About Netflix Originals*, CNET (March 19, 2015), https://www.cnet.com/news/netpicks-everything-you-need-to-know-about-netflix-originals/.

[343] *See supra* paras. 110-111.

120. *Content Discovery and Industry Fragmentation*. A 2017 report by Ericsson noted that as consumers have gained access to an unprecedented amount of content, the number of marketplace participants has increased markedly. As a result, consumers that subscribe to multiple services increasingly struggle to discover and consume content.[344] According to the report, the total average time searching for content increased from 45 minutes per day in 2016 to 51 minutes per day in 2017. The report noted further that "[c]ontent discovery remains a challenge, and consumers are finding current discovery methods unhelpful."[345] The issue of content discovery is related to what some have termed "fragmentation" of the video industry.[346] Although an increasing amount of content traditionally available from MVPDs is also available from OVDs, many OVDs provide content from a single channel or content owner (e.g., HBO Now, CBS All Access, Crackle, etc.) or target a niche market (e.g., FunimationNow). Because their catalogs are focused on a particular channel or genre, some suggest that consumers face the prospect of having to purchase a growing number of subscriptions.[347] Others, however, caution that it is unclear where the video market is going as many OVDs have yet to prove the viability of their service.[348]

121. *Devices*. Not all video display devices work with all video services. Most TVs sold today have connections for set-top receivers, Internet-connected streaming devices, and broadcast TV antennas. As such, TVs can display video from MVPDs, OVDs, and over-the-air broadcasters. Few other display devices connect to as many services. For example, personal computers connect to wireline and Wi-Fi Internet and may have input for a broadcast TV antenna to receive over-the-air broadcast service, but they are not designed to connect to MVPD set-top receivers. Smartphones and other mobile wireless devices connect to wireless and Wi-Fi Internet but are not designed to connect to set-top receivers or broadcast TV antennas.

122. In comparing services, consumers must discern what services work with what devices and where the services are available (geographically). To help consumers make informed choices, marketing materials often list the devices that work with the services and where the services are available. In addition to PCs, laptops, tablets, smart TVs, and smartphones, which can be used to both connect to and view online video, there are a number of devices that can be used to stream video from the Internet to a television or other display device. These include game consoles (such as X-Box or PlayStation 4), Blu-Ray players, and streaming media players/sticks (such as Roku, Amazon Firestick and Apple TV). S&P Global explains that online "devices can play a significant role in the success of these services, with numerous players seeking to make their offerings compatible with as many devices as possible."[349] Often, new online video services work with fewer devices than more established services, but providers typically add more devices over time. As software and hardware evolves, in some cases a software

[344] James K. Willcox, *Sites That Help You Find Streaming Shows*, Consumer Reports (Sept. 11, 2018), https://www.consumerreports.org/streaming-media/sites-that-help-you-find-streaming-shows/.

[345] Ericsson ConsumerLab, TV and Media 2017: A Consumer-driven Future of Media at 10-11 (Oct. 2017), https://www.ericsson.com/en/networked-society/trends-and-insights/consumerlab/consumer-insights/reports/tv-and-media-2017.

[346] Hayley Tsukayama and Sintia Radu, *Freedom from Cable TV Isn't free: Flood of Streaming Options Complicates Cord-cutting*, The Washington Post (Aug. 12, 2017), https://www.washingtonpost.com/business/economy/freedom-from-cable-isnt-free-flood-of-streaming-services-will-make-cutting-the-cord-more-complicated/2017/08/11/01f9ade0-7d1f-11e7-a669-b400c5c7e1cc_story.html?utm_term=.2a158d87963e.

[347] *Id*.

[348] Sarah Barry James, *DISH CEO Says Competitors' OTT Model 'a License to Lose Money*,' S&P Global (May 1, 2017). *See also* S&P Global, The State of Online Video Delivery at 16 (Oct. 2017) (where S&P Global explains that for some virtual MVPDs margins appear to be thin or potentially negative).

[349] S&P Global, Internet & OTT Industry Overview: Over-the-Top Video at 10 (April 2017).

update will render older devices incompatible of supporting the service.

123. *Consumer Access*. Consumer access to video providers varies depending on geographic market and type of service. As noted above, most households have access to at least one cable provider and two DBS providers.[350] Some consumers also have access to a telephone company MVPD.[351] To obtain service from an OVD, a consumer must have broadband access. In addition, the top four mobile providers offer upgraded plans with faster speeds for streaming HD video.[352] Absent these upgrades, streaming video is typically reduced in quality.[353] With respect to over the air television, the number of available stations depends both on the number of stations allocated to the consumer's DMA and the consumer's ability to receive a useable over-the-air signal from the station.[354]

124. *Subscribers*. One way to analyze the performance of MVPDs and OVDs is to compare their subscribership figures. The subscribership figures for the seven largest video subscription services at the end of 2017 were: Amazon Prime with 55.4 million, Netflix with 52.8 million, AT&T/DIRECTV with 24.1 million, Comcast with 22.4 million, Hulu with 17.0 million, Charter with 17.0 million, and DISH Network with 11.0.[355] Figure B-6 shows video subscribers for MVPDs, virtual MVPDs, and OVDs offering VOD content. In general, traditional cable, DBS, and telephone company MVPDs lost subscribers from 2016 and 2017, while virtual MVPDs and large OVDs offering VOD content gained subscribers. S&P Global maintains that the growth of virtual MVPDs "shares a large part, although not all, of the blame for declining multichannel subscriptions."[356]

[350] *See supra* para. 51.

[351] *See id.*

[352] Ookla, 2018 Speedtest U.S. Mobile Performance Report (July 18, 2018), http://www.speedtest.net/reports/united-states/.

[353] *Id*. Mobile wireless is currently designed for smaller screens found on smartphones, tablets, and laptops. DSL Reports, *[General] Replace Cable Internet with Verizon 4g LTE Unlimited?*, http://www.dslreports.com/forum/r31252944-General-Replace-Cable-Internet-with-Verizon-4g-LTE-Unlimited.

[354] FCC, *DTV Reception Maps*, https://www.fcc.gov/media/engineering/dtvmaps.

[355] *Q4'17 Top US Video Provider Rankings*, S&P Global (Apr. 2, 2018) (*Q4'17 Rankings*). Estimates for AT&T/DIRECTV and DISH Network do not include DIRECTV NOW and Sling TV.

[356] S&P Global, Cable Program Investor at 1 (Oct. 26, 2017). *See also* S&P Global, Broadband Cable Financial Databook at iv-v (2017).

Fig. B-6

Video Subscribers (in millions)[357]

	2016	2017	Change
MVPD Total[358]	97.6	94.0	(3.6)
Cable	52.8	51.9	(0.9)
DBS	33.2	31.5	(1.7)
Telco	11.5	10.6	(0.9)
Virtual MVPD Total[359]	2.2	4.8	2.6
Sling TV	1.5	2.2	0.7
DIRECTV NOW	0.3	1.2	0.9
Other Virtual MVPDs[360]	0.4	1.4	1.0
Select Other OVDs[361]			
Amazon Prime	43.6	55.4	11.8
Netflix	47.9	52.8	4.9
Hulu	11.7	17.0	5.3

125. As shown in Figure B-7, most households subscribe to an MVPD. The trend for MVPDs, however, is downward, while the trend for virtual MVPDs, OVDs offering VOD content, and over-the-air broadcast service is upward.

Fig. B-7
Video Households by Delivery Method[362]

	2016 Occupied Households (millions)	2016 Percent of Occupied Households	2017 Occupied Households (millions)	2017 Percent of Occupied Households
Total	122.3		123.7	
MVPD[363]	93.1	76.1%	89.7	72.5%
Virtual MVPD	1.8	1.5%	4.8	3.8%
Online VOD-Only[364]	11.4	9.4%	12.2	9.8%
Over-the-Air Broadcast[365]	14.2	11.6%	16.1	13.0%
Other[366]	1.4	1.2%	1.0	0.8%

[357] Due to rounding, individual entries in table may not sum to totals.

[358] S&P Global, Cable TV Investor at 4 (Mar. 27, 2018). Includes residential and commercial subscribers and overlap created by households with multiple MVPD subscriptions.

[359] *Q4'17 Rankings.*

[360] Other virtual MVPDs include PlayStation Vue, Hulu with Live TV, and YouTube TV. S&P Global, Cable TV Investor at 7 (June 2018).

[361] *Q4'17 Rankings*.

[362] S&P Global, Historical and Projected US Multichannel Subscriptions: 2008 - 2022 (June 19, 2018).

[363] Excludes commercial subscribers. Also excludes overlap created by households taking more than one MVPD.

[364] Excludes households that subscribe to virtual MVPDs. Also excludes households with an over-the-air antenna.

[365] Includes households with an antenna that also access online video.

[366] Includes non-TV households.

126. *Advertising revenue.* As discussed above, broadcasters and some OVDs generate a significant portion of their revenue via advertising, whereas other providers, most notably MVPDs, rely on subscription fees.[367] Figure B-8 provides a breakdown of local advertising revenue by sector. Broadcaster revenue from local advertising remained relatively flat from 2016 to 2017. Cable earns a smaller share of local advertising revenue than both television broadcasters and digital platforms.

Fig. B-8
Local Advertising Gross Revenue by Sector (in millions)[368]

Revenue Source	**2016**		**2017**	
	Revenue	**Percentage**	**Revenue**	**Percentage**
Broadcast Television Stations	$12,642	15.8%	$12,269	15.0%
Cable Television	$5,296	6.6%	$4,923	6.0%
Radio	$10,557	13.2%	$10,402	12.7%
Internet/Online[369]	$28,280	35.4%	$33,912	41.7%
Daily Newspaper	$11,166	13.9%	$9,671	11.8%
Regional Sports Networks	$1,261	1.57%	$1,185	1.45%
Telco	$560	0.7%	$555	0.68%
Other	$10,055	12.5%	$8357	10.2%
Total	**$79,817**	**100%**	**$81,274**	**100%**

127. Figure B-9 provides a breakdown of national advertising revenue by sector. Between 2016 and 2017, national advertising revenues earned by broadcast television stations decreased, while national advertising revenues for broadcast networks, cable/VOD networks, RSNs, and DBS were comparatively stable.

[367] *See supra* paras. 50, 84-85, 97-99.

[368] S&P Global, *U.S. Local versus National Advertising Revenue 2017-2027 (Jan. 2018).*

[369] Three companies, Google, Facebook, and Twitter, received 80% of total online advertising revenue in 2017. *See* George P. Slefo, *IAB: Another Record Breaking Year For Digital Ad Revenue*, AdAge (Dec. 20, 2017), https://adage.com/article/digital/iab-record-breaking-year-digital-ad-revenue/311712/.

Fig B-9
National Advertising Gross Revenue by Sector (in millions)[370]

Revenue Source	2016		2017	
	Revenue	Percentage	Revenue	Percentage
Broadcast Television Stations	$9,119	5.6%	$5,981	3.7%
Broadcast Networks	$20,170	12.4%	$18,805	11.7%
Cable & VOD Networks	$29,539	18.2%	$29,697	18.5%
DBS	$1,156	0.7%	$1,323	0.8%
Internet/Online[371]	$38,084	23.5%	$42,763	26.7%
Radio	$2,661	1.6%	$2,584	1.6%
Satellite Radio	$135	0.1%	$160	0.1%
Radio Network	$1,091	0.6%	$1,071	0.6%
Daily Newspaper	$2,360	1.8%	$2,129	1.3%
Barter Syndication	$2,924	1.9%	$2,895	1.8%
Other	$54,423	33.6%	$52,393	32.7%
Total	**$161,662**	**100%**	**$159,802**	**100%**

5. Marketplace Factors Relevant to Entry, Competition, and Expansion

128. MVPDs, OVDs, and television broadcasters all face marketplace barriers affecting entry and competition, including barriers related to infrastructure, equipment, and technology. The acquisition and significant cost of video programming are also key issues affecting all video providers.

129. *Infrastructure, Equipment, and Technology*. While it is possible to enter the MVPD marketplace by building new delivery infrastructure (e.g., a cable system or fiber optic network), data show that MVPD service is currently available to almost all consumers,[372] and construction of new infrastructure requires significant capital. While telephone companies installed new fiber optic networks in recent years to compete with cable video providers, this activity has slowed significantly in recent years.[373] As a result, most entry into the MVPD marketplace occurs via the acquisition of existing MVPD systems. In light of ongoing consolidation in the MVPD industry, however, it may be difficult for new entities to enter the marketplace in this manner.

130. Similarly, entry into the television broadcast industry typically can occur only via acquisition of existing licensees or stations, as the Commission is not awarding permits for new full-power broadcast television stations.[374] Acquiring broadcast stations requires significant capital.[375] Single

[370] *Id*.

[371] *See supra* note 369.

[372] *See supra* para. 51.

[373] *See supra* para. 69.

[374] *See supra* para. 90.

[375] Capital for station purchases and operation may come in the form of debt or equity financing. In determining whether to lend money or invest in a licensee, banks or other firms look at expected revenues and expenses,

(continued….)

television stations can sometimes carry multi-million dollar price tags.[376] While entry into the market via the purchase of a single station is possible, such purchase opportunities may be limited. In addition, it is noted that recent television broadcast transactions typically have involved merger and consolidation of existing broadcasters, not purchases by new entrants. [377]

131. OVDs face challenges relating to content delivery and consumer devices. As discussed above, OVDs must have access to the infrastructure to deliver their video content to consumers with appropriate speed and quality.[378] This, in turn, may require additional capital expenditures. For example, an OVD may have to build its own CDN, contract with one or more third party CDNs, or lease capacity from a local broadband provider.[379] Moreover, because OVDs make content available to consumers on a variety of Internet-connected devices,[380] they typically must negotiate and reach agreements with multiple device manufacturers. Netflix indicates that its agreements with consumer electronics manufacturers are typically between one and three years in duration, and that the degree of accessibility and prominence of its service on the manufacturer's device are important aspects of those agreements.[381] Netflix also notes that, as it makes technological changes to its streaming capabilities, the consumer electronics manufacturers may need to update their devices in order to maintain quality of service for Netflix's subscribers.[382] Sometimes the business incentives facing OVDs and equipment manufacturers hamper efforts to make OVDs available on certain devices.[383] Accordingly, the negotiations, and balancing of benefits, between device manufacturers and OVDs tend to evolve as technology, content availability, and consumer tastes change.

132. *Acquisition and Cost of Content*. In order to compete in the marketplace, MVPDs, OVDs, and television broadcasters must acquire programming that attracts viewers. All three types of entities face challenges in this regard. Content costs for MVPDs are significant, and they have been increasing in recent years.[384] MVPDs that are vertically integrated with broadcast and cable networks may enjoy cost advantages. Larger MVPDs, for example, may enjoy price advantages when purchasing programming. In particular, scale economies may enable larger MVPDs to lower their costs by obtaining volume discounts for purchased programming.[385] S&P Global has stated that while some smaller MVPDs

(Continued from previous page)
especially whether new owners could increase profits by changing programming or reducing expenses. Structural changes in the media industry, combined with the strong correlation of their revenues and profits to economic cycles, indicate that financing media transactions with debt entails some risk. In particular, high interest rates may lead station owners to file for bankruptcy and transfer control to lenders or sell their stations. *See 18th Report*, 32 FCC Rcd at 606, para. 97.

[376] *See supra* para. 113.

[377] *See id*.

[378] *See supra* para. 86.

[379] *See id*.

[380] *See supra* para. 87.

[381] Netflix Inc., SEC Form 10-K for the Year Ended December 31, 2018 at 7 (Netflix 2018 Form 10-K).

[382] *Id*.

[383] For example, due to business disagreements between Amazon and Apple, Amazon Prime was not available on Apple TV until late 2017. *See, e.g.*, Steve Dent, *Amazon Prime Video Finally Arrives on Apple TV*, Engadget (Dec. 16, 2017), https://www.engadget.com/2017/12/06/amazon-prime-video-on-apple-tv/; Kif Leswing, Amazon Prime Video is finally available for Apple TV, Business Insider (Dec. 16, 2017), https://www.businessinsider.com/amazon-prime-video-app-finally-available-apple-tv-2017-12.

[384] *See supra* para. 66.

[385] *See, e.g., AT&T and DIRECTV MO&O*, 30 FCC Rcd at 9202, para. 188 (noting several commenters "assert[ed] that the combined entity's increased size and market power would give it the ability to negotiate substantial volume (continued….)

have formed cooperatives to purchase programming, these cooperatives are small in comparison to the larger MVPDs and may lack significant negotiating leverage.[386]

133. Further, some MVPDs maintain that they are disadvantaged by tying and tier placement conditions imposed by programmers.[387] These MVPDs state that programmers often use tying provisions to require carriage of additional channels.[388] In some cases, these providers indicate that programmers impose penetration requirements that force MVPDs to place channels on the basic tier.[389] Some MVPDs argue that tying and tiering practices make it difficult to offer video packages that their subscribers want and can afford.[390] In contrast, others have argued that bundling is a common practice in competitive markets and is generally procompetitive.[391]

134. Pre-existing business relationships may impact the availability of content to OVDs. For example, owners and producers of content may be vertically integrated with, or have exclusivity arrangements with, cable networks, broadcast networks, and/or MVPDs, and these arrangements may affect unaffiliated OVDs' ability to establish carriage agreements with content owners.[392] A second constraint on OVD content acquisition occurs when content owners are vertically integrated, or negotiate exclusive relationships with, other OVDs.[393]

135. As discussed above, OVDs are increasingly supplementing their third-party content with original content.[394] While this strategy may be economically favorable and can help guard against some of the difficulties involved in licensing content from third parties, it is capital intensive.[395] In 2018, for example, Netflix and Amazon are expected to spend $2.1 billion and $1 billion, respectively, on original content.[396]

(Continued from previous page)
discounts for programming"). S&P Global indicated that Comcast has benefited from sizable volume discounts, and the merger of AT&T and DIRECTV was expected to lower programming costs for the combined entity. *See* Chris Young and Tony Lenoir, *Programming Expenses Exceed 50% of Video Revenue in 2015*, S&P Global (Mar. 18, 2016); Chris Young and Tony Lenoir, *Programming Expenses Exceed 50% of Video Revenue in 2015*, S&P Global (Mar. 18, 2016). Similarly, S&P Global has stated that "[s]maller operators are having more difficulty maintaining margins because their programming costs tend to be higher without the bulk discounts of their larger peers." S&P Global, Media & Communications Report at 4 (May 25, 2016).

[386] *See 18th Report*, 32 FCC Rcd at 581, para. 32.

[387] *See id*. at 582, para. 33. The Commission's NOI on the availability of diverse and independent sources of video programming addresses, tying and program tiers, among other issues. *See Promoting the Availability of Diverse and Independent Sources of Video Programming*, MB Docket No. 16-41, Notice of Inquiry, 31 FCC Rcd 1610, 1618-18, paras. 15-18 (2016).

[388] *See 18th Report*, 32 FCC Rcd at 582, para. 33. *See also* NTCA Comments at 9-10, ITTA Comments at 2-6, WTA Comments at 6, Verizon Comments at 7-8, INSP Reply Comments at 4, 7.

[389] *See 18th Report*, 32 FCC Rcd at 582, para. 33. *See also* ITTA Comments at 6, WTA Comments at 6, ACA Comments at 7-11.

[390] *See 18th Report*, 32 FCC Rcd at 582, para. 33. *See also* NTCA Comments at 10, WTA Comments at 6, ACA Comments at 7, Verizon Comments at 7-8.

[391] *See 18th Report*, 32 FCC Rcd at 582, para. 33.

[392] *See 16th Report*, 30 FCC Rcd at 3370-71, para. 253.

[393] *Id*.

[394] *See supra* paras. 77-80.

[395] *See id*.

[396] *See id*.

136. Contracts and business arrangements can have an impact on television broadcasters' access to content as well. In general, television broadcasters obtain programming from broadcast networks and program syndicators, under contracts that often run for several years.[397] Broadcast network affiliations often require affiliates to pay significant compensation to the broadcast networks.[398] A station that loses its network affiliation may not be able to affiliate with an alternative network, because that alternative network is likely to already have a distribution agreement in place with another station in the market. The loss of network programming likely would require the station to obtain replacement programming, which may be less attractive to the station's audience, at a higher cost. Similarly, popular syndicated programming may not be available for a new station due to exclusive distribution arrangements with competing outlets.[399]

C. The Audio Market

137. This chapter discusses competition in the market for the delivery of audio programming. We begin by discussing the three main categories of audio providers, providing an overview of the services offered by each type of provider, a description of some of the notable industry participants, an explanation of the business models and competitive strategies used by each, and a discussion of recent entry into and exit from the marketplace. We then discuss intermodal competition, i.e., competition among providers in the various categories, as well as some regulatory factors that may form barriers to entry or competition in this marketplace.[400]

138. In the United States, consumers can access audio programming from multiple sources, from terrestrial broadcast radio stations, which have existed in the marketplace for nearly a century, to more recent marketplace entrants, such as entities that use Internet and mobile technologies to deliver audio content to consumers. The major participants in today's marketplace for the delivery of audio programming can be divided into three categories:

- Terrestrial radio broadcasters: These entities use terrestrial radio stations licensed by the Commission to broadcast audio content over the air (OTA) to consumers, who use radios to receive the stations' programming. Participants in this category include AM, FM, and low power FM (LPFM) radio stations. There are thousands of terrestrial radio stations in the United States, providing linear channels[401] of music, news, sports, entertainment, educational, and other content.

[397] *See 18th Report*, 32 FCC Rcd at 606, para. 98. As an alternative to contracting for expensive third-party programming, stations may produce their own programming in-house or lease time to other parties (e.g., producers of infomercials) willing to pay stations for the airing of programming.

[398] For example, television stations typically must pay a portion of the retransmission consent fees they obtain from MVPDs with the broadcast network with which they are affiliated; this is referred to as "reverse compensation." *Id.* at 620, para. 124.

[399] *See id.* at 606, para. 98.

[400] In this section, we rely on a variety of publicly available sources of industry information and data including: Securities and Exchange Commission filings; data from trade association and government entities; data from securities analysts and other research companies and consultants (e.g., S&P Global and Nielsen Media Research); company news releases and websites; newspaper and periodical articles; scholarly publications; white papers; and various public Commission filings, decisions, reports, and data. We make use of both individual company data and industry-wide data. In addition, we also rely on comments and reply comments submitted in response to the Media Bureau's Public Notice seeking input for this chapter. *See Media Bureau Seeks Comment on the Status of Competition in the Marketplace for Delivery of Audio Programming*, Public Notice, MB Docket No. 18-227, DA 18-761 (rel. July 23, 2018) (Public Notice).

[401] Linear channels provide specific audio content or programs at a specific time of day. By contrast, podcasts or audio downloads allow users to access pre-packaged audio content and listen to it at any time.

- Satellite radio: Currently, SiriusXM is the only satellite radio provider in the United States. It uses satellite technology to offer subscription-based audio programming to consumers, primarily through installation in automobiles. Subscribers use specially-designed receivers that come standard or can be installed by the factory/dealer with every major automaker to access this content. Recently, consumers have also gained the ability to access this content by using computers, smartphones, and other devices through the Internet. SiriusXM provides multiple linear channels of programming and is able to offer content and features not available from other sources.
- Online Audio Providers: This varied group of marketplace participants uses the Internet to deliver audio content to consumers. Consumers, in turn, can access this content using computers, smartphones, and other devices. Some such providers offer linear audio channels similar to those offered by terrestrial radio stations, and some allow users to access and download audio content and listen to it at any time (e.g., podcasts). Participants in this category include larger, well-known entities like Pandora and Spotify, as well as numerous other providers, some of which focus on small or niche audiences.

139. Distinguishing features of audio providers include method of delivery, option(s) to download rather than solely stream or listen live, type and quantity of content offered, and consumer devices compatible with the service.

1. Terrestrial Radio Broadcasters

140. Terrestrial radio broadcasters, which today include full power AM and FM radio stations and LPFM stations,[402] have long been the mainstay of the audio programming market. All radio stations broadcast analog signals OTA to consumers, with some stations also transmitting higher-quality digital audio OTA to consumers as well.[403] Stations that broadcast in digital are able to provide multiple streams of programming to consumers, as well as other data, such as information about music airing on the station, weather updates, traffic reports, and other news; however, consumers must have a receiver with both an analog tuner and a digital tuner in order to receive all the signals broadcast.[404]

141. Terrestrial radio stations must receive authorization from the Commission before they may construct and operate in the United States[405] and are subject to both the Communications Act of 1934, as amended, and regulations promulgated by the Commission thereunder. In allocating and

[402] The Commission created the LPFM radio service in January 2000. LPFM stations operate at a much lower power, and serve a much smaller area, than full power FM stations. FCC, *Low Power FM (LPFM) Broadcast Radio Stations*, https://www.fcc.gov/media/radio/lpfm. LPFM stations are authorized for noncommercial educational broadcasting only and must be licensed to government or non-profit educational institutions; non-profit organizations, associations, or entities with an educational purpose; or government or non-profit entities providing local public safety or transportation service. *See* 47 CFR § 73.583; FCC, *Low Power FM (LPFM) Radio*, https://www.fcc.gov/consumers/guides/low-power-fm-lpfm-radio. LPFM license applicants must be based in the community in which they intend to broadcast. *Id.* LPFM stations typically provide opportunities for local and niche programming. *See* Brian Stelter, *Low Power FM Radio to Gain Space on the Dial*, New York Times (Jan. 24, 2011), https://www.nytimes.com/2011/01/25/arts/25radio.html?_r=1.

[403] Digital audio transmission and reception is more resistant to interference and eliminates many imperfections of analog radio transmission and reception, offering better sound quality than analog. FM digital radio can provide clear sound comparable in quality to CDs, and AM digital radio can provide sound quality equivalent to that of standard analog FM. FCC, *Digital Radio*, https://www.fcc.gov/consumers/guides/digital-radio.

[404] *See id.*; FCC, *Digital Radio*, https://www.fcc.gov/media/radio/digital-radio.

[405] 47 U.S.C. § 301. The Commission licenses broadcast spectrum to respective applicants and approves any assignment or transfer of control of broadcast licenses. *Id.* §§ 303(c), 308(a), 309(a), 310(d). In addition, certain obligations and rules are imposed on licensees to ensure that the licensed spectrum is used to serve the public interest during each license term, which is generally eight years. *Id.* § 307(c); 47 CFR §§ 73.1020, 73.3555.

authorizing terrestrial radio stations, the Commission is charged with ensuring that such stations are distributed across the country and licensed to communities in a manner that serves the public interest.[406] In addition, licensees of terrestrial broadcast stations must comply with certain obligations and rules to ensure that the licensed spectrum is used to serve the public interest.[407] Licenses for broadcast radio stations have an eight-year term, but can be renewed by the Commission upon application by the licensee.[408]

142. The number of AM and FM radio stations in the country has been fairly steady in recent years, while the number of LPFM stations has increased somewhat. The Commission's most recent tally of stations showed 4,626 AM stations; 10,867 FM stations (consisting of 6,737 commercial stations and 4,130 non-commercial stations); and 2,175 LPFM stations, for a total of 17,668 terrestrial radio stations.[409] New stations are possible only through new allocations and award of licenses, either via an auction in the case of commercial stations[410] or a comparative system for noncommercial stations.[411] Some of the largest terrestrial radio licensees in the United States include:[412]

- iHeartMedia: iHeartMedia operates 547 FM stations and 178 AM stations, for a total of 725 radio stations in 149 radio markets, with station ad revenue of $2.275 billion.[413]
- Cumulus Media: Cumulus operates 298 FM stations and 70 AM stations, for a total of 368 radio stations in 88 radio markets, with station ad revenues of $676.33 million.[414]
- Entercom Communications: Entercom operates 171 FM stations and 50 AM stations, for a total of 221 radio stations in 50 radio markets, with station ad revenue of $1.335 billion.[415]
- Townsquare Media: Townsquare operates 173 FM stations and 46 AM stations, for a total of 219 radio stations in 51 radio markets, with station ad revenues of $193.84 million.[416]

143. In addition to their OTA signals, terrestrial broadcasters have increasingly sought to expand their offerings by using digital platforms such as station websites and mobile applications. For instance, iHeartMedia offers free live audio streaming from its stations on its website,[417] and several

[406] 47 U.S.C. §§ 303, 307.

[407] *See, e.g.*, 47 CFR §§ 73.1020, 73.3555.

[408] *Id.*

[409] *See* September 30, 2018 Broadcast Station Totals.

[410] *See Reexamination of the Comparative Standards for Noncommercial Educational Applicants*, MM Docket No. 95-31, Report and Order, 15 FCC Rcd 7386, 7427-33, paras. 101-11 (2000) (*NCE Comparative Standards R&O*). The Balanced Budget Act of 1997 amended Section 307(j) of the Communications Act "to require the Commission to use competitive bidding to resolve application conflicts, but exempted NCE stations from this process." *Reexamination of the Comparative Standards for Noncommercial Educational Applicants*, MM Docket No. 95-31, Memorandum Opinion and Third Order on Reconsideration, 23 FCC Rcd 17423, 17424, para. 3 (2008) (citing Balanced Budget Act of 1997, Pub. L. No. 105-33, Title III, 111 Stat. 251 (1997), amending 47 U.S.C. § 307(j)).

[411] *See NCE Comparative Standards R&O*, 15 FCC Rcd at 7393-7420, paras. 16-79.

[412] S&P Global Market Intelligence, Radio Station Owners by Total Radio Station Ad Revenue (last visited Oct. 9, 2018). This represents 2017 data.

[413] *Id.*

[414] *Id.*

[415] *Id.*

[416] *Id.*

[417] iHeartRadio, *iHeartRadio/Listen to Free Radio Stations & Music Online/iHeartRadio*, https://www.iheart.com/.

popular radio apps, including NPR One, Radio Online, iHeartRadio, and TuneIn Radio, allow users to listen to radio stations and libraries of programs and podcasts for free or with a paid subscription for some premium versions.[418]

a. Broadcast Business Models and Strategy

144. *Revenue Streams.* The primary source of revenue for commercial terrestrial radio stations is advertising. To secure the highest rates and to compete for advertising market share, stations strive to gain the largest audience of listeners possible to maximize the price for ad time sold by the station. Broadcast stations generate advertising revenue from consumers listening to programming broadcast over-the-air, as well as increasingly from listeners via Internet or mobile platforms. musicFIRST Coalition and Future of Music Coalition note that terrestrial broadcast radio station clusters in small markets "find it difficult to sell advertising revenue when competing against larger local clusters."[419]

145. Broadcast radio total revenue (including network, national and local spot advertising revenue) was $17.70 billion in 2016—up 1.9% from 2015, helped largely by political ad revenue and digital/online revenue.[420] Total revenue decreased slightly in 2017, a non-election year, by 0.4% to $17.62 billion.[421] Annual revenue from digital/online was nearly $1.11 billion, or 6.2% of total radio station revenues, in 2016 and nearly $1.19 billion, or 6.7% of total radio station revenues, in 2017.[422]

146. Internet and mobile revenue growth in 2017 was powered by the expansion of offerings by radio stations designed to help augment traditional OTA advertising packages.[423] One notable development in the radio ad-buying process has been the introduction of platforms that enable advertisers to target listeners easily across both OTA radio and Internet/mobile platforms.[424] Targeting and employing consumer data from digital assets have helped radio groups better serve advertisers by improving the reach and effectiveness of ads.[425] Such digital assets and products include Smart Audio ad products (iHeart Media), a new digital data-fed feature of the SoundPoint programmatic ad solution for broadcast radio stations;[426] Radio.com (Entercom), which will offer access to all of Entercom's stations

[418] NAB Comments at 12 (citing Joe Hindy, *10 best radio apps for Android*, androidauthority.com (Sept. 3, 2018), https://www.androidauthority.com/best-radio-apps-for-android-393884/; Will Nicol, *Tune in and chill out with the best radio apps for Android and iOS*, digitaltrends.com (Feb. 13, 2018), https://www.digitaltrends.com/mobile/best-radio-apps/).

[419] musicFIRST Coalition and Future of Music Coalition Reply at 9-10 (citing musicFIRST Coalition and Future of Music Coalition Comments at 9). A "cluster" refers to several stations owned by the same broadcaster in a particular geographic market.

[420] S&P Global Market Intelligence, *Radio/TV Station Annual Outlook Market-by-Market Revenue Projections 2017 Edition* (Aug. 2017) at 1, 4. SNL Kagan digital/online ad revenue calculations account for annual digital and online ad buying through terrestrial radio stations, which includes station website, station streaming, HD radio and station mobile ad revenue. Peter Leitzinger, *Broadcast Investor: Radio/digital online ad revenue projections through 2027*, S&P Global Market Intelligence (Apr. 19, 2018) at 1 (*Broadcast Investor Apr. 2018*).

[421] S&P Global Market Intelligence, *Radio/TV Station Annual Outlook Market-by-Market Revenue Projections 2018 Edition* (Aug. 2018) at 1-2 (*Radio/TV Station Annual Outlook 2018*). Advertising revenues generally increase in election years due to political ad spending.

[422] *Broadcast Investor Apr. 2018* at 1.

[423] *Id.*

[424] *Id.* at 2.

[425] *Id.* at 2-3.

[426] *Id.* at 2.

and podcasts;[427] Entercom Audience Analytics (Entercom), a platform designed to give advertisers a deeper insight into on-air ad campaigns;[428] and Headway (Entravision).[429]

147. *Programming.* Stations seek to differentiate themselves based on programming, offering programming that will be popular and well-received in the market, but which perhaps does not have a dominant outlet in the market.[430] Broadcasters that own a cluster of stations in a geographic market often will employ a variety of different formats on their stations to achieve a broad and diverse audience.[431]

b. Broadcast Radio Station Entry and Exit

148. Frequencies for radio stations are typically in high demand;[432] in fact, in many areas of the country no frequencies may be available on which a new station could begin operating without causing impermissible interference to existing stations.[433] As a result, the Commission does not allocate many new stations and, to the extent that new stations are allocated, they tend not to be in the largest markets or the highest power stations. Spectrum limitations and the dearth of new stations pose significant barriers to entry.[434] Consequently, a new entrant's best chance of entering the terrestrial radio broadcast business is the secondary market.

149. In 2016, 491 stations were sold for a total of $546 million—the lowest year on record since 1982 for deal volume and number of full-power stations sold.[435] In 2017, deal volume substantially increased to $3.177 billion, driven largely by the merger of Entercom and CBS Radio.[436] Some of the more significant transactions of the past two years are discussed below:

- In 2016, Beasley acquired all the outstanding stock of Greater Media Inc. for $239.9 million. In order to come into compliance with Commission regulations, Beasley sold four stations and a translator to Entercom for $24.0 million. [437]
- In 2017, Entercom and CBS Radio Inc. entered into a $2.5 billion transaction for 29 AM and 88 FM stations, with CBS Corp. spinning off its radio unit.[438] In order to come into compliance with

[427] *Id.*

[428] *Id.* at 3.

[429] *Id.*

[430] *See, e.g.*, Beasley Broadcasting Group, SEC Form 10-K for the fiscal year ended December 31, 2017 at 3 (Beasley Broadcast Group 2017 10-K).

[431] *See, e.g.*, Beasley Broadcast Group 2017 10-K; Cumulus Media 2017 10-K.

[432] *See 2002 Biennial Regulatory Review – Review of the Commission's Broadcasting Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, Report and Order and Notice of Proposed Rulemaking, 18 FCC Rcd 13620, 13730-31, para. 288 (2003) (*2002 Biennial Regulatory Review R&O and NPRM*).

[433] *See, e.g.*, FCC, *How to Apply for a Radio or Television Broadcast Station*, https://www.fcc.gov/media/radio/how-to-apply.

[434] musicFIRST and Future of Music Coalition Comments at 4, n. 9. (citing *2002 Biennial Regulatory Review R&O and NPRM*, 18 FCC Rcd 13730-31, para. 288).

[435] Volker Moerbitz, *Databook Radio Station Deals*, S&P Global Market Intelligence (June 18, 2018), at 1 (*Databook Radio Station Deals).*

[436] *Id.* at 2.

[437] *Id.*

[438] *Id.*; Michael Balderston, Entercom/CBS Merger Push Q1 2017 Broadcast Station Deals, S&P Global Market Intelligence (Apr. 3, 2017), at 1, https://www.radioworld.com/news-and-business/entercomcbs-merger-push-q1-2017-broadcast-station-deals.

Commission regulations, Entercom/CBS engaged in station swaps with iHeartMedia and Beasley, trading 11 of its stations for seven iHeart Media stations, one Beasley station and $12.0 million cash, transactions that had an estimated value of $140 million.[439]

- In 2017, non-commercial Educational Media Foundation agreed to pay Entercom $57.7 million for three FM stations in Los Angeles, San Diego, and Wilkes Barre-Scranton.[440]
- The largest single station sales of 2016 and 2017 were Universal Media Access's sale of KFWB in Los Angeles to Lotus Communications for $11.2 million and Emmis Communications' sale of KPWR in Los Angeles to Meruelo Group for $82.8 million, respectively.[441]
- In September 2018, Entercom acquired WBWB(FM) in Philadelphia, PA from Jerry Lee Radio, LLC in Philadelphia, PA for $57.5 million in cash.[442] Simultaneously, Entercom divested WXTU(FM), also in Philadelphia, PA, to Beasley Broadcasting.

150. Also notable were the recent Chapter 11 bankruptcy filings of the two largest radio broadcasters—iHeartMedia and Cumulus Media—in 2018 and 2017, respectively,[443] which are undergoing capital restructuring and cost-cutting plans.[444] It appears that these restructurings may be the result of substantial debt incurred in borrowing funds to purchase large numbers of radio stations, which the companies struggled to repay.[445]

2. Satellite Radio

151. In 1995, the Commission allocated spectrum in the 2310–2360 MHz band for satellite digital audio radio service (SDARS).[446] In contrast to digital radio offered by terrestrial radio stations as a supplement to their analog signals and available free OTA, SDARS is a subscription-based satellite-delivered digital radio service.[447] Following the Commission's establishment of general service rules for SDARS in 1997,[448] two SDARS licensees—Sirius Satellite Radio Inc. (Sirius) and XM Radio Inc. (XM)—purchased their licenses at auction, successfully launched their satellite systems, and commenced

[439] *Databook Radio Station Deals* at 2.

[440] *Id.*

[441] *Id.*

[442] Press Release, Entercom Communications Corp, Entercom Enters Into Definitive Agreements to Acquire WBEB-FM 101.1 MORE FM and Divest WXTU-FM 92.5 FM in Philadelphia (July 19, 2018), https://entercom.com/press/entercom-enters-into-definitive-agreements-to-acquire-wbeb-fm-101-1-more-fm-and-divest-wxtu-fm-92-5-fm-in-philadelphia/.

[443] *See* Andrew Flanagan, *iHeartMedia Turns the Dial to Bankruptcy*, NPR (Mar. 15, 2018), https://www.npr.org/sections/thetwo-way/2018/03/15/593868390/iheartmedia-turns-the-dial-to-bankruptcy.

[444] *Radio/TV Station Annual Outlook 2018* at 1-2.

[445] *See* musicFIRST and Future of Music Coalition Comments at 23 (citing, e.g., Parker Hall, *Is Tech Finally Killing Radio? Don't let iHeart's Bleeding Fool You*, Digital Trends (Mar. 23, 2018), https://www.digitaltrends.com/music/is-tech-finally-killing-radio-dont-let-ihearts-bleeding-fool-you/).

[446] *Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services*, Report and Order, 10 FCC Rcd 2310, 2310, para. 1 (1995).

[447] *See Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, IB Docket No. 95-91 et al., Second Further Notice of Proposed Rulemaking, 22 FCC Rcd 22123, 22150, Appx. B (2007) (*SDARS Second FNPRM*).

[448] *See generally Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, Report and Order, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754 (1997).

commercial service to the public.[449] SDARS provides nationally distributed subscription radio service and requires a significant investment of capital for operation.[450] In 2008, Sirius and XM merged and formed SiriusXM,[451] which is currently the only provider of SDARS in the audio marketplace. SiriusXM reports that it had more than 27.5 million self-paying U.S. subscribers at the end of 2017.[452]

152. *Revenue Streams.* As a primarily subscription based-service,[453] SiriusXM—unlike terrestrial broadcast radio—does not rely on advertising as its primary revenue source. In 2016, SiriusXM's total revenue was approximately $5.0 billion.[454] Subscription revenue constituted the bulk of this revenue, accounting for $4,2 billion while advertising represented $138 million of total revenue, equipment revenue was $119 million, and other revenue was $563 million.[455] In 2017, SiriusXM's total revenue was $5.4 billion, representing an 8% increase over 2016.[456] Subscription revenue was the largest source of revenue, constituting $4.5 billion of total revenue; while advertising revenue represented $160 million; equipment revenue was $132, million; and other revenue was $661 million.[457]

153. *Channel and Streaming Packages.* SiriusXM offers consumers three principal subscription packages: Select ($15.99/month), All Access ($20.99/month), and Mostly Music ($10.99/month).[458] All three packages offer access to all of SiriusXM's commercial-free music channels; Select and All Access also offer exclusive artist-dedicated channels, 24/7 comedy channels, top news channels, college sports, and traffic and weather.[459] All Access additionally offers Howard Stern's channels and professional sports channels.[460] SiriusXM also offers two non-satellite (i.e., online audio) plans: Streaming Add-On ($5.00/month) and Premier Streaming ($15.99/month), which is a stand-alone streaming package.[461] In addition, the company offers several specialty satellite packages, including a

[449] XM began nationwide commercial service on November 12, 2001. Sirius began commercial service on February 14, 2002. *See SDARS Second FNPRM*, 22 FCC Rcd at 22123, para. 1, n. 4.

[450] *See id.* at 22150, Appx. B.

[451] *Applications for Consent to the Transfer of Control of Licenses from XM Satellite Radio Holdings Inc. to Sirius Satellite Radio Inc.*, MB Docket No. 07-57, Memorandum Opinion and Order and Report and Order, 23 FCC Rcd 12348, 12349, para. 1 (2008).

[452] Press Release, SiriusXM, SiriusXM Reports Fourth Quarter and Full-Year 2017 Results (Jan. 31, 2018), http://investor.siriusxm.com/investor-overview/press-releases/press-release-details/2018/SiriusXM-Reports-Fourth-Quarter-and-Full-Year-2017-Results/default.aspx (SiriusXM Press Release).

[453] SiriusXM, *Will I hear commercials on SiriusXM?*, https://listenercare.siriusxm.com/app/answers/detail/a_id/3562/~/will-i-hear-commercials-on-siriusxm%3F.

[454] SiriusXM Press Release.

[455] *Id.* Equipment revenue includes revenue and royalties from the sale of satellite radios, components, and accessories. Other revenue includes amounts earned from subscribers for the U.S. Music Royalty Fee, revenue from SiriusXM's connected vehicle business, its Canadian affiliate, and ancillary revenues. SiriusXM, SEC Form 10-K for the fiscal year ended December 31, 2017 at 29.

[456] *Id.*

[457] *Id.*

[458] *See* SiriusXM, *Our Packages*, https://www.siriusxm.com/ourmostpopularpackages?intcmp=GN_HEADER_NEW_Subscriptions_SubscribeNow_CompareAllPackages.

[459] *Id.*

[460] *Id.*

[461] *Id.*

family-friendly package and an a la carte option.[462] SiriusXM offers over 1000 channels, providing content and features not available from other sources.

3. Online Audio Providers

154. In addition to terrestrial broadcast radio stations and satellite delivered radio service, audio programming delivered via the Internet and mobile devices has emerged as the third category of providers in the audio marketplace. Though this significant and growing group of audio providers share the characteristic that their services rely on the Internet and mobile technologies to deliver audio content to consumers, these providers take many different forms. Generally, Online Audio Providers may be classified as non-interactive or interactive, with the latter involving user choice, such as choosing specific songs and downloading content; however, some services offer both non-interactive features and interactive features. In addition, as discussed above, both terrestrial radio broadcasters and SiriusXM have taken advantage of the Internet and the proliferation of mobile devices to supplement their traditional offerings with content delivered via the Internet.

155. A recent S&P Global survey suggests that, unlike listeners consuming radio from a variety of terrestrial broadcast stations, most users of online music services tend to use just one service, especially those who use a pay music service.[463] 75% of respondents reported listening to free music or watching music videos from at least one online source over the past three months.[464] Of those free music service users, 47% use only one service; 28% use two services; and 25 % use three or more services.[465] 34% of online music service users reported using a paid music streaming service, with the top two paid services being Amazon's Prime Music (15%) and Spotify (12%).[466] 74% of paid music service subscribers use only one service.[467] Many of those who subscribe to more than one service appear to subscribe to Amazon Prime Music.[468]

156. Among podcast listeners, the apps most commonly used are Apple's iTunes (41%), Pandora (37%), Spotify (28%), iHeartRadio (21%), and Google Play Music (18%).[469] These services also offer some form of streaming music, which may suggest that podcast listeners were already using the app(s) to listen to music.[470]

157. *Revenue Streams.* Online Audio Providers' sources of revenue include both paid subscriptions and advertising for ad-supported tiers that are free to consumers. The portion of total revenue that these revenue sources represent varies significantly depending on the provider. For example, in 2017, Spotify reported $5 billion in total revenue, with subscription revenue representing 90% of the company's total revenue since 2016.[471] In contrast, advertising comprised $1.075 billion of Pandora's

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[462] *Id.*

[463] Brian Bacon, *Consumer Insights: Online music user profiles*, S&P Global Market Intelligence (July 12, 2018), at 1. S&P Global's March 2018 online consumer survey included 2,523 U.S. Internet adults.

[464] *Id.* at 1.

[465] *Id.*

[466] *Id.* at 2.

[467] *Id.*

[468] *Id.* at 2-3.

[469] Brian Bacon, *Consumer Insights: Podcast listeners by demographics, genre, platform and listening location*, S&P Global (Apr. 26, 2018), at 1.

[470] *Id.*

[471] Alison Weissbrot, *Spotify's F-1 Shows Programmatic Makes Up 18% of Ad Revenue*, Ad Exchanger (Feb. 28, 2018), https://adexchanger.com/digital-audio-radio/spotifys-f-1-shows-programmatic-makes-18-ad-revenue/.

$1.467 billion total revenue in 2017 (approximately 73%).[472] In 2016, the top three services by subscription revenue were Spotify ($2.784 billion), Apple Music ($1.082 billion), and Deezer ($271.5 million), with Pandora coming in at $237 million.[473]

158. *Tiers of Services.* Major Online Audio Providers with free offerings include Pandora, Slacker Radio, and Spotify.[474] These free offerings are generally ad-supported, and while they may require users to register for the service, they do not require a subscription fee. Online Audio Providers often offer additional programming tiers and differentiate themselves based on the unique features of their premium subscriptions. Some features, like the ability to download content, are fairly common among premium offerings, including Apple Music, Napster, and Spotify. Other features are more distinctive. TuneIn, for example, offers live NFL, MLB, NBA, and NHL games as part of its Premium tier.[475] Other services, like Apple Music[476] and TIDAL,[477] offer exclusive original content.

159. *Pricing Strategies.* Online Audio Providers employ a wide variety of pricing strategies. For example, many Online Audio Providers offer free trials for their premium subscriptions. In some cases, the length of the free trial varies depending on the tier of service selected, with more expensive services garnering longer trial periods.[478] Some services offer reduced pricing for users who commit to a year-long paid subscription. These include Amazon Music for Prime members (the Individual Plan at $79/year and the Amazon Music Unlimited Family Plan at $149/year) and Slacker Radio ($29.99/year for its Plus offering).[479] A significant number of Online Audio Providers offer family plans that generally provide access for multiple family members. Most services' family plans—including Amazon Music, Apple Music, Deezer, Napster, Pandora, Spotify, and TIDAL (for TIDAL Premium)[480]— cost $14.99/month.[481] Several Online Audio Providers—including Amazon Music's Unlimited Plan, Apple

[472] Pandora, SEC Form 10-K for the fiscal year ended December 31, 2017 at 4, 48.

[473] S&P Global Market Intelligence, *Economics of Mobile Music: 2017 Edition* (July 2017), at 5.

[474] Pandora, *Pandora – Listen to Free Music You'll Love*, https://www.pandora.com/ (last visited Oct. 16, 2018) (Pandora Website); Slacker Radio, *Slacker Radio/ Free Internet Radio/Slacker Radio*, https://www.slacker.com/ (last visited Oct. 16, 2018) (Slacker Website); Spotify, https://www.spotify.com/us/premium/?checkout=false (last visited Oct. 16, 2018) (Spotify Website).

[475] TuneIn, *TuneIn/Free Internet Radio/NFL, Sports, Podcasts, Music, & News*, https://tunein.com/ (last visited Oct. 16, 2018).

[476] Apple Music, *Apple Music – Apple*, https://www.apple.com/apple-music/ (last visited Oct. 16, 2018) (Apple Music Website).

[477] Hugh McIntyre, *Sprint Takes 33% Stake in Jay-Z's Tidal for $200M*, Forbes (Jan. 23, 2017), https://www.forbes.com/sites/hughmcintyre/2017/01/23/jay-zs-tidal-has-been-partially-acquired-by-sprint/#3b83d8482144.

[478] Pandora offers a 30-day free trial for Pandora Plus ($4.99/month) and a 60-day free trial for Pandora Premium ($9.99/month for individuals and $14.99/month for families). Pandora Website. Napster offers a 14-day free trial for unRadio ($4.99/month) and a 30-day free trial for Napster Premier ($9.99/month). Napster, *Napster Premier & unRadio Subscription Plans/ Napster*, https://us.napster.com/pricing (last visited Oct. 16, 2018). Spotify offers a 30-day free trial for Spotify Premium ($9.99/month). Spotify Website.

[479] Amazon, *Amazon Music Unlimited FAQs: Digital Music*, https://www.amazon.com/b?ie=UTF8&node=15730321011 (last visited Oct. 29, 2018) (Prime Music Website); Slacker Website.

[480] Prime Music Website; Apple Music Website; Deezer, *Plans*, https://www.deezer.com/us/offers/ (last visited Oct. 17, 2018); Napster, *Napster Family Plan Subscriptions*, https://us.napster.com/family (last visited Oct. 16, 2018); Pandora Website; Spotify, https://www.spotify.com/us/family (last visited Oct. 17, 2018); TIDAL, *Subscription Types – TIDAL*, https://support.tidal.com/hc/en-us/articles/115003662825-Subscription-Types (last visited Oct. 29, 2018) (TIDAL Website).

[481] Prime Music Website.

Music, Spotify (with other services included), and TIDAL's Premium—offer a student rate of $4.99/month.[482]

160. *Bundles.* In some cases, Online Audio Providers bundle their services with other products. For instance, the Spotify Premium bundle for student users includes the video products Hulu Limited Commercials and SHOWTIME for $0.99/month for the first 3 months and $4.99/month thereafter, for up to 3 years.[483] In addition to Prime Music, Amazon Prime benefits include free 2-day shipping and Prime Video.[484]

4. Intermodal Competition

161. Although providers in these three main categories of audio marketplace participants all deliver audio programming to consumers, there are significant differences in the availability, reach, consumer engagement, and cost of the services. For example, Nielsen estimates weekly reach among audio marketplace participants as follows: 228.5 million consumers for broadcast radio, 35.7 million for satellite radio, 68.5 million for streaming audio, and 21.9 million for podcasts (note that both streaming audio and podcasts are delivered via the Internet or mobile devices).[485] In 2016, 91% of Americans ages 12 and older listened to terrestrial broadcast (AM/FM) radio in a given week,[486] which dropped slightly to 90% in 2017.[487] According to Edison Research's most recent "Share of Ear" report, terrestrial broadcast radio accounts for 54% of Americans' share of time listening to audio sources, with owned music accounting for 16%, streaming audio accounting for 15%, SiriusXM accounting for 7%, TV music channels accounting for 5%, podcasts accounting for 2%, and time spent listening to other sources accounting for 1%.[488]

162. *Regulatory Burdens*. Different audio marketplace participants are subject to different regulatory regimes, which may affect how they compete with one another. For example, terrestrial broadcast radio must comply with a wide range of FCC regulations that impose costs on broadcasters while Online Audio Providers are not regulated by the FCC and thus are not burdened by those compliance costs.

163. *Music Licensing.* Different audio marketplace participants are subject to different music licensing conditions under law, which may affect how they compete with one another. For example, terrestrial broadcast radio—as non-subscription, non-interactive audio transmission— is exempted from

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[482] *Id.*; Apple Music Website; Spotify, *Premium for Students – Spotify*, https://support.spotify.com/us/account_payment_help/premium_for_students/student-discount/ (last visited Oct. 16, 2018) (Spotify Students Website); *Spotify, Premium and Hulu – Spotify*, https://support.spotify.com/us/article/premium-and-hulu/ (last visited Oct. 16, 2018) (Spotify Hulu Website); TIDAL Website. TIDAL HiFi is $9.99/month for students. *Id.*

[483] Spotify Students Website; Spotify Hulu Website. *See also* Press Release, Hulu, Spotify and Hulu Unveil First-of-its-Kind Premium Entertainment Streaming Bundle (Sept. 7, 2017), https://www.hulu.com/press/spotify-and-hulu-unveil-first-of-its-kind-premium-entertainment-streaming-bundle-spotify-premium-for-students-now-with-hulu-launches-today-nationwide-bundled-offerings-targeted-at-broader-market/.

[484] *See* Brian Bacon, *Consumer Insights: Online music user profiles*, S&P Global (July 12, 2018), at 2-3.

[485] The Nielsen Company, *Audio Today 2018: How America Listens* (Apr. 2018) at 1, https://www.nielsen.com/us/en/insights/reports/2018/state-of-the-media--audio-today-2018.html#.

[486] Pew Research Center Journalism & Media, *Audio and Podcasting Fact Sheet*, http://www.journalism.org/fact-sheet/audio-and-podcasting/ (citing Nielsen Audio RADAR 136 (March 2018), publicly available via Radio Advertising Bureau) (July 12, 2018).

[487] *Id.*

[488] Edison Research, Share of Ear, https://www.shareofear.com/#audiomesurement.

paying royalties for use of sound recordings over the air.[489] In contrast, SiriusXM pays a copyright royalty for the use of sound recordings, but the Digital Millennium Copyright Act granted pre-existing services such as SiriusXM a a compulsory copyright license for sound recordings,[490] the rate for which is set by the Copyright Royalty Board (CRB) through a rate determination proceeding.[491] Subscription non-interactive services like Pandora are granted compulsory/statutory licenses as well.[492] Pandora, however, has chosen to make direct deals with many major record industry entities instead of relying on CRB's compulsory license rates.[493] Subscription interactive services like Spotify must reach commercial agreements with music labels.[494] In January 2018, the CRB announced a ruling on streaming rates to be paid by on-demand streaming subscription services that estimates suggest will raise total content costs between 2017 and 2022 by 43.8% based on the percentage of revenue and by 31.0% based on total content cost.[495]

164. *Strategic Partnerships.* In an effort to distinguish themselves in the marketplace and better compete with their rivals, some audio marketplace participants have formed various strategic partnerships, including with wireless providers, equipment or other manufacturers, and other streaming services. For instance, Amazon Music and Pandora Premium are offered as choices in AT&T's Unlimited & More Premium wireless offering.[496] Another example is Sprint, which, after purchasing a 33% stake in TIDAL,[497] offers users of its Unlimited Plus Plan access to TIDAL Premium streaming service for the duration of the Unlimited Plus subscription.[498] In a similar fashion, T-Mobile has partnered with Pandora to offer Pandora Plus free for one year to certain T-Mobile subscribers,[499] and Verizon has announced that it would be partnering with Apple Music to offer its mobile subscribers six months of Apple's streaming service.[500] In addition, T-Mobile's Music Freedom feature allows subscribers to T-Mobile's Simple Choice plan to stream unlimited music from a host of participating music streaming services while on its network without data charges.

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[489] *See, e.g.,* Citi *GPS: Putting the Band Back Together – Remastering the World of Music, Citi GPS: Global Perspectives and Solutions* (Aug. 2018) at 18, https://privateclientsolutions.citi.com/insights/citi-gps-putting-the-band-back-together/ (Citi GPS). Terrestrial radio broadcasters do pay copyright royalties to songwriters, however, which is separate from the copyright in the sound recording.

[490] *See, e.g., id;* Dana A. Scherer, *Money for Something: Music Licensing in the 21st Century*, Congressional Research Service (June 7, 2018), at 22, https://crsreports.congress.gov/product/pdf/R/R43984.

[491] *See id.* at 22-23.

[492] Citi GPS at 18.

[493] *Id.* at 1.

[494] *Id.*

[495] Peter Leitzinger, *Economics of Internet: New Kagan Report: Economics of Internet Music and Radio 2018*, S&P Global (Apr. 25, 2018), at 1. In 2017, prior to the CRB ruling, total content costs represented 10.5% of revenue and 20.0% of total content costs for on-demand streaming services. *Id.*

[496] Eli Blumenthal, *T-Mobile adds free Pandora Plus subscription as latest wireless perk*, USA Today (Aug. 16, 2018), https://www.usatoday.com/story/money/2018/08/16/t-mobile-free-pandora-plus-subscription/1006857002/ (Blumenthal).

[497] Hugh McIntyre, *Sprint Takes 33% Stake in Jay-Z's Tidal for $200M*, Forbes (Jan. 23, 2017), https://www.forbes.com/sites/hughmcintyre/2017/01/23/jay-zs-tidal-has-been-partially-acquired-by-sprint/#3b83d8482144.

[498] Sprint, TIDAL X Sprint, http://sprint.tidal.com/us.

[499] Blumenthal.

[500] *Id.*

165. In terms of partnerships with manufacturers, one unique aspect of SiriusXM's marketplace position is that the service comes as a standard (or factory/dealer-installed) option with every major automaker,[501] and car dealerships have long offered free trials or free year-long subscriptions when customers buy a satellite-equipped new or pre-owned vehicle.[502] More recently, Spotify has partnered with electronics manufacturer Samsung to integrate Spotify into Galaxy phones, tablets and watches, as well as Samsung's smart refrigerators, smart TVs, Galaxy Home smart speaker, and Bixby digital assistant.[503] Smart speakers have begun to emerge as an important focus for audio marketplace participants, as smart speaker owners tend to listen to more audio than they did prior to becoming smart speaker owners.[504]

166. *Mergers and Acquisitions.* In September 2018, satellite radio provider SiriusXM announced plans to acquire digital audio streaming company Pandora in an all-stock deal worth $3.5 billion.[505] According to some observers, the acquisition could offer the combined company key benefits including: (1) an online, streaming presence for SiriusXM as vehicles become increasingly digitized, (2) the largest digital audio advertising offering currently available, (3) access to Pandora's 71.4 million monthly access users, and (4) the ability to invest in new products, such as seamless listening from vehicle to phone, placement of Pandora's content on SiriusXM's satellite system, or adding SiriusXM's content to Pandora's offerings.[506]

5. Marketplace Factors Relevant to Entry, Competition, and Expansion

167. Terrestrial radio broadcasters, satellite radio, and Online Audio Providers all face marketplace barriers that affect entry and competition in the audio marketplace. As with most businesses involving the creation and distribution of entertainment programming to consumers, entry into the audio marketplace typically requires significant capital. For example, given that entry in the terrestrial broadcast radio industry occurs primarily via acquisition of existing licensees, new market entrants must have the ability to acquire a license (or multiple licenses) on the secondary market, which, along with operational expenses, can be a significant barrier to entry.[507] Even more restrictive than terrestrial broadcasting, currently, there is only one satellite radio provider, and no additional spectrum is currently allocated for new SDARS entrants.[508] To enter the marketplace as an Online Audio Provider, an entity must have access to necessary delivery infrastructure and must develop and maintain apps or other mechanisms for delivery of content to consumers. In the current marketplace, such entry may be challenging given the multiplicity of streaming options available to consumers and the fact that many incumbent providers have strategic partnerships with wireless service providers, video providers, or

[501] NAB Comments at 11.

[502] Nicole Lyn Pesce, *These companies are now offering free Netflix, Hulu, Spotify and more*, Moneyish (Sept. 11, 2017), https://moneyish.com/upgrade/these-companies-are-now-offering-free-netflix-hulu-spotify-and-more/.

[503] Eli Blumenthal, *Spotify stock pops after company links up with Samsung to take on Apple, Amazon and Google*, USA Today (Aug. 9, 2018), https://www.usatoday.com/story/money/2018/08/09/spotify-and-samsung-partner-up-take-apple-amazon-and-google/949470002/.

[504] *See* Miller at 18.

[505] *See* Richard Windsor, *Sirius XM Paying Cash Would Open Pandora's Box*, Forbes (Sept. 24, 2018), https://www.forbes.com/sites/richardwindsoreurope/2018/09/24/sirius-xm-paying-cash-would-open-pandoras-box/#22453fe24453.

[506] *Id.*

[507] *See supra* para. 148.

[508] *See supra* para. 151.

particular consumer devices. Finally, satellite radio and Online Audio Providers must contend with content costs that terrestrial radio does not due to its unique music licensing status.[509]

168. Consumers must use devices to receive content from audio marketplace participants. The radios necessary to receive the signals of terrestrial radio broadcasters are ubiquitous in the marketplace, as are computers, smartphones, and other devices needed to receive online audio content. As discussed above, audio marketplace participants continue to work with equipment manufacturers and other parties to make their content accessible on multiple devices.[510]

D. The Fixed Broadband Market

169. We next assess the state of competition in the fixed broadband market. We will first examine the various fixed technologies that Internet service providers currently deploy and how some technologies have begun to merge in the face of competition from other services. In addition, we will describe findings from the latest Measuring Broadband America reports, which provide a snapshot of fixed broadband Internet access service performance in the United States. We will then present data, based on the Commission's December 2017 FCC Form 477 data collection, on fixed broadband competition in the United States.

170. Internet service providers continue to invest in their networks to improve the quality and availability of their services, typically in competition with each other.[511] Further, as we have identified previously, our data understate the benefits that come from competition because: (1) fixed Internet service providers have strong incentives, even when facing a single competitor, to capture customers or induce greater use of their networks; and (2) competitive pressures often have spillover effects across a given provider, meaning an Internet service provider facing competition broadly, if not universally, will tend to treat customers that do not have a competitive choice as if they do.[512] Based on Internet service providers' incentives to invest and our actions to facilitate broadband deployment, we are optimistic that Internet service providers will continue to close the digital divide and give more Americans the benefits of fixed broadband competition.

1. Overview of the Fixed Broadband Communications Marketplace

171. The RAY BAUM'S Act directs the Commission to consider "all forms of competition"[513] in its competition assessment, "including the effect of intermodal competition, facilities-based competition, and competition from new and emergent communications services."[514] While some commenters advocate in favor of the Commission's competition analysis including both fixed and mobile broadband,[515] this Chapter will focus only on the state of competition for fixed broadband services.

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[509] *See supra* para. 162; musicFIRST Coalition and the Future of Music Coalition Comments at 26.

[510] *See supra* paras. 163-164.

[511] *See Restoring Internet Freedom*, WC Docket No. 17-108, Declaratory Ruling, Order, Report and Order, 33 FCC Rcd 311, 385, para. 126-27 (2018) (*Restoring Internet Freedom Order*).

[512] *Restoring Internet Freedom Order*, 33 FCC Rcd at 383-85, paras. 126-27.

[513] 47 U.S.C. § 163(d)(1).

[514] *Id*.

[515] *See, e.g.*, USTelecom Comments, GN Docket No. 18-231, at 6 (Aug. 17, 2018) (USTelecom Fixed Competition Comments); Verizon Comments, GN Docket No. 18-231, at 3-4 (Aug. 17, 2018) (Verizon Fixed Competition Comments); NCTA Comments, GN Docket No. 18-231, at 6 (Aug. 17, 2018) (NCTA Fixed Competition Comments); *cf.* American Cable Association (ACA) Comments, GN Docket No. 18-231, at 2-3 (Aug. 17, 2018) (ACA Fixed Competition Comments) (stating that mobile service is "increasingly being viewed by consumers in markets served by smaller providers as a substitute for fixed service . . . it [is] necessary for any fixed broadband competition analysis to take into account future trends and the possible emergence of new sources of competition not foreseen today"). Other commenters contend that fixed and mobile broadband should not be viewed as

(continued….)

Mobile competition is evaluated in a separate Chapter of this Report.[516] This Chapter makes no finding with respect to whether fixed and mobile broadband services are competitive substitutes. In February, the *2018 Broadband Deployment Report* found that there are "salient differences between the two technologies" and that mobile services are not "currently full substitutes for fixed services."[517]

a. Technologies Deployed

172. Today, consumers can access the Internet through many types of fixed technologies, including fiber to the end user, cable broadband services, digital subscriber lines (DSL), fixed wireless, and satellite. Each service differs in function, speed, and cost of deployment. In the current broadband marketplace, to compete with the technological advancements of other services, providers are continually investing in network upgrades.[518] To provide context on the state of broadband competition today, we review several common types of service, including the technology used, speed, latency,[519] cost of deployment, and other unique characteristics.

173. *Fiber optics.* Some Internet service providers provide broadband services entirely over optical fiber, or over a combination of optical fiber and other transmission technology such as copper wire or coaxial cable.[520] Fiber-to-the-premises (FTTP),[521] uses optical fiber to deliver a communications signal

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competitors. *See, e.g.*, Common Cause, Public Knowledge, Center for Rural Strategies, & The Benton Foundation Comments, GN Docket No. 18-231, at 2-5 (Aug. 17, 2018) (Common Cause et al. Fixed Competition Comments); INCOMPAS Comments, GN Docket No. 18-231, at 6 (Aug. 17, 2018) (INCOMPAS Fixed Competition Comments); New America Comments, GN Docket No. 18-238, at 20 (Sept. 17, 2018) (New America Fixed Competition Comments).

[516] *See supra* section II.A.

[517] *2018 Broadband Deployment Report*, 33 FCC Rcd at 1666, para. 18; *see also* Common Cause et al. Fixed Competition Comments at 2 ("[M]obile broadband services typically come with data caps where the mobile network operator places a limit on the amount of data a customer can use over their internet connection. . . . mak[ing] it difficult for consumers to continuously use data-intensive applications like video streaming or video conferencing on a mobile connection as compared to a fixed connection where large amounts of data usage are generally permitted. Other key character differences between fixed and mobile broadband include pricing models, variability of speed, and reliability."); INCOMPAS Fixed Competition Comments at 6; New America Fixed Competition Comments at 20 ("Mobile wireless Internet service providers operate in a separate market from fixed Internet service providers and the distant prospect of 5G is unlikely to change that reality."). In the most recent Broadband Deployment Report Notice of Inquiry, the Commission sought comment on "whether and to what extent fixed and mobile services of similar functionality are substitutes for each other." *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 18-238, Fourteenth Broadband Deployment Report Notice of Inquiry, FCC 18-119, para. 11 (Aug. 9, 2018) (*Fourteenth Notice*).

[518] The lines between the services we describe below are not rigid. For instance, fiber-to-the-curb (FTTC) and hybrid fiber/coaxial use a mix of fiber and legacy copper wire or coaxial cable to provide service. As carriers deploy 5G technology, Internet service providers may combine wireline backhaul and 5G fixed wireless access last-mile connections to offer high-speed services at reduced costs. *See Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket No. 17-79, Declaratory Ruling and Third Report and Order, FCC 18-133, 2, 9, paras. 2, 24 (Sept. 27, 2018) (*Wireless Infrastructure Third Report and Order)*; *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Third Report and Order and Declaratory Ruling, FCC 18-111, para. 2 (Aug 3, 2018). Some fixed carriers may also rely on satellite backhaul. *See, e.g.*, *Connect America Fund; Universal Service Reform—Mobility Fund; Connect America Fund—Alaska Plan*, Report and Order and Further Notice of Proposed Rulemaking, WC Docket Nos. 10-90 and 16-271, WT Docket No. 10-208, 31 FCC Rcd 10139, 10147, para. 24.

[519] Latency refers to the time it takes for a data packet to travel back and forth through a network.

[520] Electronic Frontier Foundation (EFF) Comments, GN Docket No. 18-231, at 3 (Aug. 17, 2018) (EFF Fixed Competition Comments).

from the operator's switching equipment to a home or business.[522] FTTP has the potential to offer higher speeds than other broadband technologies, such as cable broadband service[523] or DSL, as it "can carry high bandwidth signals over long distances without degradation."[524] An all-fiber network allows providers to offer end-users equal upload and download speeds (i.e., symmetrical service), "as well as high-quality voice and video services."[525] In contrast, other technologies allocate greater capacity to download speeds than upload speeds to reflect typical consumer use. According to the *Eighth Measuring Broadband America Fixed Broadband Report* (Eighth MBA Report),[526] as of September 2017, for participating Internet service providers using fiber technology,[527] (1) the maximum advertised download speeds among the service tiers measured in the report range from 100 to 150 Mbps;[528] (2) the median

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[521] *Id.* FTTP is also sometimes referred to as fiber-to-the-home (FTTH). *See Differences between FTTH, FTTC, and FTTN*. AT&T High-Speed Internet & Resource Directory, https://www.attinternetservice.com/resources/different-types-fiber/.

[522] Dan Mahoney and Greg Rafert, Broadband Competition Helps to Drive Lower Prices and Faster Download Speeds for U.S. Residential Consumers, 3 (Nov. 2016), http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/broadband_competition_report_november_2016.pdf (Mahoney and Rafert).

[523] Cable companies, such as Xfinity Comcast, Charter and CenturyLink, currently use both FTTP and FTTC technology to serve some customers. *See* Laurel Ridge Comments, GN Docket No. 18-231, at 2 (Aug. 17, 2018); Charter Spectrum Availability Map, https://broadbandnow.com/Charter-Communications; Sean Buckley, *Century Link says G.Fast is a non-disruptive means to enhance Ethernet delivery, upgrade existing FTTC sites*, FierceTelecom (Sept. 14, 2016), https://www.fiercetelecom.com/installer/centurylink-says-g-fast-a-non-disruptive-means-to-enhance-ethernet-delivery-upgrade; TV, Internet and Voice Connection Types for Your Xfinity Service, https://www.xfinity.com/support/articles/identifying-video-connection-types; Letter from Brian Hurley, Vice President of Regulatory Affairs, ACA, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-231 et al., at 3 (filed Dec. 4, 2018) (ACA Dec. 4, 2018 *Ex Parte* Letter).

[524] Building Fiber-to-the-Home Communities Together, FTTH Council, 1, https://www.jaxenergy.com/broadband/faq/downloads/FTTHQ&A.pdf; *see also* Mahoney at Rafert at 3-4. Cable and DSL rely on copper wire to deliver signals, which can carry high bandwidth only for a few hundred yards until the signal begins to degrade. Building Fiber-to-the-Home Communities Together, FTTH Council, 1, https://www.jaxenergy.com/broadband/faq/downloads/FTTHQ&A.pdf.

[525] Verizon Fixed Competition Comments at 6.

[526] *Eighth Measuring Broadband America Fixed Broadband Report*, OET (2018) (Eighth MBA Report) (attached as Appendix F-2). The Measuring Broadband America (MBA) program is a rigorous, ongoing nationwide study of consumer broadband performance that relies upon a sample of more than 4,000 actual broadband subscribers spread across different fixed Internet service providers serving over 80% of the residential marketplace, and across different technologies, subscription speeds, and geographic regions. *Id*. at 6. The Seventh and Eighth MBA Reports contain validated data collected in September 2016 and September 2017, respectively, from fourteen Internet service providers. *Id*.; *Seventh Measuring Broadband America Fixed Broadband Report*, OET, 6 (Seventh MBA Report) (attached as Appendix F-1). The maximum advertised download speeds among the service tiers measured in the reports ranged between 3 and 200 Mbps. Seventh MBA Report at 6; Eighth MBA Report at 6. Among the key findings of the Seventh and Eighth MBA Reports are that (1) the median download speeds experienced by subscribers of participating providers was 57 Mbps as of September 2016 and 72 Mbps as of September 2017; and (2) for the majority of the providers that were tested, measured download speeds were 100% or better of advertised speeds during peak usage periods (i.e., 7 to 11 pm local time). *Id*.

[527] Participation in the program by Internet service providers is voluntary. For purposes of satisfying the Commission's transparency requirements that apply to Internet service providers, fixed providers that choose to participate in the MBA program may disclose their results as a sufficient representation of the actual performance their customers can expect to experience. *Restoring Internet Freedom Order*, 33 FCC Rcd at 441 n.818.

[528] Eighth MBA Report at 11.

download speed experienced by their subscribers is 73 Mbps;[529] and (3) approximately 60% of subscribers experience median download speeds exceeding the advertised download speed.[530] The Eighth MBA Report also found that, as of September 2017, participating fiber providers demonstrate the lowest median latencies in comparison to cable and DSL providers, ranging from 12 milliseconds (ms) to 20 ms.[531] Another advantage of using fiber is that Internet service providers can generally upgrade fiber networks to higher speeds, or in other ways, less expensively than other broadband services that require new infrastructure.[532]

174. *Cable broadband services.* Cable broadband services use infrastructure that was initially deployed for cable television to deliver high-speed broadband service.[533] Through the use of coaxial cables that deliver cable TV programming and Internet service on separate channels (or frequencies), users can access the Internet without disrupting the cable TV service.[534] Today, most cable systems rely on hybrid fiber-coaxial (HFC) technology that uses fiber connections to send signals from the operator's facility to an optical node near the customer's premises.[535] Yet cable providers are increasingly deploying FTTP networks that use fiber to connect directly to subscriber premises.[536] Instead, they use coaxial cable to send the signal to cover the remaining distance from the node to the customer's premises.[537] According to NCTA, propelled by a competitive landscape, cable operators have invested "over $50 billion in the last three years alone and by the end of 2018 are expected to offer gigabit services reaching 70 to 75% of American households."[538] Indeed, cable providers are steadily upgrading their networks to provide high speed broadband service to a larger percentage of customers.[539] The newest technological standard for

[529] *Id.* at 25.

[530] *Id.* at 30.

[531] *Id.* at 17.

[532] EFF Fixed Competition Comments at 5.

[533] Mahoney and Rafert at 3; *see also Applications Filed by Altice N.V. and Cable Vision Systems Corporation to Transfer Control of Authorizations from Cablevision Systems Corporation to Altice N.V.*, WC Docket No. 15-257, 4380, para. 33 (May 3, 2016) ("Cable modems connect consumer equipment to the broadband Internet access service offered by cable operators.").

[534] David N. Beede, Economist, Office of the Chief Economist, Competition Among U.S. Broadband Service Providers, U.S. Dept. of Commerce, 12, Technical Appx., Tbl. 3 (Dec. 2014), https://www.commerce.gov/sites/default/files/migrated/reports/competition-among-us-broadband-service-providers.pdf (Beede).

[535] *The State of the Art and Evolution of Cable Television and Broadband Technology*, Columbia Telecommunications Corporation, 4 (prepared for Public Knowledge, Nov. 2014), https://ecfsapi.fcc.gov/file/60000983290.pdf.

[536] ACA Dec. 4, 2018 *Ex Parte* Letter at 3.

[537] *Id.* Some commenters discuss anticipated technological advancements with the deployment of 5G networks. *See* ADTRAN Comments, GN Docket No. 18-231, at 8 (Aug. 17, 2-18) (ADTRAN Fixed Competition Comments); NCTA Fixed Competition Comments at 9; Verizon Fixed Competition Comments at 8; USTelecom Fixed Competition Comments at 4-5. Given its potential, it is conceivable that 5G technology could also eventually be incorporated into a hybrid service with an existing fixed broadband service. *But see* New America Fixed Competition Comments at 3 (arguing that 5G networks are years away from deployment).

[538] NCTA Fixed Competition Comments at 8.

[539] *See, e.g.*, Thomson Reuters StreetEvents, Edited Transcript: CMCSA – Q1 2018 Comcast Corp Earnings Call, 6 (Apr. 25, 2018), https://www.cmcsa.com/static-files/fdafc0ba-9422- 4659-ac3b-898fdaf1115c (statement by Comcast Corp. Senior EVP & CFO Michael Cavanagh); Charter Communications, Inc. Press Release, Charter Announces Second Quarter 2018 Results (July 31, 2018), https://newsroom.charter.com/press-releases/charter-announces-second-quarter2018-results/ (stating that Charter's DOCSIS 3.1 service is now available to approximately 60% of its footprint); Midco, Midco Gig, https://www.midco.com/services/internet/midco-gig; Cox (continued….)

cable broadband services is Data Over Cable Service Interface Specifications 3.1 ("DOCSIS 3.1"), which offers faster broadband service than older standards, and is capable of achieving upload and download speeds of up to 10 gigabits per second.[540] As of 2017, according to NCTA, the most commonly deployed cable technology is still DOCSIS 3.0, which has the capability of delivering download speeds up to 900 Mbps.[541] According to the Eighth MBA Report, as of September 2017, for participating Internet service providers using cable technology, (1) the maximum advertised download speeds among the service tiers measured in the report are between 100 and 200 Mbps;[542] (2) the median download speed experienced by their subscribers is 97 Mbps;[543] and (3) approximately 80% of subscribers experience median download speeds exceeding the advertised download speed.[544] The Eighth MBA Report also found that, as of September 2017, the median latencies for participating cable-based providers range from 15 ms to 34 ms.[545]

175. *Digital Subscriber Lines (DSL).* DSL, the technology that telephone companies most commonly use to provide high-speed data services,[546] "transmits data over traditional copper telephone lines to homes and businesses (using separate lines to carry voice traffic)," enabling users "to connect to the high-speed Internet via a modem without disruption [of] their telephone service."[547] DSL speeds "depend[] on the distance between the subscriber and the central office."[548] According to the Eighth MBA Report, as of September 2017, for participating DSL providers, (1) the maximum advertised download speeds among the service tiers measured in the report range from 3 to 45 Mbps;[549] (2) the median download speed experienced by their subscribers is 16 Mbps;[550] and (3) 40% of subscribers to DSL-based services experience median download speeds exceeding the advertised download speed.[551] The majority of DSL service used primarily by residential consumers is asymmetric (i.e., download speeds are greater than upload speeds).[552] Symmetric DSL, on the other hand, is typically used by

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Communications, Inc. Press Release, Cox Expands Gigabit Speeds at Rapid Pace (Jan. 9, 2018), http://newsroom.cox.com/2018-01-09-Cox-Expands-Gigabit-Speeds-atRapid-Pace (asserting Cox offers gigabit service to 40% of its footprint with plans to expand).

[540] *See* Verizon Fixed Competition Comments at 5; USTelecom Fixed Competition Comments at Exh. B (Patrick Brogan, VP of Industry Analysis, U.S. Broadband Availability Year-End 2016, 7 (Feb. 22, 2018)) at 16. According to NCTA, an update to the DOCSIS 3.1 technology, Full Duplex DOCSIS 3.1, "enables up to 10 gigabits for both download and upload speeds." The Near Future Becomes Closer with New Cable Broadband Technology, NCTA (Oct. 18, 2017), https://www.ncta.com/whats-new/the-near-future-becomes-closer-with-new-cable-broadband-technology. The previous version of the DOCSIS 3.1 allowed for download speeds of up to 10 gigabits, but upload speeds of only up to 1 gigabit for uploads and downloads. *Id.*

[541] How Cable Networks Deliver Ultra-Fast Internet, NCTA (Apr. 5, 2017), https://www.ncta.com/how-cable-networks-deliver-ultra-fast-internet.

[542] Eighth MBA Report at 11.

[543] *Id.* at 25.

[544] *Id.* at 30.

[545] *Id.* at 17.

[546] Beede at 12, Technical Appx., Tbl. 3.

[547] *Id.*

[548] Eighth MBA Report at 30.

[549] *Id.* at 11.

[550] *Id.* at 25.

[551] *Id.* at 30.

[552] Bradley Mitchell, What Are the Different Types of DSL Technology, Lifewire (May 10, 2018), https://www.lifewire.com/different-types-of-dsl-technology-817522; *see also* Beede at 12, Technical Appx., Tbl. 3.

businesses that move large data files, and provides equal bandwidth for uploading and downloading data.[553] The costs of providing, and hence the prices for, symmetric DSL services are considerably higher—generally prohibitively so for mass marketing of the service—than costs and prices of providing asymmetric DSL.[554]

176. Fiber-to-the-node or neighborhood (FTTN), offered by Internet service providers such as AT&T, is a short-loop DSL service relying on fiber-optic connections from a local central office into a neighborhood, and twisted-pair copper wiring (traditional telephone lines) to cover the remaining distance to the home.[555] Fiber-to-the-curb (FTTC) uses fiber to send signals to and from a mounted communications device, often located on a utility pole, and then employs twisted-pair copper to transmit the signal from the pole or other location to a home.[556] FTTP has the potential for the highest speeds but is the most expensive to install, while FTTN and FTTC deliver broadband at a lower cost because both technologies rely on pre-existing copper networks.[557] With the existence of a copper network, FTTN is the least expensive of the three alternatives, followed by FTTC then FTTP when the sunk costs of the existing copper network are not counted.

177. *Terrestrial Fixed Wireless Broadband Technology.* Fixed wireless providers deliver broadband service to consumers in fixed wireless locations, including residences and businesses, primarily using wireless spectrum technology for the end connection to users while often relying on fiber optics to form parts of the rest of their network infrastructure.[558] Providers deliver services using a combination of licensed spectrum, shared access spectrum, and unlicensed spectrum.[559] According to WISPA, fixed wireless broadband technology is defined by its "low start-up costs" and "ability to quickly deploy affordable high-speed broadband at a low cost, particularly in geographically challenging areas and for low density populations" not typically serviced by traditional broadband providers.[560] Currently, fixed wireless providers primarily serve "rural and suburban markets where fiber and cable deployment is not cost-effective."[561] Typically, a fixed wireless provider receives broadband content "from an external distribution point via fiber or microwave connections," then wireless transmitters on towers that are connected by licensed or unlicensed spectrum deliver the signals to the customer's fixed antennas.[562]

[553] Beede at 12, Technical Appx., Tbl. 3.

[554] *See id.*

[555] *See Differences between FTTH, FTTC, and FTTN.* AT&T High-Speed Internet & Resource Directory, https://www.attinternetservice.com/resources/different-types-fiber/. This remaining distance is sometimes referred to as the "last mile." *Id.*

[556] *See id.*

[557] *See id.*

[558] WISPA Comments, GN Docket No. 18-231, at Attach. at 5 (Aug. 17, 2018) (WISPA Fixed Competition Comments).

[559] *Id.*

[560] *Id.* at 2-3. According to WISPA, "[wireless internet service providers] can deploy fixed wireless broadband to residential consumers at about one-seventh of the capital cost of FTTH and about one-fourth of the capital cost of cable." *Id.* at 6, at Attach. at 12.

[561] *Id.* at Attach. at 6.

[562] *Id.* at Attach. at 7. Unlicensed fixed wireless, such as WiFi and Worldwide Interoperability for Microwave Access (WiMAX) uses spectrum shared among Internet service providers to provide broadband service to a specific geographic area. *See* Beede at 12, Technical Appx., Tbl. 3. It requires an unimpeded line of line for transmission of data. *Id.* Licensed fixed wireless is similar to unlicensed except that it uses spectrum licensed to the Internet service provider. *Id.*

WISPA reports that typical download speeds are in the range of 5 to 50 Mbps, but that speeds can reach up to 1 Gbps.[563]

178. *Satellite Services*. Today, satellite providers deliver broadband service to consumers through geostationary satellites (GSO) that operate at approximately 22,300 miles above the Earth, and appear to be fixed above a particular point on the Earth.[564] GSO satellite broadband operators, namely ViaSat and Hughes, provide satellite broadband services to consumers in the United States through the use of satellite constellations in authorized spectrum for fixed satellite service.[565] According to SIA, satellite operators "began broadly providing users across the United States" with services at the Commission's fixed speed advanced telecommunications capability benchmark of 25 Mbps/3 Mbps.[566] In February 2018, ViaSat announced that it now offers unlimited data plans with speeds up to 100 Mbps through its new ViaSat-2 satellite system.[567] ViaSat expects to launch beginning in 2020 the ViaSat-3 system, which is a trio of Ka-band satellites that will "provide unprecedented capabilities in terms of service speed and flexibility for a satellite platform" and are "expected to deliver more than 1-Terabit per second of network capacity."[568] In August 2017, Hughes announced it will launch Jupiter 3/EchoStar XXIV in early 2021 that will deliver greater capacity and broadband at higher speeds, including broadband services of 100 Mbps download speeds or more in parts of the United States.[569] In 2017 and 2018, the Commission approved a number of non-geostationary orbit (NGSO) satellite systems[570] for launch and operation or market access that plan to provide high-throughput, lower-latency[571] broadband

[563] WISPA Fixed Competition Comments at 2, Attach. at 5.

[564] *Third Report and Analysis of Competitive Market Conditions with Respect to Domestic and International Satellite Communications Services; Report and Analysis of Competitive Market Conditions with Respect to Domestic and International Satellite Communications Services*, Third Report, 26 FCC Rcd 17284, 17288, para. 8, n.9 (2011) (*Third Satellite Competition Report*).

[565] *See* EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC Comments, GN Docket No. 18-231, at 2 (Aug. 17, 2018) (EchoStar and Hughes Fixed Competition Comments). For example, Hughes provides broadband service through the use of a three-satellite, Ka-band constellation over the United States. *Id.* ViaSat and Hughes are the only operators that provide satellite broadband service directly to consumer end users.

[566] Satellite Industry Association (SIA) Comments, GN Docket No. 18-231, at 1-2 (Aug. 17, 2018) (SIA Fixed Competition Comments). In 2016, ViaSat began providing 25 Mbps /3 Mbps broadband service in the United States. *Id.* at 2, n.3. Hughes launched 25 Mbps/3 Mbps broadband services "across the continental United States and southeastern Alaska in March 2017, Puerto Rico in July 2017, and the U.S. Virgin Islands in November 2017." *Id.*; EchoStar and Hughes Fixed Competition Comments at 3.

[567] ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide.

[568] ViaSat, *Viasat, Boeing Enter Next Phase of ViaSat-3 Satellite Integration* (Aug. 30, 2018), https://www.viasat.com/news/viasat-boeing-enter-next-phase-viasat-3-satellite-integration.

[569] Hughes, *Hughes Selects Space Systems Loral to Build Next-Generation Ultra High Density Satellite* (Aug. 9, 2017), https://www.echostar.com/en/Press/Newsandmedia/Hughes%20Selects%20Space%20Systems%20Loral%20To%20Build%20Next-Generation%20Ultra%20High%20Density%20Satellite.aspx; EchoStar and Hughes Fixed Competition Comments at 2; SIA Fixed Competition Comments at 2.

[570] Non-geostationary orbits include a number of orbital configurations. Medium-earth orbits (MEO) range from 6,000 to 12,000 miles above the Earth and circle the Earth in five to 12 hours. Howard Hausman, Fundamentals of Satellite Communications, Part 1, at 23 (2008), https://www.ieee.li/pdf/viewgraphs/fundamentals_satellite_communication_part-1.pdf (*Fundamentals*). Low-earth orbits (LEO) range from 100 to 300 miles above the Earth and circle the Earth approximately every 90 minutes. *Id.* at 25.

[571] In this context, lower latency times may be 100 milliseconds or less round trip.

services than currently offered by GSO satellite services, including to remote or rural areas, using a new generation of medium-Earth or low-Earth orbit satellite technologies.[572]

b. Intermodal Competition Among Fixed Broadband Services

179. We next evaluate competition between fixed broadband providers that rely on different types of transmission technology. Today, most fixed broadband services include fiber, cable, and DSL, each occupying a different percentage of the market and offering varying download speeds and latencies to consumers. Fixed wireless and satellite broadband providers have lower market shares, but can be important sources of broadband for consumers in rural and suburban areas.

180. According to the Commission's December 2017 Form 477 subscriber data, cable providers hold 62% of the overall residential fixed broadband market in the United States, and 79% of all residential subscribers with speeds of at least 25 Mbps/3 Mbps.[573] Companies offering DSL or FTTP (generally telephone companies) have 35% of the overall residential fixed broadband market in the United States and 20% of all residential subscribers with speeds of at least 25 Mbps/3 Mbps.[574] Satellite, fixed wireless, and other technologies make up 3% of the overall residential fixed broadband market in the United States with 1% of all residential subscribers with speeds of at least 25 Mbps/3 Mbps.[575] December 2017 Form 477 data also indicates that 89% of Americans in the United States reside in areas where DSL is deployed, 89% live in areas where cable broadband is deployed, and 40% live in areas where fiber broadband is deployed.[576]

181. According to a 2016 survey of WISPA members, "76.7% . . . reported serving 2,000 or fewer residential consumers, [] more than 56% reported having 1,000 or fewer residential customers," and over 75% serve primarily rural areas.[577] As demonstrated by this survey, fixed wireless providers are more likely to serve rural and suburban markets when other fixed Internet services such as cable and fiber

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[572] *See, e.g.*, *Space Exploration Holdings, LLC; Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System; Application For Approval For Orbital Deployment And Operating Authority for the SpaceX NGSO Satellite System Supplement*, Memorandum Opinion, Order and Authorization, 33 FCC Rcd 3391 (2018) (*SpaceX Authorization Order*); *WorldVu Satellites Limited; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017) (*WorldVu Order and Declaratory Ruling*); *Space Norway AS; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission*, Order and Declaratory Ruling, 32 FCC Rcd 9649 (2017) (*Space Norway AS Order and Declaratory Ruling*); *Telesat Canada; Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation*, Order and Declaratory Ruling, 32 FCC Rcd 9663 (2017) (*2017 Telesat Canada Order and Declaratory Ruling*); *Karousel Satellite LLC; Application for Authority to Launch and Operate a Non-Geostationary Earth Orbit Satellite System in the Fixed Satellite Service*, Memorandum Opinion, Order and Authorization, FCC 18-125 (rel. Aug. 16, 2018), 2018 WL 3955599 (*Karousel Authorization Order*); *Telesat Canada; Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-Band NGSO Constellation*, Order and Declaratory Ruling, FCC 18-163 (rel. Nov. 19, 2018), 2018 WL 6075370 (*Telesat Canada V-band NGSO Order and Declaratory Ruling*); *LeoSat MA, Inc.; Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System*, Order and Declaratory Ruling, FCC 18-164 (rel. Nov. 19, 2018), 2018 WL 6075371 (*LeoSat Order and Declaratory Ruling*); *Space Exploration Holdings LLC*; *Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System*, Memorandum Opinion, Order and Authorization, FCC 18-161 (rel. Nov. 19, 2018), 2018 WL 6075368 (*SpaceX V-band NGSO Authorization Order*).

[573] FCC Form 477 subscriber data, as of December 31, 2017.

[574] *Id.*

[575] *Id.*

[576] *Id.*

[577] WISPA Fixed Competition Comments at 10.

are less effective.[578] However, with wireless technology advancements producing improving speeds that "are approaching cable and ultimately will catch up to fiber," fixed wireless service may over time become a more attractive option for more consumers.[579]

182. With the deployment of new high-throughput satellites in 2017 and 2018, satellite broadband providers can play an increasingly important role in helping close the digital divide across the United States, especially in the most rural and remote areas of the country, where it may be uneconomical to build terrestrial networks.[580] According to SIA, satellite broadband providers serve approximately 2 million subscribers in the United States at rates and speeds that meet and surpass the Commission's 25 Mbps/3 Mbps fixed speed benchmark for advanced telecommunications capability.[581] The recent launches and commencement of service of the high throughput satellites Jupiter 2/EchoStar XIX and ViaSat-2 in the last two years by Hughes and ViaSat, respectively, have further increased 25 Mbps/3 Mbps satellite offerings.[582] Both Hughes and ViaSat have been awarded funding to serve remote areas through the CAF II auction process.[583] The planned launches of next-generation GSO satellites Jupiter 3/EchoStar XXIV and ViaSat-3, and proposed low latency NGSO satellite constellations, may result in higher-speed satellite broadband offerings in the future.

2. Fixed Broadband Competition Data

183. We provide an overall assessment of the number of fixed broadband provider options deployed to consumers using Form 477 deployment data at five minimum speed thresholds—10 Mbps/1 Mbps, 25 Mbps/3 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps. Using this data

[578] *Id.* at Attach. at 6. Currently, over 2,000 fixed wireless providers deliver services to approximately four million customers and "each state has at least one fixed wireless provider," with the largest concentrations of providers located in the Midwest, Northwest, Southwest, and central and northern California. *Id.* Fixed wireless providers are typically small and medium-sized businesses that "serve an average of 1,200 customers" in the United States. *Id.*

[579] *Id.* at Attach. at 12, Fig. 6. In fact, "Google, AT&T, Verizon, Windstream, and other carriers have recently announced plans to deploy more fixed wireless, generally as an extension of their wired services." *Id.* at 16.

[580] *See* SIA Fixed Competition Comments at 2.

[581] *Id.* As of June 30, 2018, ViaSat had approximately 577,000 fixed broadband subscribers in the United States. ViaSat, *Viasat Announces First Quarter Fiscal Year 2019 Results* (Aug. 9, 2018), https://www.viasat.com/news/viasat-announces-first-quarter-fiscal-year-2019-results.

[582] *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51; EchoStar Corporation, Form 10-K (For the fiscal year ended December 31, 2017) at 8 (*EchoStar Form 10-K*), http://ir.echostar.com/static-files/d98e3836-bb15-4957-b05d-2743be5f110f; ViaSat, Inc., Form 10-K (For the fiscal year ended March 31, 2018) at 3 (*ViaSat Form 10-K*), http://investors.viasat.com/static-files/e75b82fb-e7df-4273-8212-984c1fd332fb; ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide.

[583] Hughes was awarded funding to serve 76,873 units in New York state, while ViaSat was a winning bidder in 20 states, potentially serving 190,575 locations. NYS Broadband Program Office, *Phase 3 Awards*, https://nysbroadband.ny.gov/new-ny-broadband-program/phase-3-awards; Press Release, FCC, Connect America Fund Auction to Expand Broadband to Over 700,000 Rural Homes and Businesses (Aug. 28, 2018); *Wireline Competition Bureau Announces FCC Deadlines For New York Broadband Program Winning Bidders*, WC Docket No. 10-90, Public Notice, DA 18-510 (May 18, 2018) at Attachment A (listing Hughes among applicants awarded support through Phase 3 of New York's New NY Broadband Program); *Connect America Fund Phase II Auction (Auction 903) Closes; Winning Bidders Announced; FCC Form 683 Due October 15, 2018*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, DA 18-887 (Aug. 28, 2018) at Attachment A.

and American Community Survey demographic data,[584] we also offer an analysis to provide insight into the demographics of areas that have multiple broadband providers, and those that do not.

a. Data Sources and Methodologies

184. In assessing fixed broadband competition, we rely primarily upon our Form 477 deployment data to evaluate consumers' broadband options for fixed terrestrial services.[585] Consistent with previous findings by the Commission,[586] the Form 477 data are currently the most accurate data available to the Commission for this analysis.[587] The Form 477 deployment data are collected at the census block level.[588] For purposes of this analysis, a whole census block is classified as served if the Form 477 data indicate that service can be provided anywhere in the census block. Therefore, it is not necessarily the case that every household,[589] housing unit, or person will have coverage of a service in a census block that this analysis indicates is served.[590] Furthermore, although staff examine our Form 477 data for quality and consistency, the data may understate or overstate deployment of services to the extent that broadband providers fail to report data or misreport data.[591] Our deployment data for fixed terrestrial

[584] For this analysis we examine population density, the number of households and median household income. We rely upon the American Community Survey Five-Year Estimates 2012-2016 for Median Household Income (in 2016 inflation-adjusted dollars) reported at the census block group level.

[585] On August 3, 2017, the Commission adopted a Further Notice of Proposed Rulemaking seeking comment on ways to improve the quality and accuracy of information collected on Form 477. *See generally Modernizing the FCC Form 477 Data Program*, Further Notice of Proposed Rulemaking, 32 Rcd 6329 (2017) (*Form 477 Modernization FNPRM).*

[586] *2018 Broadband Deployment Report*, 31 FCC Rcd at 1677, para. 43.

[587] The Commission continues to analyze whether, and how the Form 477 data collection might be revised to address concerns about accuracy. *See Modernizing the FCC Form 477 Data*, FNPRM, 32 FCC Rcd, 6329, 6337, paras. 26-27 (2017) (*Form 477 Modernization*). In this report, we use the best data available while recognizing improvements to the data may be needed. We note that our analysis may understate or overstate consumers' options for services to the extent that broadband providers fail to report data or misreport data. *See* FCC, *Explanation of Broadband Deployment Data* (Nov. 20, 2017), https://www.fcc.gov/general/explanation-broadband-deployment-data (describing quality and consistency checks performed on providers' submitted data and explaining any adjustments made to the Form 477 data as filed).

[588] For purposes of this form, fixed broadband connections are available to consumers in a census block if the provider does, or could, within a service interval that is typical for that type of connection—that is, without an extraordinary commitment of resources—provision two-way data transmission to and from the Internet with advertised speeds exceeding 200 kbps in at least one direction to end-user premises in the census block. FCC, FCC Form 477 Local Telephone Competition and Broadband Report Instructions at 17 (2016), https://transition.fcc.gov/form477/477inst.pdf.

[589] A household consists of all the people who occupy a housing unit. A house, an apartment or other group of rooms, or a single room, is regarded as a housing unit when it is occupied or intended for occupancy as separate living quarters; that is, when the occupants do not live with any other persons in the structure and there is direct access from the outside or through a common hall. U.S. Census, Current Population Survey Subject Definitions (Aug. 25, 2018), https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household.

[590] We note that these coverage estimates represent deployment of networks to consumers and do not indicate the extent to which service providers affirmatively offer service to residents in the covered areas. Further, this analysis likely overstates the coverage experienced by some consumers, especially in large or irregularly shaped census blocks. We therefore acknowledge that this analysis may overstate or understate the deployment of fixed and mobile services. *See 2018 Broadband Deployment Report*, 33 FCC Rcd at 1677, para. 43.

[591] *See* FCC, *Explanation of Broadband Deployment Data* (Nov. 20, 2017), https://www.fcc.gov/general/explanation-broadband-deployment-data (describing quality and consistency checks performed on providers' submitted data and explaining any adjustments made to the Form 477 data as filed).

services are evaluated using 2010 census block population data that the Commission staff has updated to account for population growth and economic development.[592]

185. Our analysis examines Form 477 consumer deployment data as of December 31, 2016, and data as of December 31, 2017, for fixed terrestrial broadband provider options with a minimum advertised speed of 10 Mbps/1 Mbps, 25 Mbps/3 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps. Data for the U.S. Territories is reported separately as it may not accurately reflect damage to infrastructure in Puerto Rico and the U.S. Virgin Islands from Hurricanes Maria and Irma.

b. Consumer Fixed Terrestrial Broadband Competition

186. First, we present an evaluation of fixed terrestrial broadband deployment to consumers.[593] Figures D-1 and D-2 report estimates of the percentage of the U.S. population where Form 477 consumer deployment data indicate that zero, one, two, and more than two providers of fixed terrestrial broadband services are deployed as of December 31, 2016 and as of December 31, 2017. Focusing on the population with access to two or more providers, the 2017 data shows that 83% of Americans have at least 2 options for 10 Mbps/1 Mbps fixed terrestrial service, 70% have at least two options for 25 Mbps/3 Mbps fixed terrestrial service, 65% have at least two options for 50 Mbps/5 Mbps service, 55% have at least two options for 100 Mbps/10 Mbps service, and 25% have at least 2 options for 250 Mbps/25 Mbps service.[594] Comparing the data year over year also shows an increase in the service options available for all speed tiers, where, for example, between 2016 and 2017, the percentage of the population with two or more provider options offering 10 Mbps/1 Mbps service increased from 76% to 83%, and percentage of the population with two or more provider options offering 25 Mbps/3 Mbps service increased from 58% to 70%. If we were to include satellite broadband in the analysis below, the Form 477 data indicate that nearly all areas in the country[595] have access to satellite broadband as an alternative for fixed terrestrial broadband service at both the 10 Mbps/1 Mbps and 25 Mbps/3 Mbps levels, but not yet at the higher speeds.[596]

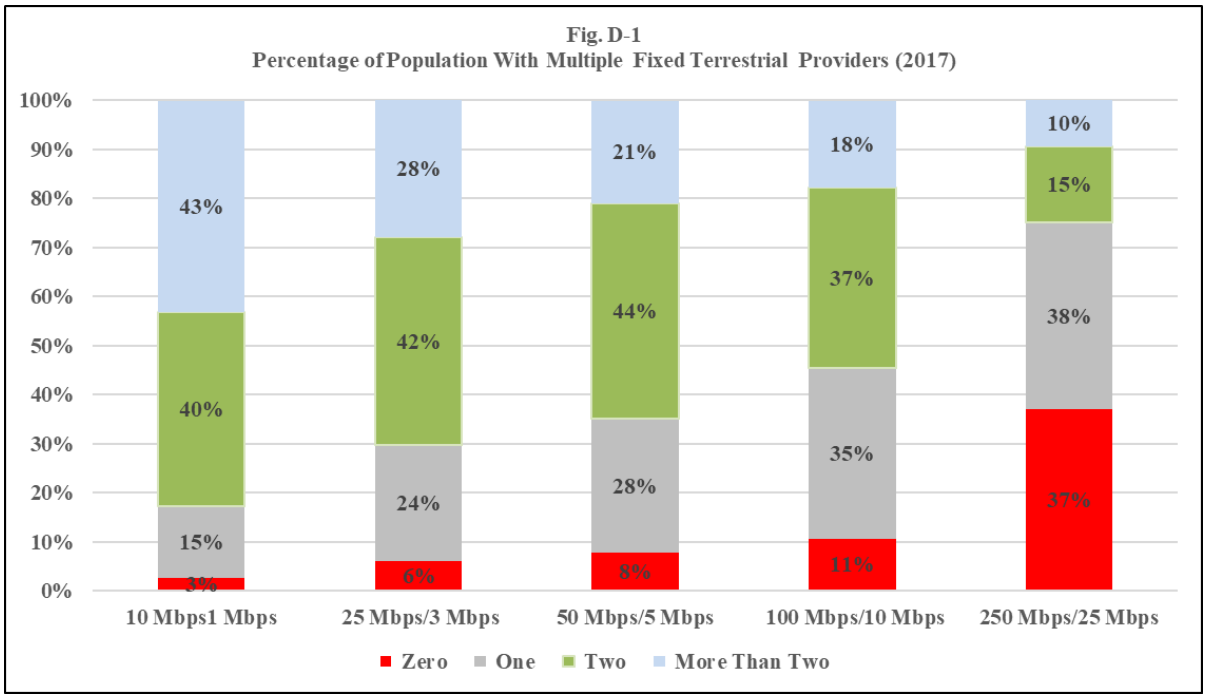
[592] FCC Staff developed population estimates for 2011-2017 by updating the 2010 census block population estimates. These estimates are based upon annual U.S. Census mid-year county (or county-equivalent) level population and housing unit estimates for the fifty states, the District of Columbia, and Puerto Rico. These data are used in conjunction with U.S. Census Bureau Tiger data to indicate new roads, i.e., new housing development, to distribute population amongst the census blocks comprising each county (or county-equivalent). FCC, Staff Block Estimates, https://www.fcc.gov/reports-research/data/staff-block-estimates.

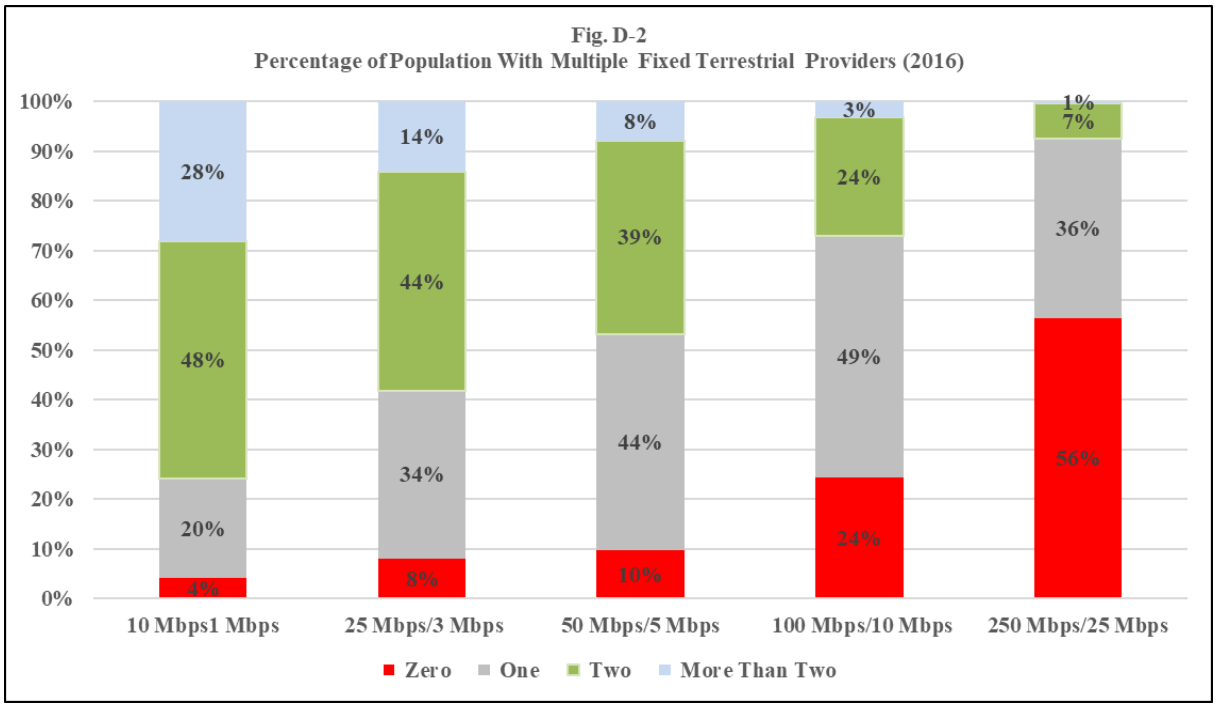
[593] The Form 477 data discussed in this Chapter is exclusively focused on deployment to consumer end users. Throughout this Chapter, percentages provided may not sum to exactly 100 due to rounding.

[594] The percentage of the population with estimated number of fixed terrestrial provider options in a census block equals the population with coverage from the specific number of providers (e.g., zero, one, two, more than two) within the geographic area divided by the total population in census block.

[595] The Form 477 deployment data for satellite broadband indicate that satellite service offering 25 Mbps/3 Mbps speeds is available to all but 0.03% of the population. As we have noted in the past, these data could overstate the availability of satellite services. While satellite signal coverage may enable operators to offer services to wide swaths of the country, overall satellite capacity may limit the number of consumers that can actually subscribe to satellite service at any one time. *See Fourteenth Notice*, FCC 18-119, para. 17, n.46; *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51, n.148.

[596] We note that, more recently than reflected in the Measuring Broadband America Reports, satellite broadband services are being offered at higher speeds. *See* Eighth MBA Report at 11 (noting that the maximum offered download speed tier included in the report for Internet Service Providers using satellite technology is between 12-25 Mbps).





187. We next evaluate the population estimates and the percentage of the population with coverage of multiple fixed terrestrial broadband service providers in rural and urban areas, and on Tribal Lands.[597] Our analysis of the population shows that, in general, more Americans have multiple provider

[597] We separately provide estimates of the percentage of the population with multiple provider options for fixed terrestrial broadband services, for each state and the District of Columbia, as of December 31, 2017. *See infra* Fixed Communications Market Appendices C-1, C-2, C-3, C-4 and C-5. For these figures, we aggregate census blocks within a state by competitor count category, i.e., we group census blocks within each state by the number of

(continued….)

options in 2017 than in 2016 regardless of the speed tier. Figures D-3 and D-4, below, show that for rural areas, there was more than a 12 percentage point increase between 2016 and 2017 for 10 Mbps/1 Mbps service, more than a 14 percentage point increase for 25 Mbps/3 Mbps service, more than a 13 percentage point increase for 50 Mbps/5 Mpbs services, more than a 15 percentage point increase for 100 Mbps/10 Mbps service, and almost an 8 percentage point increase for 250 Mbps/25 Mbps service. In urban areas there was an increase of almost 6 percentage points for 10 Mbps/1 Mbps service, an increase of over 11 percentage points for 25 Mbps/3 Mbps services, an increase of 19 percentage points for 50 Mbps/5 Mbps service, an increase of over 30 percentage points for 100 Mbps/10 Mbps service, and an increase of almost 20 percentage points for 250 Mbps/25 Mbps service. On Tribal lands, the change in the percentage of the population with multiple provider options increased by over 2 percentage points for 10 Mbps/1 Mbps service, increased by almost 5 percentage points for 25 Mbps/3 Mbps service, increased over 7 percentage point for 50 Mbps/5 Mbps service, increased 8 percentage points for 100 Mbps/10 Mbps service, and increased almost 3 percentage points for 250 Mbps/25 Mbps service.[598]

Fig. D-3

Population (Millions) by Provider Options for Fixed Terrestrial Services (As of December 31, 2017)

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
All Areas										
Zero	8.905	2.7%	19.388	6.0%	25.242	7.7%	34.832	10.7%	120.479	37.0%
One	47.149	14.5%	77.197	23.7%	89.665	27.5%	113.079	34.7%	124.157	38.1%
Two	129.139	39.6%	137.957	42.4%	142.683	43.8%	119.689	36.7%	50.250	15.4%
More than Two	140.523	43.1%	91.174	28.0%	68.126	20.9%	58.116	17.8%	30.829	9.5%
Rural Areas										
Zero	6.850	10.7%	15.495	24.3%	19.798	31.0%	24.623	38.6%	39.913	62.6%
One	19.844	31.1%	24.492	38.4%	25.257	39.6%	24.849	39.0%	18.345	28.8%
Two	22.087	34.6%	17.862	28.0%	15.200	23.8%	11.728	18.4%	4.710	7.4%

(Continued from previous page)
competitors in the census block and add then sum the population in these census blocks by competitor count category. The census blocks within a state are aggregated by the number of provider option (zero, one, two, and more than two).

[598] 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); (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.

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
More than Two	15.002	23.5%	5.933	9.3%	3.527	5.5%	2.583	4.0%	0.815	1.3%
Urban Areas										
Zero	2.055	0.8%	3.893	1.5%	5.444	2.1%	10.209	3.9%	80.566	30.8%
One	27.305	10.4%	52.705	20.1%	64.408	24.6%	88.231	33.7%	105.812	40.4%
Two	107.052	40.9%	120.095	45.8%	127.483	48.7%	107.960	41.2%	45.540	17.4%
More than Two	125.520	47.9%	85.240	32.5%	64.599	24.7%	55.533	21.2%	30.014	11.5%
Tribal Lands										
Zero	0.688	17.1%	1.286	32.0%	1.552	38.6%	1.816	45.2%	2.397	59.7%
One	1.406	35.0%	1.450	36.1%	1.674	41.7%	1.724	42.9%	1.465	36.5%
Two	1.232	30.7%	0.846	21.1%	0.725	18.1%	0.435	10.8%	0.156	3.9%
More than Two	0.691	17.2%	0.435	10.8%	0.066	1.7%	0.043	1.1%	0.000	0.0%

Fig. D-4

Population (Millions) by Provider Options for Fixed Terrestrial Services (As of December 31, 2016)

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
All Areas										
Zero	13.410	4.2%	26.146	8.1%	31.139	9.7%	78.222	24.3%	181.723	56.3%
One	64.310	19.9%	108.549	33.7%	140.377	43.5%	156.727	48.6%	116.636	36.2%
Two	153.811	47.7%	141.913	44.0%	125.586	38.9%	76.776	23.8%	22.677	7.0%
More than Two	90.987	28.2%	45.911	14.2%	25.416	7.9%	10.794	3.3%	1.483	0.5%
Rural Areas										
Zero	10.489	16.7%	20.248	32.2%	23.665	37.6%	37.001	58.8%	52.896	84.1%
One	23.516	37.4%	28.226	44.9%	29.411	46.7%	21.421	34.0%	9.401	14.9%
Two	20.261	32.2%	11.938	19.0%	8.743	13.9%	4.088	6.5%	0.605	1.0%
More than Two	8.660	13.8%	2.513	4.0%	1.106	1.8%	0.416	0.7%	0.023	0.0%
Urban Areas										
Zero	2.921	1.1%	5.897	2.3%	7.473	2.9%	41.221	15.9%	128.827	49.6%
One	40.794	15.7%	80.323	30.9%	110.966	42.7%	135.306	52.1%	107.234	41.3%
Two	133.550	51.4%	129.974	50.1%	116.843	45.0%	72.688	28.0%	22.072	8.5%
More than Two	82.328	31.7%	43.398	16.7%	24.310	9.4%	10.378	4.0%	1.460	0.6%
Tribal Lands										

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Zero	0.791	19.8%	1.471	36.9%	1.722	43.1%	2.116	53.0%	2.661	66.7%
One	1.394	34.9%	1.444	36.2%	1.771	44.4%	1.719	43.1%	1.290	32.3%
Two	1.070	26.8%	0.728	18.3%	0.449	11.3%	0.131	3.3%	0.040	1.0%
More than Two	0.737	18.5%	0.348	8.7%	0.050	1.2%	0.025	0.6%	0.000	0.0%

188. Figure D-5 presents an analysis of the Form 477 deployment data for the U.S. Territories as of December 31, 2017. We caution that these data may significantly overstate current deployment in Puerto Rico and the U.S. Virgin Islands given the damage to infrastructure in these areas from Hurricanes Maria and Irma in 2017. We do not compare 2017 data to 2016 data because this may be misleading about any gains in deployment that could have occurred in the U.S. Territories since 2016. The December 31, 2017 data suggest that approximately 77.7% of the population in the U.S. Territories have multiple provider options for 10 Mbps/1 Mbps, 58.3% have multiple provider options for 25 Mbps/3 Mbps and approximately 2.4% have multiple provider options for 50 Mbps/5 Mbps.

Fig. D-5
Population (Millions) by Provider Options for Fixed Terrestrial Services in the U.S. Territories (As of December 31, 2017)

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
All Areas										
Zero	0.273	7.4%	0.524	14.1%	1.451	39.1%	3.525	94.9%	3.525	94.9%
One	0.555	14.9%	1.026	27.6%	2.173	58.5%	0.188	5.1%	0.189	5.1%
Two	0.874	23.5%	1.501	40.4%	0.087	2.3%	0.003	0.1%	0.002	0.0%
More Than Two	2.014	54.2%	0.664	17.9%	0.005	0.1%	0.000	0.0%	0.000	0.0%

189. Figures D-6 to D-10 present a demographic analysis of the average percentage of the population with coverage for the number of provider options and speed tiers by population density quartile, median household income quartile and household count quartile. We observe that the number of provider options increases with the number of households in the census block group, population density and median household income.[599] In general, the census block groups in rural areas will have the lowest population density and the lowest number of households, and are likely to have the largest percentage of the population with zero provider options, i.e., no deployment of the reported service.[600]

[599] We use the American Community Survey (ACS) Five-Year Estimates 2012–2016 for income measures. Median household income in the past twelve months is measured in 2016 Inflation-Adjusted Dollars.

[600] For these figures, we aggregate census blocks within a census block group by competitor count category, i.e., we group census blocks within a census block group by the number of competitors and then sum the population in these census blocks by competitor count category. The census blocks within a state are aggregated by provider number option groups (zero, one, two and more than two). The census block group is the smallest geographic area for which income data is available.

Fig. D-6

Average Percentage of Population With Multiple Provider Options for 10 Mbps/1 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	10.1%	30.8%	35.1%	23.9%
Second Quartile	1.0%	14.3%	42.5%	42.3%
Third Quartile	0.5%	10.1%	40.1%	49.3%
Fourth Quartile (Highest Pop. Density)	0.5%	8.1%	37.6%	53.7%
Median Household Income($2016)				
First Quartile (Lowest Median Household Income)	3.9%	22.4%	38.3%	35.4%
Second Quartile	4.2%	18.4%	39.3%	38.1%
Third Quartile	2.8%	14.1%	39.9%	43.2%
Fourth Quartile (Highest Median Household Income)	1.0%	7.7%	38.4%	52.9%
Number of Households				
First Quartile (Lowest Household Count)	3.9%	18.9%	37.7%	39.5%
Second Quartile	3.2%	16.3%	37.7%	42.9%
Third Quartile	2.9%	15.4%	38.9%	42.8%
Fourth Quartile (Highest Household Count)	2.1%	12.6%	41.2%	44.1%

Fig. D-7

Average Percentage of Population with Multiple Provider Options for 25 Mbps/3 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	23.0%	39.7%	28.1%	9.1%
Second Quartile	2.2%	27.9%	45.6%	24.3%
Third Quartile	0.9%	20.5%	46.7%	31.9%
Fourth Quartile (Highest Pop. Density)	0.8%	14.7%	42.6%	42.0%
Median Household Income($2016)				
First Quartile (Lowest Median Household Income)	8.1%	34.6%	37.4%	19.9%
Second Quartile	9.5%	29.2%	39.8%	21.4%
Third Quartile	6.8%	24.0%	42.4%	26.9%
Fourth Quartile (Highest Median Household Income)	2.1%	14.2%	44.4%	39.3%

	Zero	One	Two	More Than Two
Number of Households				
First Quartile (Lowest Household Count)	8.4%	29.7%	36.9%	25.0%
Second Quartile	7.4%	26.6%	39.1%	26.9%
Third Quartile	6.7%	25.0%	41.9%	26.4%
Fourth Quartile (Highest Household Count)	4.4%	21.4%	45.2%	29.0%

Fig. D-8

Average Percentage of Population with Multiple Provider Options for 50 Mbps/5 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	28.9%	41.4%	24.3%	5.4%
Second Quartile	3.2%	33.5%	45.6%	17.6%
Third Quartile	1.3%	25.1%	50.3%	23.3%
Fourth Quartile (Highest Pop. Density)	0.9%	17.0%	46.8%	35.3%
Median Household Income($2016)				
First Quartile (Lowest Median Household Income)	9.8%	38.8%	37.5%	13.9%
Second Quartile	12.0%	32.6%	39.9%	15.5%
Third Quartile	9.2%	27.5%	43.2%	20.2%
Fourth Quartile (Highest Median Household Income)	3.0%	17.5%	47.4%	32.0%
Number of Households				
First Quartile (Lowest Household Count)	10.4%	32.8%	37.5%	19.3%
Second Quartile	9.5%	30.1%	39.9%	20.6%
Third Quartile	8.6%	28.7%	42.7%	20.0%
Fourth Quartile (Highest Household Count)	5.9%	25.5%	47.0%	21.7%

Fig. D-9

Average Percentage of Population with Multiple Provider Options for 100 Mbps/10 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	36.4%	40.9%	18.8%	4.0%
Second Quartile	6.4%	41.5%	37.6%	14.5%
Third Quartile	2.5%	35.3%	42.8%	19.3%

	Zero	One	Two	More Than Two
Fourth Quartile (Highest Pop. Density)	1.4%	25.0%	41.1%	32.5%
Median Household Income($2016)				
First Quartile (Lowest Median Household Income)	13.9%	43.9%	30.6%	11.5%
Second Quartile	16.1%	38.2%	33.0%	12.7%
Third Quartile	12.2%	34.4%	36.2%	17.2%
Fourth Quartile (Highest Median Household Income)	4.2%	25.8%	41.2%	28.7%
Number of Households				
First Quartile (Lowest Household Count)	13.5%	38.1%	31.3%	17.0%
Second Quartile	12.8%	35.9%	33.4%	17.9%
Third Quartile	11.8%	35.2%	35.8%	17.2%
Fourth Quartile (Highest Household Count)	8.6%	33.6%	39.7%	18.1%

Fig. D-10

Average Percentage of Population with Multiple Provider Options for 250 Mbps/25 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

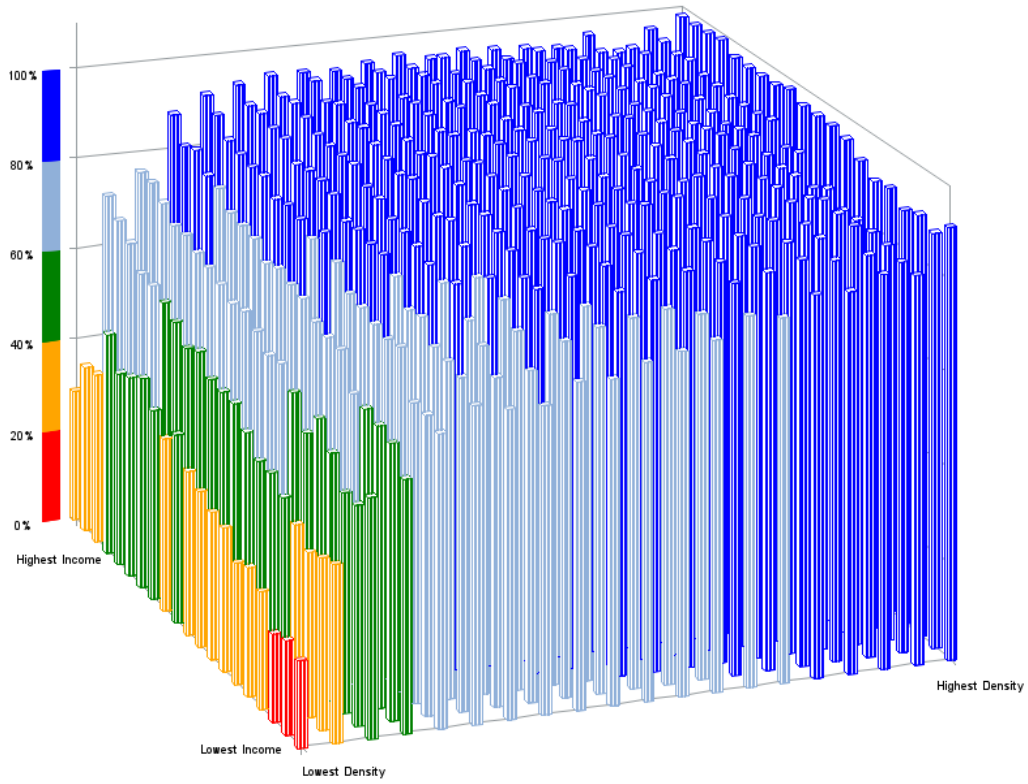
	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	61.3%	30.0%	7.5%	1.2%
Second Quartile	37.2%	40.4%	16.2%	6.2%
Third Quartile	29.3%	44.1%	17.7%	8.9%
Fourth Quartile (Highest Pop. Density)	22.4%	36.4%	18.7%	22.6%
Median Household Income($2016)				
First Quartile (Lowest Median Household Income)	45.1%	37.7%	11.3%	5.8%
Second Quartile	44.1%	37.4%	12.5%	6.0%
Third Quartile	37.3%	38.4%	15.4%	8.9%
Fourth Quartile (Highest Median Household Income)	23.5%	37.5%	21.0%	18.0%
Number of Households				
First Quartile (Lowest Household Count)	39.1%	36.6%	13.9%	10.4%
Second Quartile	37.9%	36.9%	14.6%	10.6%
Third Quartile	37.4%	38.1%	15.1%	9.4%
Fourth Quartile (Highest Household Count)	35.8%	39.2%	16.5%	8.5%

190. Figures D-11 through D-15 present a visual analysis of population that have at least two options for fixed terrestrial providers across the different speed tiers as of December 31, 2017. This analysis focuses on the estimated average percentage of the population with two or more provider options and examines this percentage simultaneously by population density and income quantiles. For this analysis, census block group data are grouped into 400 density/income quantiles based upon population

per square mile and median household income.[601] Each column in a figure represents one of these combinations. For each quantile, the height of the grid represents the population-weighted average ratio of the population with at least two provider options to the population across the census block groups in the decile.[602]

191. Each figure has three axes (x, y, and z). The x axis shows population density, ranging from the lowest population density to the highest population density, and the y axis shows the median household income ranging from lowest income to highest income. The vertical axis (z) shows the average percentage of the population with at least two provider options, ranging from 0% to 100%. These percentages are grouped into five color coded categories (0% to less than 20%, 20% to less than 40%, 40% to less than 60%, 60% to less than 80%, and 80% to 100%). By presenting the data in this manner, the relationship of both population density and household income on the incidence of multiple provider options can be visualized simultaneously. For example, in Figure D-11, the uppermost right corner shows that the census blocks with the highest population density (the x axis) and the highest median household income (the y axis) have at least two providers close to 100% of the time (the z axis). In general, the figures demonstrate that both variables appear to influence the incidence of multiple provider options.

Fig. D-11
Percentage of Population with at least Two Providers of 10 Mbps/1 Mbps by Income and Population Density (As of December 31, 2017)



[601] We use the American Community Survey (ACS) Five-Year Estimates 2012–2016 for income measures. Median household income in the past twelve months is measured in 2016 Inflation-Adjusted Dollars

[602] We exclude from this analysis any census block group with a zero population.

Fig. D-12
Percentage of Population with at least Two Providers of 25 Mbps/3 Mbps by Income and Population Density (As of December 31, 2017)

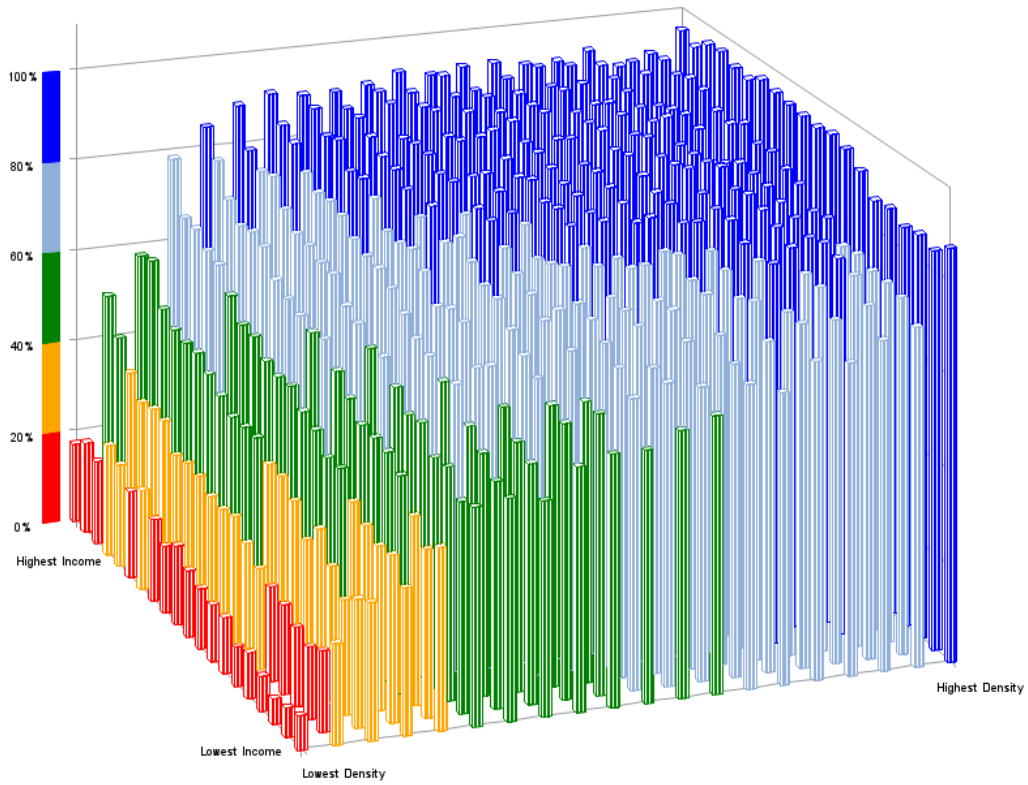


Fig. D-13
Percentage of Population with at least Two Providers of 50 Mbps/5 Mbps by Income and Population Density (As of December 31, 2017)

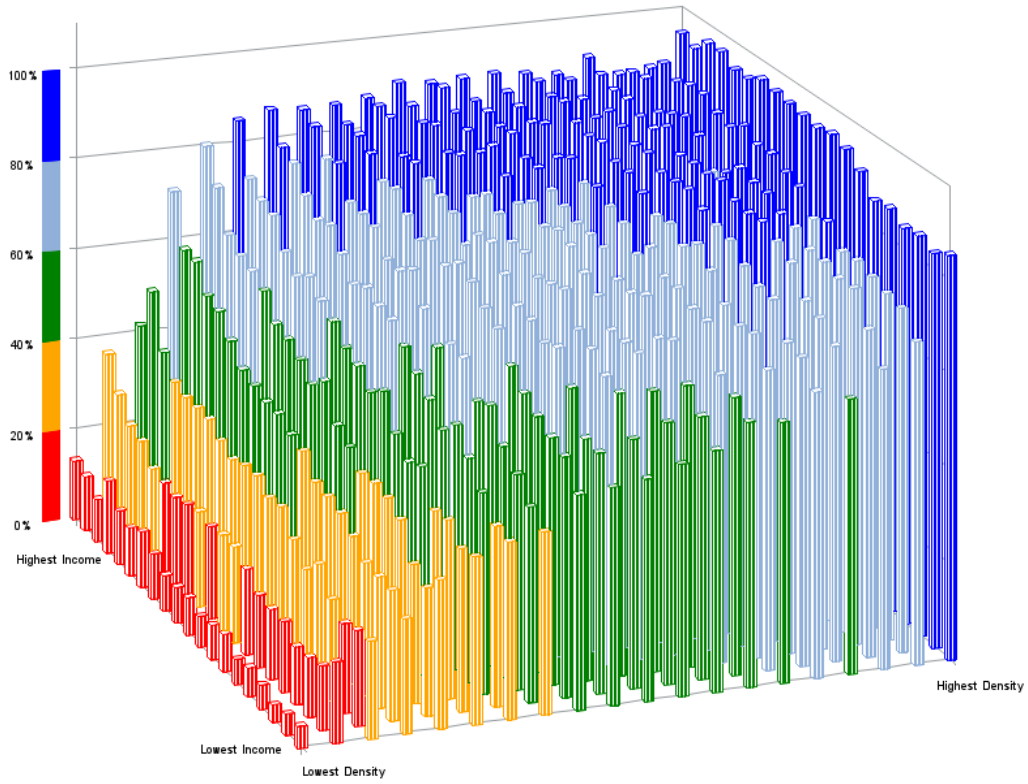


Fig. D-14
Percentage of Population with at least Two Providers of 100 Mbps/10 Mbps by Income and Population Density (As of December 31, 2017)

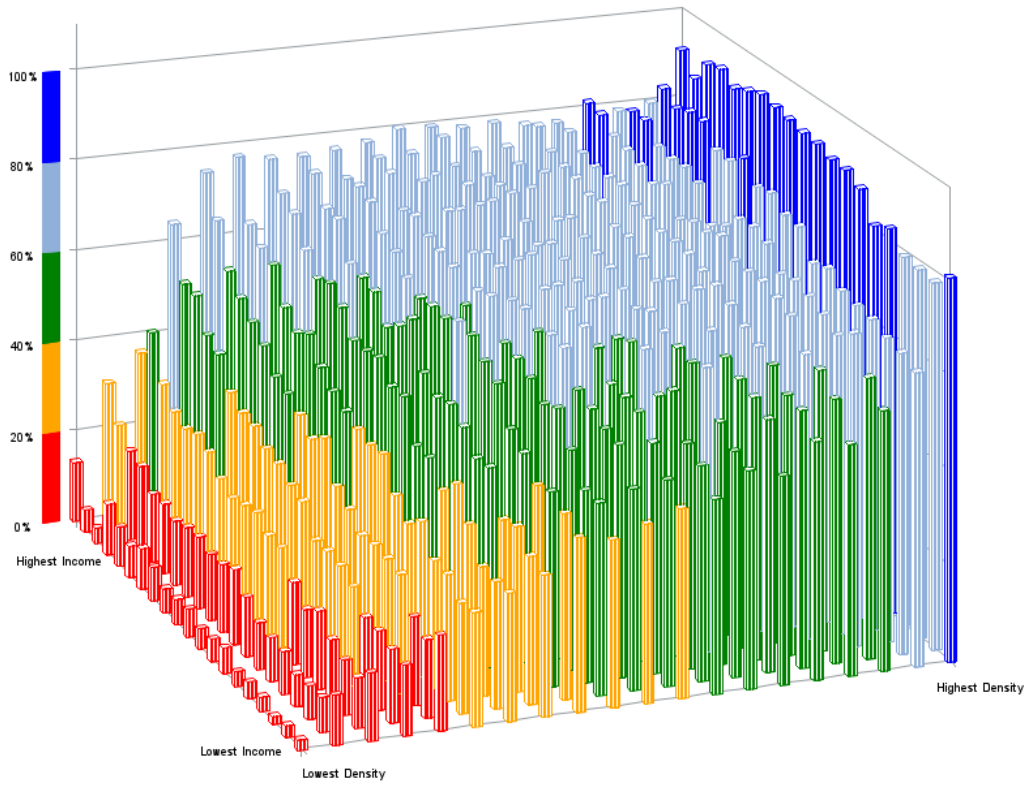
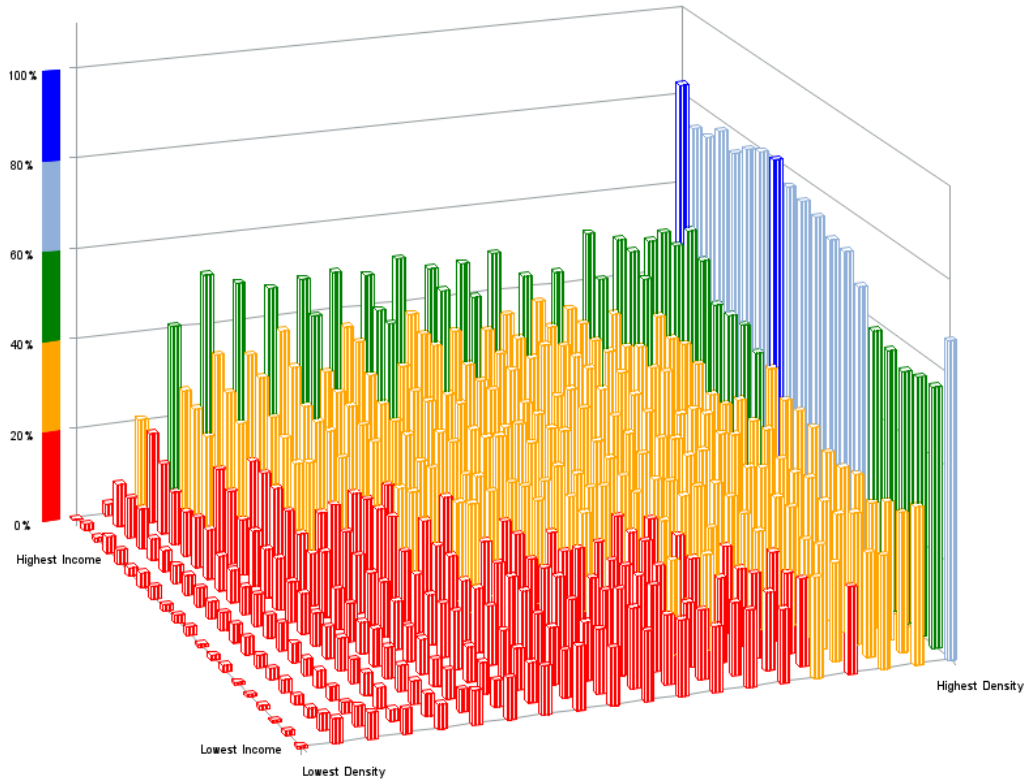


Fig. D-15
Percentage of Population with at least Two Providers of 250 Mbps/25 Mbps by Income and Population Density (As of December 31, 2017)



3. Regulatory and Market Barriers

192. We also assess barriers to competitive entry Identifying regulations that act as roadblocks to Internet service providers' investment in their networks and infrastructure, as well as market entry barriers for emerging and small Internet service providers, are key to assessing the current state of broadband competition.[603] While commenters highlight in the record some of the recent Commission efforts to eliminate regulatory barriers to network investment and deployment,[604] they also point to numerous other existing barriers that constrain the development of a robust broadband marketplace. These barriers include geography, existing Commission regulations—many of which are currently under review—local and state regulations, and a lack of access to spectrum resources.

193. The record indicates that a major barrier to additional competition throughout the United States is the high costs and low population densities common in rural parts of the country.[605] USTelecom comments that "[t]he economics of providing broadband at affordable and nationally comparable rates in many rural areas is difficult and in some cases prohibitive for wired providers who must deploy facilities all the way to end user locations."[606] The American Cable Association (ACA) identifies the costs associated with service upgrades in less competitive rural markets as a deterrent for small cable operators with modest profit margins and limited access to capital.[607] An additional barrier to fixed broadband competition in rural communities is the dearth of wholesale fiber providers with access to longer term financing that could facilitate providing fiber networks in these communities.[608]

194. While numerous commenters commend the Commission for its efforts to remove regulatory barriers to broadband deployment,[609] some also allege that regulatory barriers remain.[610]

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[603] *See* 47 U.S.C. § 257(a). *See also* 47 U.S.C. § 163(c) (stating that in the course of conducting a review of the state of competition and regulatory barriers in the communications marketplace, "the Commission shall consider market barriers for entrepreneurs and other small businesses . . . in accordance with . . . [47 U.S.C. § 257(b)].").

[604] *See* NCTA Fixed Competition Comments at 11-12; ACA Fixed Competition Comments at 8-9; ADTRAN Fixed Competition Comments at 9.

[605] *See* USTelecom Fixed Competition Comments at Exh. B at 7 (Patrick Brogan, VP of Industry Analysis, U.S. Broadband Availability Year-End 2016, 7 (February 22, 2018)). Indeed, the deployment data illustrated above in figures 1 through 4 support these assertions.

[606] USTelecom Fixed Competition Comments at Exh. B at 7 (Patrick Brogan, VP of Industry Analysis, U.S. Broadband Availability Year-End 2016, 7 (February 22, 2018)). As a potential solution, USTelecom advocates for "the Commission to fully fund programs such as CAF and find other means to assist providers in closing the digital divide." USTelecom Fixed Competition Comments at 6.

[607] ACA Fixed Competition Comments at 7.

[608] EFF Fixed Competition Comments at 5.

[609] Some commenters claim that recent Commission actions, such as the 2017 decisions to return to a light-touch regulatory regime under Title I and to deregulate the rates for business data services, where competition exists or is likely to exist and reject regulation of packet-based services offered by competitive providers, precipitated increased network investment and increased marketplace competition. *See* NCTA Fixed Competition Comments at 11; *see also* ACA Fixed Competition Comments at 8 ("By restoring the classification of broadband Internet access service as an information service, the Commission has freed ACA members from the heavy costs of regulatory compliance and uncertainty under a Title II regime. . . . ACA members can now invest their limited resources in improving and expanding their broadband networks with renewed confidence."). *But see* Common Cause et al. Fixed Competition Comments at 11 ("Deregulating the BDS market has detrimental impact on more than just businesses which rely on it. . . . The Commission's move to deregulate and exacerbate this already lucrative profit margin for incumbents was and is bad for consumers."); ADTRAN Fixed Competition Comments at 9. Similarly, the record commends Commission efforts to streamline pole attachment and discontinuance procedures for facilitating easier, faster, and less expensive deployment. *See* NCTA Fixed Competition Comments at 12; ACA Fixed Competition Comments at 9 ("The Commission's recent pole attachment reforms should make the process faster, less expensive, and more transparent, paving the way for more fixed broadband upgrades and new deployments, and with them increased

(continued….)

Among the barriers cited are the subsidization of LECs,[611] conflicting Connect America Fund (CAF) subsidy requirements,[612] duplicative franchise fees imposed on broadband and other new services over the same network,[613] rates that exceed a locality's costs for access to public rights-of-way and poles,[614] and excessive pole attachment fees charged by electric cooperatives.[615] The record also reflects some commenters' views that exclusive agreements and revenue sharing agreements between landlords of multiple tenant environments (MTEs) and fixed broadband providers that prevent other Internet service providers from offering service to tenants pose a barrier to a competitive fixed marketplace, even in areas where there are multiple providers.[616]

(Continued from previous page)
competition."); ADTRAN Fixed Competition Comments at 9. *But see* Common Cause et al. Fixed Competition Comments at 9-10 ("[T]he Commission's gutting of Section 214 Discontinuance rules will result in a downgrade for American consumers who still rely on the copper network (particularly rural Americans).").

[610] Numerous commenters also address the Commission's Form 477 data collection policy, either expressing frustration over current collection practices, suggesting preservation of current requirements, or advocating that any changes made to the FCC Form 477 data collection not impose greater burdens on smaller providers that are necessary to achieve the goals of collection. *See* new America Fixed Competition Comments at 2; WISPA Fixed Competition Comments at 18; ACA Fixed Competition Comments at 12; Verizon Fixed Competition Comments at 12; INCOMPAS Fixed Competition Comments at 6, 12-13. The Commission is currently considering a proceeding to review the Form 477 filing requirements. *See Form 477 Modernization FNPRM*, 32 FCC Rcd at 6329-30, para. 1.

[611] NCTA Fixed Competition Comments at 14 (citing the subsidization of LECs "at the expense of all other providers" as a policy that impedes closing the digital divide and growing broadband competition).

[612] ACA Fixed Competition Comments at 15 (arguing that the Commission should not allow "CAF funds to subsidize overbuilds of privately funded networks in the territories served by price-cap carriers"). New America contends that Internet service providers tend to invest the minimum required to obtain a CAF subsidy in areas where there is no competition and focus greater investment in competitive areas. New America Fixed Competition Comments at 16. EchoStar and Hughes express frustration over the CAF Phase II bidding process and what they call its "penalty on latency"– "the one service characteristic that satellite providers uniquely cannot control." EchoStar and Hughes Aug. 17, 2018 Comments at 5.

[613] NCTA Fixed Competition Comments at 15 (contending that "prohibiting local governments from imposing duplicative franchise requirements on broadband and other new services provided over the same network," would encourage greater deployment).

[614] Verizon Fixed Competition Comments at 10-11 (arguing that "constru[ing] Section 253(a) to preclude rates that exceed a locality's costs for access to public rights-of-way and poles" will remove roadblocks to the installation of equipment and facilities required for small cell and fiber deployment); *see also* INCOMPAS Fixed Competition Comments at 7. INCOMPAS supports (1) strengthening shot clocks applicable to wireless siting applications, and (2) limiting rights-of-way use charges and siting application fees, consistent with Sections 253 and 332. *Id*.

[615] ACA Fixed Competition Comments at 10 ("[U]rg[ing] the Commission to recommend to Congress that it enact legislation to bring electric cooperatives under Commission authority, placing them on the same playing field as the investor-owned utilities the Commission regulates today."). Some commenters express frustration over state-imposed barriers to broadband deployment, such as laws that restrict or prohibit municipal broadband. New America Fixed Competition Comments at 8-14; ACA Fixed Competition Comments at 10; Common Cause et al. Fixed Competition Comments at 13 ("Municipal broadband, or broadband provided by citizens as a utility, is an innovative practice that spurs competition while narrowing the digital divide."). In 2016, the Sixth Circuit concluded that the FCC could not preempt state statutory provisions that limited a municipality from expanding the service area of its own municipal-owned network. *See Tennessee v. FCC*, 832 F.3d 597, 597 (6th Cir. 2016).

[616] *See* New America Fixed Competition Comments at 18; Common Cause et al. Fixed Competition Comments at 15-17; INCOMPAS Fixed Competition Comments at 5, 10-11. The Commission has sought comment on the effect of state and local regulatory barriers, exclusive marketing and bulk billing agreements, revenue sharing agreements, and exclusive wiring agreements on the current state of broadband competition in MTEs. *See Improving*
(continued….)

195. Some commenters identify technology-specific barriers. According to WISPA, an existing barrier to the ability of fixed wireless broadband to compete with incumbent fixed services is the lack of availability of government subsidies to aid deployment.[617] WISPA contends that another barrier for fixed wireless broadband is the "absence of comprehensive and consistent spectrum infrastructure policy" as many fixed wireless providers who rely on spectrum currently have limited access to dedicated spectrum resources.[618]

196. Regarding satellite broadband, SIA contends that to enable further competition, the Commission should "ensure that its regulations are technology neutral, including for the allocation of scarce resources, such as spectrum and funding."[619] EchoStar and Hughes assert that another barrier for satellite broadband is failure to harmonize spectrum regionally and internationally, which, among other things, "creates a significant technical barrier, and competitive hurdle for satellite providers, endangering [ ] the emergence of existing and planned next generation satellite networks."[620]

197. The Commission remains committed to addressing where possible regulatory and market barriers to broadband deployment to help ensure that as many Americans as possible receive the benefits of broadband competition. The Commission's past and future efforts towards this end are discussed later in this Report.[621]

198. *ISP Transparency and Identifying and Eliminating Market Barriers for Entrepreneurs and Small Businesses Accessing and Provisioning Broadband Internet Access Service.* The Restoring Internet Freedom Order,[622] which modified the transparency requirements that apply to Internet service providers, took effect on June 11, 2018.[623] As the Commission explained in that order, information about

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Competitive Broadband Access to Multiple Tenant Environments, Notice of Inquiry, GN Docket No. 17-142, 5387-5389, paras. 11-15 (2017).

[617] WISPA Fixed Competition Comments at 16 (expressing frustration that larger incumbents are awarded government subsidies to deploy broadband in the same geographic area where the small wireless Internet service provider has already used its own capital to invest in equipment and infrastructure).

[618] WISPA Fixed Competition Comments at 16; GeoLinks Comments, GN Docket No. 18-231, at 1-3 (Aug. 17, 2018) (arguing that the opportunity to obtain additional access to additional spectrum resources, would allow fixed wireless providers to better compete with traditional fixed broadband providers by enabling them to "deliver enterprise-grade connections that rival those of traditional, wired broadband providers"); Common Cause et al. Fixed Competition Comments at 15 ("[T]he Commission should consider spectrum reforms that enhance the deployment of fixed wireless to rural America.").

[619] SIA Fixed Competition Comments at 3; *see also* EchoStar and Hughes Fixed Competition Comments at 4-9.

[620] EchoStar and Hughes Fixed Competition Comments at 9.

[621] *See infra.* Section III.B., IV.B.

[622] *Restoring Internet Freedom Order*, 33 FCC Rcd 311.

[623] *Wireline Competition Bureau Announces Effective Date of Restoring Internet Freedom Order*, WC Docket No. 17-108, Public Notice, DA 18-485 (WCB May 11, 2018), https://www.fcc.gov/document/wcb-announces-effective-date-restoring-internet-freedom-order. While Congress repealed the triennial reporting requirement of section 257(c) earlier this year, it replaced that provision with a biennial reporting requirement codified at 47 U.S.C. § 163. *See* RAY BAUM'S Act of 2018, Pub. L. No. 115-141, Div. P, §§ 401, 402(f), 132 Stat. at 1087-89. Like the now-repealed section 257(c), section 163 continues to require the Commission to report to Congress periodically on "market entry barriers for entrepreneurs and small businesses in the communications marketplace." 47 U.S.C. § 163(d)(3). Congress thus recodified the reporting requirement of section 257(c) under another provision of the Communications Act. And a savings clause in the legislation confirmed that "[n]othing in this title or the amendments made by this title shall be construed to expand or contract the authority of the Commission." Pub. L. No. 115-141, Div. P, § 403, 132 Stat. at 1090. As a result, nothing in the new legislation altered the FCC's authority to adopt a transparency rule so that the agency can collect the information it needs to perform its statutory duty to report to Congress on market entry barriers.

how Internet service providers manage their networks assists entrepreneurs and other small businesses, including edge providers, as they "judge which broadband Internet access service offerings will best meet their needs given the applications and service they wish to use."[624] The transparency requirements also reduce barriers for entrepreneurs and small businesses who wish to enter the market for the provision of broadband Internet access services.[625]

199. In keeping with our ongoing obligation to "identify[] and eliminat[e] . . . market entry barriers for entrepreneurs and other small businesses,"[626] Commission staff conducted a review of Internet service provider compliance with the revised disclosure requirements.[627] The Commission staff review found that all Internet service providers with more than 100,000 subscribers, based on FCC Form 477 data, were in compliance with the transparency requirements at the time of the review.[628] These Internet service providers collectively serve over 99% of mobile Internet service provider subscribers and over 94% of fixed Internet service provider subscribers. The overwhelming majority of entrepreneurs and small businesses are therefore able to "make the most educated choice among Internet service providers and particular broadband Internet access service offerings."[629] Commission staff also reviewed the disclosures of each of the remaining Internet service providers in the United States based on FCC Form 477 data, finding that the vast majority of smaller Internet service providers at the time of the review were complying with the transparency requirements. Commission staff are currently taking steps to help ensure that all smaller Internet service providers come into compliance with the transparency requirements.[630]

4. Investment Trends

200. Recent marketplace developments suggest that increased investments by Internet service providers should, over time, increase broadband competition. For instance, according to USTelecom, in 2017 broadband providers invested approximately $76.3 billion dollars in network infrastructure, an

[624] *Restoring Internet Freedom Order*, 33 FCC Rcd at 447, para. 233; *see id.* at 446 n.850 (describing examples of applications which may require quality-of-service guarantees from Internet service providers).

[625] 47 U.S.C. § 257(a); *see Restoring Internet Freedom Order*, 33 FCC Rcd at 446, para. 233.

[626] *See* 47 U.S.C. § 257(a). *See also* 47 U.S.C. § 163(c) (stating that in the course of conducting a review of the state of competition and regulatory barriers in the communications marketplace, "the Commission shall consider market barriers for entrepreneurs and other small businesses . . . in accordance with . . . [47 U.S.C. § 257(b)].").

[627] Internet service providers can either post their transparency disclosures on a "publicly available, easily accessible website" or transmit them to the Commission, which posts them at CG Docket No. 18-142. *Restoring Internet Freedom Order*, 33 FCC Rcd at 444, para. 229; FCC, ISP Transparency Disclosures Portal, https://www.fcc.gov/isp-disclosures.

[628] The subscriber count is based on FCC Form 477 data.

[629] *Restoring Internet Freedom Order*, 33 FCC Rcd at 447, para. 233.

[630] Internet service providers with fewer than 100,000 subscribers (later increased to Internet service providers with fewer than 250,000 subscribers) were exempt from the enhanced transparency requirements adopted in the *Title II Order*. *See Protecting and Promoting the Open Internet*, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5677-79, paras. 172-75 (2015) (*Title II Order*); *Small Business Exemption From Open Internet Enhanced Transparency Requirements*, GN Docket No. 14-28, Order, 32 FCC Rcd 1772 (2017). The enhanced transparency requirements were eliminated by the *Restoring Internet Freedom Order*. 33 FCC Rcd at 442-43, paras. 225-226. However, the transparency requirements adopted in the *Open Internet Order* in 2010, affirmed by the D.C. Circuit in *Verizon v. FCC*, 740 F.3d 623, 659 (D.C. Cir. 2014), and reaffirmed and refined in the *Restoring Internet Freedom Order* continue apply to all Internet service providers, regardless of size. *Preserving the Open Internet, Broadband Industry Practices*, Report and Order, 25 FCC Rcd 17936-40, paras. 53-58 (2010) (*Open Internet Order*); *Restoring Internet Freedom Order*, 33 FCC Rcd at 444, para. 227.

increase of $1.5 billion over 2016 levels.[631] Such an increase marked a reversal from the declines in investment observed in 2015 and 2016 when the Commission regulated broadband providers under Title II of the Communications Act.[632] Multiple commenters cite the substantial investment in higher speed services by Internet service providers as evidence of a competitive marketplace.[633] According to these commenters, this investment by Internet service providers has resulted in aggressive and ongoing efforts by competing Internet service providers to upgrade their networks, facilities, and services, which will likely continue into the future especially with the anticipated deployment of 5G networks.[634] For instance, NCTA claims that cable operators have spent over $50 billion upgrading their networks over the last three years in direct response to aggressive competition in the broadband marketplace.[635] ACA also reports that in order to keep pace with competitors, its members "invested more than $10 billion to expand and upgrade their broadband networks" between 2013 and 2017 and "continue to invest more than $1 billion annually."[636] Similarly, Verizon claims that it faces "nearly ubiquitous competition from cable providers" and that the "advanced services that Verizon brings prompts those competitors to upgrade their own facilities and services."[637]

201. In his analysis of FCC Form 477 data, Dr. George S. Ford supports these claims of competition among fixed Internet service providers, finding that Comcast "faces competition from one of the six largest broadband providers at the 25/3 level in 74% of its territory where another provider offers service" and at the 10/1 Mbps level from "another large provider of broadband across 81% of its footprint."[638] He also found that "AT&T faces competition from another of the large providers of broadband across 81% of its broadband footprint at the 25/3 level, and 88% at the 10/1 Mbps level."[639]

202. At the same time, despite these encouraging levels of Internet service provider network investments, some commenters suggest that fixed broadband competition could improve,[640] and we agree that we must continue efforts to promote broadband deployment and competition. For instance, several commenters assert that even when multiple fixed broadband providers are available in a market, one single incumbent provider tends to dominate the market share.[641] FCC Form 477 subscription data indicates that this is the case in some, but certainly not all instances. These commenters also discuss the

[631] *See* Patrick Brogan, VP, Industry Analysis, USTelecom, U.S. Broadband Investment Rebounded in 2017, 1 (Oct. 18, 2018).

[632] *Id.* at 1-2.

[633] *See, e.g.*, USTelecom Fixed Competition Comments at 3-4, Exh. A at 18 (Patrick Brogan, VP Industry Analysis, USTelecom Industry Metrics and Trends 2018, 18 (March 1, 2018)); NCTA Fixed Competition Comments at 8; ACA Fixed Competition Comments at 15.

[634] *See, e.g.*, NCTA Fixed Competition Comments at 8; ACA Fixed Competition Comments at 15; Verizon Fixed Competition Comments at 7.

[635] NCTA Fixed Competition Comments at 8 ("Cable operators have been consistently upgrading their networks for years, investing over $50 billion in the last three years alone, and by the end of 2018 they are expected to offer gigabit services reaching 70 to 75% of American households. There would be no reason for cable operators to invest in these upgrades if they were not competing aggressively in the broadband marketplace.").

[636] ACA Fixed Competition Comments at 15.

[637] Verizon Fixed Competition Comments at 7.

[638] Dr. George S. Ford, *Rhetoric Aside: What the Data Actually Say About Broadband Deployment*, Perspectives: Phoenix Center for Advanced Legal & Economic Public Policy Studies, 6 (Sept. 4, 2018).

[639] *Id.*

[640] *See* Common Cause et al. Fixed Competition Comments at 15; New America Fixed Competition Comments at 2.

[641] Common Cause et al. Fixed Competition Comments at 15.

limited broadband options in rural America,[642] and the FCC Form 477 data show that competitive options for broadband are more limited in rural areas.[643] We agree that the business case to serve rural areas is often more difficult, which is why the Commission has consistently worked to provide universal service funding to rural areas and decrease the costs of the broadband investment,[644] an effort we are committed to continuing.[645]

E. Voice Telephone Services

203. Although the public switched telephone network used to be the only means to connect, there now exists a multitude of other voice service options for consumers. We focus on interconnected voice in our reporting, but acknowledge there are many other types of telecommunications offerings, including apps running solely on data networks that are nearly indistinguishable to the consumer from the core communications functionality of the public switched telephone network, and nearly indistinguishable to providers and the Commission from other network data traffic. Many of these apps combine the benefits of voice, video, and text communication into one data-based service.

204. Modern interconnected voice services are divided between fixed and mobile voice. Fixed is further divided into traditional switched access connections and interconnected VoIP. VoIP is voice carried simply as data over an Internet Protocol network, and can be a voice service that is bundled with the underlying broadband connection or offered independent of the necessary data service ("over the top", or "OTT").

205. *Fixed Voice*. There are two fixed technologies through which retail voice subscriptions are provided: traditional switched access and interconnected VoIP subscriptions. Our most recent data from the June 2017 Form 477 show there are 55 million end-user switched access lines, including 22.5 million residential lines, and 64 million interconnected VoIP subscriptions, including 40 million residential subscriptions.[646] Of these combined 119 million fixed retail voice telephone service subscriptions, 53% were residential connections, and 47% were business connections.[647] The relative growth trends between fixed switched access and interconnected VoIP services are illustrative. The number of fixed retail switched-access lines declined over the past three years at a compound annual growth rate of 11%, while interconnected VoIP subscriptions increased a compound annual growth rate of 8%.[648] Unsurprisingly, the number of fixed switched access providers also decreased, with 1,014 providers reporting fixed end-user switched access lines in June 2017, down from 1,029 in June 2016.[649] There were also 1,078 providers of interconnected VoIP subscriptions in June 2017, up from 1,004 a year earlier.[650] As of June 2017, residential fixed voice connections were about 36% switched access and 64% interconnected VoIP, with residential switched access connections comprising only 18.8% of all fixed retail voice connections.[651]

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[642] *See* Common Cause et al. Fixed Competition Comments at 13 ("[O]ver 31% of Americans with a rural zip code lack access to high speed internet at home. . . . [and] often only have one choice in service providers."); WISPA Fixed Competition Comments at 2-3; ADTRAN Fixed Competition Comments.

[643] *See infra* Table 1.

[644] *See infra* Section III.B.

[645] *See infra* Section IV.B.

[646] FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

[647] FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

[648] FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

[649] FCC, Voice Telephone Services: Status as of June 30, 2017, Table 2, (2018).

[650] FCC, Voice Telephone Services: Status as of June 30, 2017, Table 2, (2018).

[651] FCC, Voice Telephone Services: Status as of June 30, 2017, Figure 2, (2018).

206. *Mobile Voice*. In June 2017, our Form 477 data indicate there were 336 million mobile subscriptions in the United States, representing an increase in mobile voice subscriptions at a compound annual growth rate of 2% over the previous three years.[652] The number of households that eschew fixed subscriptions altogether in favor of relying solely on mobile services has been increasing. Approximately 54% of all households were mobile-only in late 2017, with the percentage of adults living in mobile-only households decreasing as age increased.[653] In the age group 25-29, over 75% of adults lived in mobile-only households; 73.3% of those aged 30-34 lived in mobile-only households; 64.5% of those aged 35-44 lived in mobile-only households; 48.1% of those aged 45-64 lived in mobile-only households; and 26.4% of those 65 and older lived in mobile-only households.[654] Yet even in these older groups, the proportion of adults living in mobile only households has increased in recent years; among those aged 45 and older, the percentage has increased from 36.2% in 2014 to 40.4% in late 2017.[655] About 3.2% of households had neither mobile nor fixed voice subscriptions, as of late 2017.[656]

207. *Over the Top*. Fixed VoIP carriers distinguish over the top ("OTT") VoIP where the consumer uses an independent data service over a broadband connection, from all other types of interconnected VoIP.[657] The June 2017 Form 477 data show 7.8 million OTT VoIP subscriptions, with far more non-OTT VoIP, numbering 56.7 million subscriptions.[658] Mobile VoIP presents a more complicated picture, given the plethora of communications apps in smartphone app ecosystems. Figures on how customers use these apps for voice communication are not reported on Form 477, as many of them do not permit users to receive calls that originate on the public switched telephone network or terminate calls on the public switched telephone network, and therefore not classified as interconnected VoIP.[659] The dynamic nature of this subsector makes it difficult to quantify the number of users, though we find that consumers benefit from the ever evolving choices available to meet their voice communication needs.

F. The Satellite Market

208. We next assess the state of competition to deliver voice, video, audio, and data services by providers of satellite communications.[660] Satellite communications services constitute a technology sector that participates in multiple marketplaces. Our analysis and the comments we received indicate that providers of satellite communications offer a wide range of services across the United States and globally today.[661]

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[652] FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

[653] U.S. Department of Health and Human Services, National Center for Health Statistics, Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July-December 2017 at 1-2 (2018).

[654] U.S. Department of Health and Human Services, National Center for Health Statistics, Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July-December 2017 at 2 (2018).

[655] U.S. Department of Health and Human Services, National Center for Health Statistics, Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July-December 2017 at 2 (2018).

[656] U.S. Department of Health and Human Services, National Center for Health Statistics, Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July-December 2017 at 2 (2018).

[657] FCC, Voice Telephone Services: Status as of June 30, 2017 at 1, (2018).

[658] FCC, Voice Telephone Services: Status as of June 30, 2017 Figure 3, (2018).

[659] 47 C.F.R. § 9.3. Examples of these services are apps such as Skype, Facebook Messenger, Facetime, WhatsApp.

[660] RAY BAUM'S Act § 401, 132 Stat. at 1087-88; 47 U.S.C. § 163(b)(1) (requiring the Commission to assess the state of competition in the communications marketplace, including competition to deliver voice, video, audio, and data services among providers of communications services, including providers of satellite communications).

[661] To inform our analysis, on August 17, 2018, the International Bureau requested data, information, and comment on the delivery of services by providers of satellite communications. *International Bureau Satellite Public Notice*.

(continued….)

1. Overview of the Commercial Satellite Services Industry

209. In the United States and globally, satellites provide telecommunications infrastructure for communications, including voice, video, audio, and data services. Satellites function as relay stations in space that receive signals from an earth station and then re-transmit the signal to a distant point located often thousands of miles from the point of signal origination.[662] In broad terms, satellites operate in either a geostationary (GSO) or non-geostationary (NGSO) orbit.[663] Satellite communications services may be provided in several ways based on the specific business context and objective. Satellite operators provide commercial satellite services to other business entities, government organizations, and consumer end users. For purposes of this *Report*, we describe five major types of services provided by the commercial satellite services industry.

210. *Fixed Satellite Service (FSS).* The Commission defines FSS as involving the transmitting and receiving of communications signals from earth stations, including customer stations, that are located at fixed points on earth, and has allocated specific spectrum bands for FSS, most importantly, the C-, Ku-, and Ka-bands.[664] More recently, there also has been interest in use of the V-band frequencies.[665]

(Continued from previous page)
Several commenters contend that services from current satellites and from planned satellite launches ensure that satellite services not only play an important role today but will continue to do so in the future. EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC Comments, IB Docket No. 18-251, at 1-2, 4 (Sept. 7, 2018) (EchoStar and Hughes Sept. 7, 2018 Comments); Iridium Communications Inc., IB Docket No. 18-251, at 2, 5-6 (Sept. 7, 2018) (Iridium Comments); Satellite Industry Association (SIA) Comments, IB Docket No. 18-251, at 2 (Sept. 7, 2018) (SIA Sept. 7, 2018 Comments) ("Satellites also play a critical role in situations where terrestrial communication infrastructure networks are not available such as natural disasters and electrical outages."). We do not address other industry sectors, such as launch industry, satellite manufacturing, earth station and network equipment manufacturing, consumer terminal equipment, and launch insurance. Nor do we address military applications of satellite services.

[662] An earth station is a station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication: (1) With one or more space stations; or (2) With one or more stations of the same kind by means of one or more reflecting satellites or other objects in space. 47 CFR § 25.103 (*Earth station*). The Commission's definition is identical to the definition established by the International Telecommunication Union (ITU). ITU, Radio Regulations—Articles (ed. 2016) at 13 (Article 1, 1.63) (*ITU Radio Regulations*), http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/1.43.48.en.101.pdf.

[663] GSO satellites operate on an equatorial plane at approximately 22,300 miles above the Earth and rotate around the Earth at the same speed that the Earth rotates. *Third Satellite Competition Report*, 26 FCC Rcd at 17288, para. 8, n.9; *see also* National Oceanic and Atmospheric Administration, *NOAA's Geostationary and Polar-Orbiting Weather Satellites*, https://noaasis.noaa.gov/NOAASIS/ml/genlsatl.html. As a result, a GSO satellite appears as a stationary point in the sky relative to a receiving and transmitting earth station. Non-geostationary orbits include a number of orbital configurations. MEOs range from 6,000 to 12,000 miles above the Earth and circle the Earth in five to 12 hours. *Fundamentals* at 23. LEOs range from 100 to 300 miles above the Earth and circle the Earth approximately every 90 minutes. *Id.* at 25.

[664] 47 CFR § 25.103 (*Fixed-Satellite Service (FSS)*). The conventional C-band refers to the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space) FSS frequency bands, and the extended C-band refers to the 3600-3700 MHz (space-to-Earth), 5850-5925 MHz (Earth-to-space), and 6425–6725 MHz (Earth-to-space) FSS frequency bands. The conventional Ku-band refers to the 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 (Earth-to-space) FSS frequency bands, and the extended Ku-band refers to the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), and 13.75-14.0 GHz (Earth-to-space) FSS frequency bands. The conventional Ka-band refers to the 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space) frequency bands, which the Commission has designated as primary for GSO FSS operation. 47 CFR § 25.103.

[665] We use the term "V-band" to refer to frequencies ranging from 37.5 GHz to 52.4 GHz, although there is no domestic allocation for satellite services in 42.0-42.5 GHz band and there is no domestic or international allocation for satellite services in the 51.4- 52.4 GHz frequency band. We have recently approved applications for V-band systems in portions of 37.5-50.2 GHz frequency range. *See, e.g., O3b Limited*; *Request for Modification of U.S.*
(continued….)

Examples of FSS offerings include wholesale transponder[666] services, managed services (also known as enterprise services), and consumer broadband services.[667] Over the last ten years, however, the Commission has allowed mobile services within the spectrum bands allocated to FSS.[668] Earth Stations on Vessels, Vehicle-Mounted Earth Stations, and Earth Stations Aboard Aircraft, collectively designated as Earth Stations in Motion (ESIMs),[669] are mobile in nature, but operate in FSS spectrum. Given the significant bandwidth allocated to FSS, ESIMs are able to transmit and receive very high data rate broadband communications while in motion.[670] Licensees increasingly use ESIMs to deliver broadband to ships, vehicles, trains, and aircraft using the same frequency bands, hardware, satellites, transponder beams, and gateways used to serve earth stations at fixed locations.

211. *Mobile Satellite Service (MSS).* MSS generally involves the transmitting and receiving of communications signals from mobile earth stations located on land, on sea, or on airplanes[671] and operates in the limited bandwidth allocated in the L-band, the 2 GHz MSS band, and the Big and Little LEO bands.[672] Voice and data services are conducted in the L-band, Big LEO band, and 2 GHz bands, while

(Continued from previous page)
Market Access for O3b Limited's Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service and in the Mobile-Satellite Service, Order and Declaratory Ruling, 33 FCC Rcd 5508, 5519-20, para. 30 (rel. June 6, 2018) (*O3b Modification Order*); *Audacy Corporation*; *Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services, Order and Authorization*, 33 FCC Rcd 5554, 5562, para. 20 (rel. June 6, 2018) (*Audacy Authorization Order*); *Policy Branch Information, Satellite Space Applications Actions Taken*, IBFS File Nos. SAT-LOA-20170621-00092 and SAT-AMD-20170908-00128, Public Notice, 33 FCC Rcd 2869 (2018) (granting in part and deferring in part; deferring consideration of Hughes Network Systems' request for operations in the 50.4-51.4 GHz band); *SpaceX V-band NGSO Authorization Order*; *Telesat Canada V-Band NGSO Order and Declaratory Ruling*.

[666] A communications satellite transponder is the part of a satellite that receives signals transmitted from earth stations to the antennas onboard a satellite and retransmits these signals to the Earth. *See* Dennis Roddy, Satellite Communications 199 (4th ed. 2006). The number of transponders onboard any given satellite may vary, ranging approximately from 24 to 72 transponders. U.S. Government Accountability Office, Telecommunications: Competition, Capacity, and Costs in the Fixed Satellite Services Industry at 5 (2011), https://www.gao.gov/assets/330/322861.pdf.

[667] Broadband to aircraft and vessels can also be provided via wholesale transponder services.

[668] *See generally Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands*, Report and Order, 20 FCC Rcd 674 (2005); *see also Amendment of Parts 2 and 25 of the Commission's Rules to Allocate Spectrum and Adopt Service Rules and Procedures to Govern the Use of Vehicle-Mounted Earth Stations in Certain Frequency Bands Allocated to the Fixed-Satellite Service*, Report and Order, 24 FCC Rcd 10414 (2009).

[669] *See O3b Modification Order*, 33 FCC Rcd at 5516, at para. 21, n.59.

[670] *Id.* ESIMs enable the provision of very high data rate broadband communications, navigational, situational awareness, and other services to mobile platforms that often cannot be served using other communications technologies. *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 17-95, Report and Order and Further Notice of Proposed Rulemaking, FCC 18-138 at para. 3 (Sept. 27, 2018) (*ESIMs Order*). The Commission continues to distinguish ESIMs, which operate in FSS spectrum, from mobile earth stations, which operate in MSS spectrum. *ESIMs Order* at paras. 3-4, 10 (defining ESIMs to collectively designate the three types of FSS earth stations that the Commission authorizes to transmit while in motion: Earth Stations on Vessels (ESVs), Vehicle-Mounted Earth Stations (VMESs), and Earth Stations Aboard Aircraft (ESAAs)); 47 CFR § 25.103 (*Mobile Earth Station*) (defining mobile earth station as "[a]n earth station in the Mobile-Satellite Service intended to be used while in motion or during halts at unspecified points.").

[671] 47 CFR § 25.103 (*Mobile-Satellite Service (MSS)*).

[672] There are MSS allocations in the 1525-1559 MHz (space-to-Earth) band and the 1626.5-1660.5 MHz (Earth-to-space) band of the L-band, the 2000-2020 MHz and 2180-2200 MHz bands of the 2 GHz band. Other frequency bands with MSS allocations have been given specific labels in the Commission rules: the Big LEO bands (1610-
(continued….)

the Little LEO band is limited to non-voice services.[673] Examples of MSS applications include voice, low-speed data, and tracking services for aircraft and ships, as well as handsets operating in remote locations on land.

212. *Earth Exploration Satellite Service (EESS)*. EESS satellites are increasingly used to gather Earth observation information for commercial purposes, including information to assess needs in disaster recovery, monitor strategic assets, and check crop growth. The EESS is a radiocommunication service in specified spectrum bands between earth stations and one or more space stations (which may include links between space stations) that collects information relating to the characteristics of the Earth from active or passive sensors on earth satellites and distributes that information to earth stations.[674] Many different frequency bands are allocated for the provision of EESS, including, for example, 1215-1300 MHz, 1400-1427 MHz, 2025-2110 MHz, 2200-2290 MHz, and 8025-8400 MHz. The frequency band allocation for EESS may be for sensing purposes or for feeder link use to associated Earth stations.

213. *Satellite Digital Audio Radio Service (SDARS)*. SDARS is a radiocommunication service in the 2.3 GHz band in which audio programming is digitally transmitted by one or more space stations directly to fixed, mobile, and/or portable stations.[675] Satellite-delivered radio programming is supplied nationwide by SiriusXM, presently the only SDARS operator in the nation.[676] SDARS is examined in more detail in Section II.C.2.

214. *Direct Broadcast Satellite (DBS) Service*. DBS service is a radiocommunication service in which signals transmitted or retransmitted by Broadcasting Satellite Service space stations in the 12.2–12.7 GHz band are intended for direct reception by subscribers or the general public.[677] DBS satellite operators (e.g., DISH Network and DIRECTV) provide nationwide video programming to video customers in direct competition with terrestrial television companies. DBS services are examined in more detail in Section II.B.1.

2. Satellite Revenues

215. Satellite operators provide a number of different kinds of services with varying revenue streams.[678] For example, some operators provide transponders for lease through arrangements that are multi-dimensional and tailored for specific applications required by the customer. Operators may also supply a complete, end-to-end communications solution to customers, referred to as managed services. Consumer retail services include satellite broadband service, SDARS, and satellite television (*e.g.*, DBS).

(Continued from previous page)
1626.5 MHz and 2483.5-2500 MHz) and the Little LEO bands (137-138 MHz, 400.15-401 MHz, and 148-150.5 MHz). 47 CFR § 25.103.

[673] *See, e.g., Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks; Amendments to Rules for the Ancillary Terrestrial Component of Mobile Satellite Service Systems*, Report and Order, 31 FCC Rcd 13801, 13802, n.2 (2016) (noting distinction between Big LEO systems, which operate with voice and higher data-rate capabilities, and Little LEO systems, which do not provide voice service and generally operate with lower data rate capabilities).

[674] *See ITU Radio Regulations* at 12 (Article 1, 1.51); 47 CFR § 2.1.

[675] 47 CFR § 25.103 (*Satellite Digital Audio Radio Service (SDARS*)).

[676] In 2017, SiriusXM's total revenue was $5.4 billion, which represents an increase of 8% over total revenue in 2016. SiriusXM, *SiriusXM Reports Fourth Quarter and Full-Year 2017 Results* (Jan. 31, 2018), http://investor.siriusxm.com/investor-overview/press-releases/press-release-details/2018/SiriusXM-Reports-Fourth-Quarter-and-Full-Year-2017-Results/default.aspx.

[677] 47 CFR § 25.103 (*Direct Broadcast Satellite (DBS) Service*).

[678] Intelsat, SES, Hughes, ViaSat, Iridium, Eutelsat, and Telesat are examples of facilities-based satellite operators. Facilities-based operators may also lease some excess capacity from each other to expand their geographic coverage or meet the unique transmission requirements of specific customers.

Customers of enterprise services include terrestrial telecommunications companies, television networks, and resellers of satellite transponder capacity.[679] Examples of resellers that are not the operators themselves include Digisat International Inc.,[680] Globecomm,[681] Ultisat, Inc.,[682] and Artel, LLC.[683]

216. Fig. F-1 below provides aggregated U.S. satellite services revenues from SIA for 2013 to 2017 with respect to consumer, fixed, and mobile satellite services.[684]

Fig. F-1
U.S. Satellite Services Revenue (2013-2017)

Service	Total Revenue (Billions, U.S.$)				
	2013	2014	2015	2016	2017
Consumer	44.0	46.0	48.0	46.4	45.5
Satellite TV (DBS/DTH)[685]	38.6	40.1	41.7	39.7	38.3
Satellite Radio (SDARS)	3.8	4.2	4.6	5.0	5.4
Satellite Broadband	1.6	1.7	1.7	1.7	1.8
Fixed	3.7	3.8	4.1	4.4	5.0

[679] Some satellite resellers combine leased transponder capacity with terrestrial telecommunications facilities, which the resellers may lease from terrestrial telecommunications entities or use their own facilities, to create a complete telecommunications service for corporate and government users.

[680] Digisat, *Satellite Communications Network Management Solutions*, https://www.digisat.org/managed-network-services; Digisat, *Satellite Footprint Maps and Spot Beam Coverage Areas*, https://www.digisat.org/satellite-footprint-maps.

[681] Globecomm, *Globecomm Chosen by Broadcasting Board of Governors and Middle East Broadcasting Network for Direct-to-Home Services* (May 8, 2018), http://www.globecomm.com/news/press-releases/globecomm-chosen-broadcasting-board-governors-middle-east-broadcasting-network-direct-home-services/.

[682] Ultisat, *Custom Satellite Communications Solutions (CS3)*, https://ultisat.com/custom-satellite-communications-solutions-cs3; Ultisat, *Coverage*, https://ultisat.com/coverage.

[683] Artel, *Company*, https://www.artelllc.com/company/; Artel, *Complex SatCom Solutions—Bandwidth Procurement*, https://www.artelllc.com/solutions/satcom-complex-satcom/#tab-header|1; Artel, *Air Force Awards Artel $18.9M Contract for Commercial Satellite Communications* (Mar. 26, 2018), https://www.artelllc.com/air-force-awards-artel-18-9m-contract-for-commercial-satellite-communications/.

We note that we have limited reliable information about resellers or other suppliers and the types of satellite services provided by these entities in the communications marketplace.

[684] SIA Sept. 7, 2018 Comments at 23 (referring to Appendix B of the SIA State of the Satellite Industry Report (Prepared by Bryce Space and Technology, formerly Tauri Group Space and Technology)). SIA estimates that the U.S. share of global satellite services revenue in 2017 was 40%. *Id.* SIA's estimate of global satellite services revenue includes revenue derived from direct-to-consumer retail services (e.g., satellite TV, radio, and broadband), fixed and mobile satellite services, and Earth observation services. *Id.* at 21.

[685] DTH refers to television service provided in the FSS, rather than BSS, allocation. *See Policies and Rules for the Direct Broadcast Satellite Service*, Report and Order, 17 FCC Rcd 11331, 11333, para. 3 (2002).

Managed Services[686]	3.4	3.5	3.8	4.1	4.7
Transponder Agreements[687]	0.3	0.3	0.3	0.3	0.3
Mobile	0.4	0.4	0.5	0.5	0.6
Total	48.1	50.2	52.6	51.3	51.1

3. Examination of Satellite Communications Services and Providers

a. Fixed Satellite Service (FSS)

217. Intelsat, SES, Eutelsat, Telesat Canada, Echostar,[688] and ViaSat provide nearly all of the communications services in FSS spectrum in the United States.[689] Telesat Canada provides satellite services to the U.S. government, and provides Ka-band satellite capacity to ViaSat, which uses the capacity to provide broadband services in the United States.[690] ViaSat and Hughes both provide wholesale and retail commercial broadband services to customers in the United States.[691] Intelsat, Telesat Canada, SES, ViaSat, and EchoStar have high throughput satellites[692] serving in the North America region.[693]

[686] According to SIA, the revenue represented for "Managed Services" includes VSAT, mobility, and in-flight connectivity. SIA Sept. 7, 2018 Comments at 23.

[687] According to SIA, the revenue represented for "Transponder Agreements" includes capacity for DTH satellite TV and some mobility service platforms. *Id.*

[688] EchoStar provides its consumer broadband and managed services through its wholly-owned subsidiary, Hughes Network Services.

[689] Intelsat S.A., Form 20-F: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended December 31, 2017) at 6, 19 (*Intelsat Form 20-F*), http://investors.intelsat.com/phoenix.zhtml?c=131114&p=irol-SECText&TEXT=aHR0cDovL2FwaS50ZW5rd2l6YXJkLmNvbS9maWxpbmcueG1sP2lwYWdlPTEyMDgzNTgxJkRTRVE9MCZTRVE9MCZTUURFU0M9U0VDVElPTl9FTlRJUkUmc3Vic2lkPTU3; SES, *Our Services*, https://www.ses.com/north-america/our-services; Eutelsat, Find Your Satellite, https://www.eutelsat.com/en/satellites/find-your-satellite.html (Nov. 2, 2018); Telesat Canada, Form 20-F: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended December 31, 2017) at 8, 26 (*Telesat Form 20-F*), https://www.sec.gov/Archives/edgar/data/1465191/000161577418001535/s108785_20f.htm; EchoStar and Hughes Sept. 7, 2018 Comments at 2-4; *ViaSat Form 10-K* at 3; *2018 Broadband Deployment Report*, 33 FCC Rcd at 1676, para 51.

[690] *Telesat Form 20-F* at 32.

[691] *See* ViaSat, *Services*, https://www.viasat.com/services; EchoStar and Hughes Sept. 7, 2018 Comments at 3. Hughes states that it is "currently in the process of constructing EchoStar XXIV, its next-generation, Commission-licensed, ultra-high density satellite, which will provide expanded services to consumers throughout the United States and the Americas at speeds of 100 Mbps or more" and "is expected to begin service in 2021." EchoStar and Hughes Sept. 7, 2018 Comments at 4.

[692] Through the use of small beams, high throughput satellites are capable of reusing the same frequency band multiple times over their coverage area. This allows the use of more spectrum for each of its small beams and therefore making higher throughput available anywhere in its coverage area. Intelsat General, *Defining High Throughput Satellites (HTS)* (Mar. 25, 2013), https://www.intelsatgeneral.com/blog/defining-high-throughput-satellites-hts/; Hughes Network Systems, LLC, The View from JUPITER: High-Throughput Satellite Systems (2013) at 2, https://www.hughes.com/sites/hughes.com/files/2017-04/JUPITER_H50283_HR_08-01-13.pdf. For example, ViaSat indicates that "high-capacity satellite systems are designed to grow with that demand, providing more bandwidth capacity and throughput with higher internet service speeds, quality and reliability." ViaSat, *High-*

(continued….)

218. Some FSS operators, as well as some third-party integrators, supply a complete, end-to-end communications solution that includes ground facilities, terrestrial transmission links, and management of the end-to-end communications service. Intelsat, SES, Hughes, ViaSat, and Iridium are examples of satellite operators that provide managed services. FSS operators may offer specialized services in the form of managed networks by leasing existing satellite bandwidth and combining it with fully managed, end-to-end communications infrastructure, such as Very Small Aperture Terminal (VSAT) networks, machine-to-machine (M2M) platforms, and supervisory control and data acquisition (SCADA) applications.[694] Customers of third-party providers of managed satellite services include U.S. and foreign government agencies, government contractors, and commercial entities.[695] Examples of providers of these services include Digisat International Inc., Globecomm, Ultisat, Inc., and Artel, LLC. Managed services include satellite-based data communication networks that are operated by government, corporate, and other entities to provide a combination of data, voice, and video communications to widely separated or remotely located facilities through one or more transponders.[696]

219. *Broadband Satellite Services to Aircraft and Vessels*.[697] FSS operators provide broadband services to aircraft and maritime vessels, which include government organizations, commercial entities, and individual clients. For example, Intelsat and Telesat Canada offer broadband services for maritime vessels (including maritime enterprise VSAT services[698] and broadband connectivity for cruise ships), as well as broadband connectivity for in-flight entertainment and Wi-Fi services for the aeronautical industry.[699] SES and ViaSat provide broadband service on commercial airlines[700] and cruise

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Capacity Satellite System: Transforming Satellite Broadband, https://www.viasat.com/products/high-capacity-satellites.

[693] Euroconsult, 2018 Brochure: FSS Operators—Benchmarks & Performance Review at 5 (2018), http://euroconsult-ec.com/research/FSS-operators-2018-brochure.pdf.

[694] *See, e.g.*, SES, *Managed Services*, https://www.ses.com/networks/government/managed-services; Hughes, *Retail Petroleum*, https://business.hughes.com/what-we-do/industries/retail-petroleum; *EchoStar Form 10-K* at 1, 4; Intelsat General, *The Clear Trend Towards Managed Services* (Feb. 12, 2015), https://www.intelsatgeneral.com/blog/the-clear-trend-towards-managed-services/.

[695] *See, e.g.*, *Third Satellite Competition Report*, 26 FCC Rcd at 17304, paras. 41-42 (noting that value-added resellers provide managed services to government and corporate clients (e.g., U.S. Army, Federal Bureau of Investigation, commercial shipping) that need communications in "thin markets" or need to extend the reach of their corporate networks); Ultisat, *Ultisat to Provide USG Customer COMSATCOM Services to Support Homeland & Civil Defense Activities* (Oct. 23, 2018), https://ultisat.com/blog/ultisat-provide-usg-customer-comsatcom-services-support-homeland-civil-defense-activities; Globecomm, *Communications and Transmission Systems (CTS)*, http://www.globecomm.com/industries/government/communications-transmission-systems-cts/.

[696] *See Third Satellite Competition Report*, 26 FCC Rcd at 17290, para. 11, n.17.

[697] These services are being addressed here within the managed services category, but in some cases, they may be closer to the transponder service category, as the involvement of the satellite operator may be limited to simply leasing satellite capacity. *See infra* note 699 (describing Telesat's contractual relationship with Panasonic).

[698] Vessels can connect to the global communications network with VSAT technology, which provides crew and passengers with high-speed Internet access and phone service. VT iDirect, *The Coming Wave of Maritime VSAT Growth* (2015), https://www.satellitetoday.com//long-form-stories/maritime-vsat/.

[699] *Intelsat Form 20-F* at 24; Intelsat, *Mobility*, http://www.intelsat.com/solutions/mobility/; *Telesat Form 20-F* at 28, 32. For example, Telesat has a long-term contract with Panasonic Avionics Corporation (Panasonic) to provide satellite capacity to support Panasonic's in-flight entertainment and communications systems. *See* Telesat, *Panasonic Signs Long Term Contract For Multiple Transponders on Telesat Satellites to Expand Aeronautical Broadband Service Over Latin America* (Nov. 14, 2012), www.telesat.com/news-events/panasonic-signs-long-term-contract-multiple-transponders-telesat-satellites-expand. Likewise, Intelsat leases transponder capacity to GoGo. Intelsat, *Gogo Partners with Intelsat on Major Capacity Agreement Across Intelsat Globalized Network and Becomes Anchor Tenant for World's First GEO/LEO Shared Network* (Mar. 7, 2016),

(continued….)

ships.[701] Hughes also provides broadband service on commercial airlines.[702] According to SIA, a "[s]ubstantial share of in-flight and other managed services is provided by the same satellite operators that provide consumer satellite broadband services, their [High-Throughput System] capacity divided between the two types of service."[703]

220. FSS operators in the U.S. also provide transponder capacity for lease through complex contracts for variable quantities of bandwidth, frequency, orbital location, geographic coverage, power, and length of service of the transponders required by the customer.[704] Many wholesale customers of FSS operators only lease transponder capacity and self-supply their own earth stations and terrestrial links. Applications of leased transponder capacity include point-to-point transponder capacity for use by providers of media services, point-to-multipoint transmission of video programming to multichannel cable programming distributors, and the transport of point-to-point telecommunications transmissions to terrestrial telecommunications operators and corporate users.[705] Leased transponders can also be used for the provision of broadband to aircraft and vessels.

221. Satellite broadband providers Hughes and ViaSat play an increasingly important role in the efforts to close the digital divide across the United States, especially in the most rural and remote areas of the country, where it may be uneconomical to build terrestrial networks.[706] These operators now serve nearly 2 million subscribers and, as their infrastructure expands, they are increasing the speeds made available to consumers.[707] For example, the launches and commencement of service of the high throughput satellites Jupiter 2/EchoStar XIX and ViaSat-2 in the last two years by Hughes and ViaSat, respectively, have further increased 25 Mbps/3 Mbps satellite offerings.[708] The planned launches of next-generation GSO satellites Jupiter 3/EchoStar XXIV and ViaSat-3, and proposed low latency NGSO satellite constellations, may result in higher-speed satellite broadband offerings in the future.[709]

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http://www.intelsat.com/news/press-release/gogo-partners-with-intelsat-on-major-capacity-agreement-across-intelsat-globalized-network-and-becomes-anchor-tenant-for-worlds-first-geoleo-shared-network/.

[700] SES, Sky High Connectivity (2016), https://www.ses.com/sites/default/files/2016-10/Sky%20High%20Connectivity.pdf; *ViaSat Form 10-K* at 3-4.

[701] SES, *Maritime Powered by O3b*, https://www.ses.com/networks/maritime/maritime-powered-o3b; ViaSat, *High-Speed Internet Service for Maritime Markets*, https://www.viasat.com/services/maritime.

[702] Hughes, *Aeronautical Broadband Solutions*, https://www.hughes.com/what-we-do/by-industry/aeronautical-broadband-solutions.

[703] Satellite Industry Association, State of the Satellite Industry Report at 14 (2017), https://www.sia.org/wp-content/uploads/2017/07/SIA-SSIR-2017.pdf.

[704] *See Third Satellite Competition Report*, 26 FCC Rcd at 17292-99, paras. 15-35 (discussing complexities of output produced by commercial satellite operators). The pricing of transponder services and the specific attributes of the service to be supplied to the customer are bilaterally negotiated between the customer and the satellite operator. *Id.* at 17291-92, para. 14.

[705] *Id.* at 17296-97, paras. 26-28.

[706] SIA Comments, GN Docket No. 18-231, at 2 (Aug. 17, 2018) (SIA Aug. 17, 2018 Comments).

[707] *Id.*

[708] *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51; *EchoStar Form 10-K* at 8; *ViaSat Form 10-K* at 3; ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide.

[709] *ViaSat Form 10-K* at 3; Hughes, *EchoStar XXIV*, https://www.hughes.com/technologies/hughes-high-throughput-satellite-constellation/echostar-xxiv; SIA Sept. 7, 2018 Comments at 7.

b. Mobile Satellite Service (MSS)

222. Currently, five satellite operators provide MSS to the United States. Inmarsat, a global satellite service provider, as well as Ligado (formerly known as LightSquared), use GSO satellites to provide MSS within the contiguous United States (CONUS). Iridium, Globalstar, and ORBCOMM use a constellation of LEO satellites capable of providing global coverage.[710] Given the relatively little allocated bandwidth, MSS data services are more limited than the mobile data services offered in FSS spectrum bands.

223. Due to technological differences in how MSS operators provide services, their services vary significantly in characteristics, such as cost, geographic availability, required customer equipment, data bandwidth and allowances, two-way capabilities, latency, network reliability, customer support, and ease of use.[711] According to SIA, in 2017 MSS generated approximately $600 million in U.S. revenues ($4.0 billion globally).[712]

224. *MSS via GSO Satellites*. The Commission issues licenses authorizing GSO satellites to operate MSS in the 1525-1559 MHz and 1626.5-1660.5 MHz bands of the L-band, and in the 2000-2020 MHz and 2180-2200 MHz bands of the 2 GHz MSS band.[713] Currently, two MSS GSO operators provide service to the United States. Inmarsat is the largest MSS operator, providing extensive voice, video, and data communications services to mobile earth stations using GSO satellites, six of which have been granted access to the U.S. market.[714] Ligado provides some services in the United States that could be considered IoT, using the SkyTerra 1 satellite.[715]

225. *MSS via LEO Satellites*. The Big LEO bands consist of the 1610-1626.5 MHz band and the 2483.5-2500 MHz band.[716] The Big LEO systems of Iridium and Globalstar provide low-latency voice and data services to portable handsets and other devices. Iridium, with its constellation of 66 satellites, provides low-latency mobile voice, data, and IoT communications services with fully global coverage.[717] Iridium provides services to industries such as maritime, aviation, government/military,

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[710] Iridium, *Iridium Global Network*, https://www.iridium.com/network/globalnetwork/; Globalstar, *Our Technology*, https://www.globalstar.com/en-us/corporate/about/our-technology; ORBCOMM, *ORBCOMM OG2 Next-Generation Satellite Constellation*, https://www.orbcomm.com/en/networks/satellite/orbcomm-og2.

[711] *See, e.g.*, SIA, Satellite 101: Satellite Technology and Services at 25 (identifying MSS satellite systems and locations where MSS operators provide coverage) (*Satellite 101*), https://www.sia.org/wp-content/uploads/2014/11/Website-Refresh14-Satellite-101.pdf; Inmarsat Plc, Annual Report and Accounts (2017) at 2-3, https://investors.inmarsat.com/results-centre/2017-results; Iridium Communications, Inc., Form 10-K: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended December 31, 2017) at 2-5 (*Iridium Form 10-K*), https://www.sec.gov/Archives/edgar/data/1418819/000141881918000005/irdm_12312017x10k.htm; Globalstar, 10-K Report: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the Fiscal Year Ended December 31, 2017) at 3-5 (*Globalstar Form 10-K*), https://www.globalstar.com/en-us/corporate/investors/sec-filings?page=2.

[712] SIA Sept. 7, 2018 Comments at 21, 23.

[713] 47 CFR § 25.103.

[714] FCC, Space Station Approval List (updated Dec. 3, 2018), https://www.fcc.gov/approved-space-station-list (*FCC Space Station Approval List*).

[715] Ligado Networks, Next Generation Networks Powering 5G and the Industrial Internet of Things at 9, https://ligado.com/wp-content/uploads/MarketVision-2018.pdf.

[716] *See Amendment of the Commission's Rules to Establish Rules & Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, CC Docket No. 92-166, Report and Order, 9 FCC Rcd 5936 (1994), *recon.*, 11 FCC Rcd 12861 (1996).

[717] *Iridium Form 10-K* at 4-5, 16-19; Iridium, *Iridium Edge*, https://www.iridium.com/products/iridium-edge/.

emergency/humanitarian services, mining, forestry, oil and gas, heavy equipment, transportation and utilities.[718] According to Iridium, it provides "highly reliable and secure communications that are critical for public safety, whether through daily aviation and maritime communications or in facilitating disaster response and recovery after major disasters."[719] According to Globalstar, it uses its fleet of 24 second generation satellites to provide two-way voice and data and one-way IoT low-latency services for much of North America, Europe, South America, Australia, and limited parts of Asia and Africa.[720]

226. The Little LEO bands consist of the 137-138 MHz, 400.15-401 MHz bands, and 148-150.5 MHz. Orbcomm's Little LEO system provides data services, including M2M and IoT, that remotely track, monitor, and control fixed and mobile assets.[721] Little LEO systems are restricted to non-voice low data rate services because of the relatively small uplink bandwidth and the fact that they must operate in spectrum shared with terrestrial mobile operations.[722] Non-GSO LEO systems offer much lower latency due to their low earth orbit, which is useful for satellite voice telephony and interactive data applications, and require smaller antennas.[723]

c. Earth Exploration Satellite Service (EESS)

227. Five companies operate or plan to operate Earth observation satellites that the Commission authorized as EESS: Planet Labs, Spire Global, DG Consents Sub, Inc. (part of Digital Globe, a subsidiary of Maxar), BlackSky, and Astro Digital U.S.[724] Some of these companies operate or plan to operate large numbers of satellites. For example, Planet Labs has authorization for 544 satellites (of which approximately 150 satellites are currently in orbit),[725] and Spire Global has authorization for 1,000 satellites (of which approximately 62 satellites are currently in orbit).[726] These satellites are situated in Low Earth Orbit, and many are small satellites.

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[718] Iridium, *Company Profile*, https://www.iridium.com/company-info/companyprofile/.

[719] Iridium Comments at 2.

[720] Globalstar, *Mission Accomplished! Globalstar Announces Successful Fourth Launch of Six Second-Generation Satellites* (Feb. 6, 2013), https://www.globalstar.com/en-us/corporate/press/release-archive?pr=775&region=en-ca; *Globalstar Form 10-K* at 3-4, 6, 18; Globalstar, *Our Technology*, https://www.globalstar.com/en-us/corporate/about/our-technology; Globalstar, *Coverage*, https://www.globalstar.com/en-us/products/coverage-maps.

[721] Orbcomm, *Satellite IoT and M2M Networks*, https://www.orbcomm.com/en/networks/satellite; Orbcomm, *Orbcomm*, https://www.orbcomm.com/; ORBCOMM Inc., 10-K Report: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended December 31, 2017) at 5, 9, http://investors.orbcomm.com/node/11671/html.

[722] *Third Satellite Competition Report*, 26 FCC Rcd at 17315, para. 71.

[723] European Commission, Low-Earth Orbit Satellites: Spectrum Access (2017) at 3, https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_LEO%20-%20Spectrum%20access%20v1_0.pdf.

[724] *FCC Space Station Approval List*.

[725] *Id.*; Planet, *FAQs*, https://www.planet.com/faqs/.

[726] *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 32 FCC Rcd 5579 (2017); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 32 FCC Rcd 4048 (2017); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 32 FCC Rcd 3034 (2017); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 31 FCC Rcd 11768 (2016); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 31 FCC Rcd 6985 (2016); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 31 FCC Rcd 2183 (2016); *Policy Branch Information, Satellite Space Applications Actions Taken*, IBFS File Nos. SAT-LOA-20151123-00078 and SAT-AMD-20180102-00001, Public Notice, DA 18-1235 (2018) (granting in part and deferring in part Nov. 29, (continued….)

228. Planet Labs operates satellites that capture frequent high-resolution optical images of the Earth for various purposes, including agriculture and disaster relief.[727] Spire Global operates satellites that provide weather data and the location of ships and planes in remote locations.[728] DigitalGlobe, using five satellites, provides optical high-resolution imaging with the ability to revisit the same location relatively frequently.[729] BlackSky, a fully-owned subsidiary of Spaceflight Industries, plans to deploy a constellation of 60 satellites over the next several years to enable frequent revisit rates (forty to seventy times a day in some places) over 95% of the Earth's population. BlackSky plans to provide color imagery at a resolution of one meter (one square meter equals one image pixel) to make it easier to see such activity as ships in ports, earthquake damage, or herd migration.[730] Astro Digital has one satellite in orbit and plans for up to 30 satellites in its Landmapper constellation, which will optically image all agricultural land daily.[731] According to SIA estimates, in 2017, Earth observation revenues in the United States were $1.0 billion.[732]

4. Recent Changes and Trends

a. Developments in Satellite Communications Services and Technologies

229. *Satellite Services*. In recent years, there has been an expanded interest in NGSO orbits, ESIMs, and commercial use of small, short-duration satellites for the provision of broadband services to remote locations, Earth observation, and IoT. Some operators are planning to provide services, such as intersatellite connectivity, to other satellite service providers to provide data backhaul or satellite mission extension capability. As discussed below, the Commission has taken actions to remove regulatory

(Continued from previous page)
2018); Spire, *Rocket Lab Successfully Completes First Commercial Launch with Spire* (Nov. 12, 2018), https://spire.com/company/insights/news/rocket-labs-successfully-completes-first-commercia/.

[727] Michael Baylor, *Planet Labs Targets a Search Engine of the World* (Jan. 29, 2018), https://www.nasaspaceflight.com/2018/01/planet-labs-targets-search-engine-world/; GIS Geography, *Planet Labs Imagery: The Entire Earth, Everyday* (last updated Apr. 21, 2018), https://gisgeography.com/planet-labs-imagery/.

[728] Lora Kolodny, *A Start-Up Fighting Pirates with Satellites Just Raised $70 Million* (Nov. 16, 2017), https://www.cnbc.com/2017/11/16/spire-global-raises-70-million-to-stop-pirates-with-satellites.html; Spire, *Space to Cloud—Data & Analytics*, https://spire.com/; Spire, *GNSS-RO & GPS-RO*, https://spire.com/data/weather/?spirepedia=gnss-ro-gps-ro.

[729] Digital Globe, *About Us—Our Constellation*, https://www.digitalglobe.com/about/our-constellation; Digital Globe, The DigitalGlobe Constellation (2018), https://dg-cms-uploads-production.s3.amazonaws.com/uploads/document/file/223/Constellation_Brochure_2018.pdf.

[730] BlackSky, *Black Sky*, www.blacksky.com.

[731] One part of the constellation (Landmapper-HD, a constellation of 20 satellites) will optically image all agricultural land at 2.5 meters resolution. Another part of the constellation (Landmapper-BC, a constellation of 5 to 10 satellites) will image all agricultural land daily at 22 meters resolution. Astro Digital, Annual Report (2018), https://licensing.fcc.gov/myibfs/download.do?attachment_key=1435981; Astro Digital, IBFS File No. SAT-LOA-20170508-00071, Exhibit 43; Peter B. de Selding, *Astro Digital Reduces Planned Constellation and by Maximizing Use of Europe's Sentinels & Landsat 8 Satellites* (Aug. 7, 2018), https://www.spaceintelreport.com/astro-digital-reduces-planned-constellation-by-maximizing-use-of-europes-sentinels-landsat-8-satellites/. Astro Digital satellites will travel in sun-synchronous orbit (SSO). SSO is a nearly polar orbit that allows satellites to pass over the same location each day, always in sunlight, which "lets the satellites see as much of the Earth as possible each day, let[]s the satellites see our ground station on every orbit, and maintains consistent image capture time for every place on Earth." Astro Digital, *Why sun synch orbit?* (Jul. 19, 2017), https://blog.astrodigital.com/why-sun-synch-orbit-f5c7cb74a5da.

[732] SIA Sept. 7, 2018 Comments at 23.

barriers in order to enable market-based efficient use of spectrum and facilitate the deployment of these systems.[733]

230. *Technological Developments*. Recent trends in the satellite industry include the increased use of LEO and MEO satellite systems. For example, by December 2018, Iridium is scheduled to have replaced its existing fleet of 66 LEO satellites with a new fleet of 75 LEO satellites (including, nine on-orbit spare satellites), collectively known as the Iridium NEXT constellation.[734] Other developments include new satellite launch technologies, and next generation high throughput satellite systems (i.e., GSO systems with spot beams that enable higher power transmission and spectrum reuse providing greater bandwidth availability).[735] LEO and MEO systems differ from GSO systems in their reduced power requirements and lower latency. As discussed below, a number of applications for LEO and MEO NGSO systems are pending with or have recently been approved by the Commission. Further, there have been advances in launch technology, including the development of reusable hardware and vehicles designed to launch smaller satellites.[736] In addition, several new high throughput systems have been recently launched. For example, EchoStar XIX, a high-throughput geostationary satellite employing a multi-spot beam, bent pipe Ka-band architecture, was launched in December 2016 and commenced service in March 2017.[737] ViaSat-2, a high-capacity Ka-band Spot-beam satellite, was launched in June 2017 and commenced service in February 2018.[738]

231. *Other Developments.* The current period of innovation in the space industry has resulted and will likely continue to result in a significant increase in the number of satellites and types of operations in orbit. The development of less expensive delivery systems, along with the production of small imaging satellites such as CubeSats, has lowered the cost of entry into the satellite imaging business.[739] The Commission has implemented amateur and experimental satellite rules to facilitate use of satellites for scientific and research missions and experimental testing.[740] The Commission recently

[733] *See infra* Section III.

[734] *See* Iridium, *Iridium Completes Seventh Successful Iridium® NEXT Launch* (Jul. 25, 2018) http://investor.iridium.com/2018-07-25-Iridium-Completes-Seventh-Successful-Iridium-R-NEXT-Launch; Caleb Henry, *Final Iridium Next Launch Scheduled for Dec. 30 Falcon 9 Mission* (Oct. 18, 2018), https://spacenews.com/final-iridium-next-launch-scheduled-for-dec-30-falcon-9-mission/.

[735] Organisation of Economic Cooperation and Development (OECD), *The Evolving Role of Satellite Networks in Rural and Remote Broadband Access* (2017) at 17, https://www.oecd-ilibrary.org/science-and-technology/the-evolving-role-of-satellite-networks-in-rural-and-remote-broadband-access_7610090d-en.

[736] *Id.* at 21-22.

[737] *EchoStar Form 10-K* at 8.

[738] *ViaSat Form 10-K* at 3; ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide.

[739] *See Streamlining Licensing Procedures for Small Satellites*, IB Docket 18-86, Notice of Proposed Rulemaking, 33 FCC Rcd 4152, 4155 at para. 5 (2018) (noting "[i]n the last 15 years . . . the miniaturization of components and the ability of small satellite developers to capitalize on commercial off-the-shelf equipment has enabled smaller, cheaper satellites to be built and launched into space") (*Small Satellites NPRM*); The Aerospace Corporation, Small Satellite Technology: Industry Update (May 15, 2014), https://www.nesdis.noaa.gov/CRSRA/files/Cubesat_ACCRES-15May2014_final_v2.pdf.

[740] The Commission's rules set forth three different procedures for licensing satellites. Part 25 of the Commission's rules govern licensing and operation of space stations and earth stations for the provision of satellite communication services, including commercial communication and remote sensing satellites. 47 CFR §§ 25.101-25.702. Part 5 of the Commission's rules govern experimental operations. 47 CFR §§ 5.1-5.602. Part 97 of the Commission's rules govern amateur radio service satellite operations. *See generally* 47 CFR §§ 97.111-97.117, 97.207. *See also Guidance On Obtaining Licenses For Small Satellites*, Public Notice, 28 FCC Rcd 2555 (2013).

proposed rules designed to facilitate commercial deployment of small satellites (many of which seek to operate in the EESS) by reducing application processing times and lowering application processing fees, while offering protection for critical communication links and enabling efficient use of spectrum.[741] There is also ongoing development of optical laser technologies for satellite communications, which may well enhance the capacity, flexibility, and reliability of satellite communications.[742] Proposed deployments of large satellite constellations in the intensely used LEO region, along with other satellites deployed in the LEO region, will have the potential to increase the risk of debris-generating events.[743] On November 15, 2018, the Commission undertook the first comprehensive look at the Commission's orbital debris rules since their adoption in 2004, and proposed changes to improve and clarify these rules based on experience gained in the satellite licensing process and on improvements in mitigation guidelines and practices.[744]

b. Recently Granted and Proposed NGSO FSS Systems

232. In 2017 and 2018, the Commission has approved a number of NGSO FSS MEO and LEO systems for operation in the U.S. market—completing a regulatory prerequisite for setting up such systems to serve U.S. customers. According to the applications filed with the Commission, these systems would serve a variety of purposes, such as the provision of high-throughput, low-latency broadband services to remote locations, satellite mission extension services, and inter-satellite connectivity. The authorization of a number of these systems furthers the Commission's efforts to close the digital divide across the United States.

233. For example, in 2017, the Commission adopted an order granting market access[745] to WorldVu d/b/a OneWeb for its NGSO FSS system of 720 satellites, which OneWeb plans to use to further its goal to "provide high-speed, affordable broadband connectivity to anyone, anywhere" in the United States.[746] Also, the Commission granted the request of Space Norway AS (Space Norway) to access the U.S. market using a two-satellite NGSO FSS system, in a highly-elliptical orbit, to enable

[741] *See generally Small Satellites NPRM*.

[742] *See* TNO, *Superfast Internet Using Laser Satellite Communications*, (May 18, 2018), https://www.tno.nl/en/tno-insights/articles/superfast-internet-using-laser-satellite-communications/; Sydney J. Freedberg, Jr., *Army, NASA Want Want Laser Micro-Satellites For 50 Times The Bandwidth* (Aug. 2, 2018), https://breakingdefense.com/2018/08/army-nasa-want-laser-micro-satellites-for-50-times-the-bandwidth/. *See Small Satellites NPRM*, 33 FCC Rcd at 4176, para. 58; Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, IBFS File No. SAT-LOA-20161115-00118 (filed Nov. 15, 2016), Narrative at 2 ("The system will also employ optical inter-satellite links for seamless network management and continuity of service, which will also aid in complying with emissions constraints designed to facilitate spectrum sharing with other systems.").

[743] *Mitigation of Orbital Debris in the New Space Age; Mitigation of Orbital Debris*, IB Docket No. 18-313, IB Docket No. 02-54 (Terminated), Notice of Proposed Rulemaking and Order on Reconsideration, FCC 18-159, para. 9 (rel. Nov. 19, 2018) (*Orbital Debris NPRM*). Orbital debris, also known as "space debris," consists of artificial objects orbiting the Earth that are not functional spacecraft. *Id.* at para. 2

[744] *Id.* at para. 3.

[745] In 1997, the Commission developed a market access procedure to facilitate the participation of non-U.S.-licensed satellite systems in the U.S. market even though such systems do not have a U.S. space station license. Favorable action on such a request is in the nature of a policy statement or declaratory ruling, which enables access to by the space station to spectrum in the United States and to U.S.-licensed earth stations, subject to public interest considerations. *WorldVu Order and Declaratory Ruling*, 32 FCC Rcd at 5366, para. 2, n.3; *see also Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Satellites to Provide Domestic and International Service in the United States*, Report and Order, 12 FCC Rcd 24094, 24106, 24173-74, paras. 29, 184-188 (1997).

[746] *WorldVu Order and Declaratory Ruling*, 32 FCC Rcd at 5366, para. 1; WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb System, IBFS File No. SAT-LOI-20160428-00041, Narrative at 1 (filed Apr. 28, 2016) (WorldVu Petition).

Space Norway to pursue its goal of providing broadband Internet access to currently unserved and underserved communities in the Arctic region of the United States.[747] In addition, the Commission granted the request of Space Logistics, LLC to construct, deploy, and conduct telemetry, tracking and command functions with its mission extension vehicle (MEV-1), which provides services to other satellite operators.[748] In 2018, the Commission granted O3b Limited's request to expand its grant of U.S. market access for its NGSO constellation in order to allow O3b to pursue its goal of expanding broadband Internet access to communities across the United States.[749] The Commission also authorized Audacy to construct, deploy, and operate a NGSO satellite system to provide continuous, high-speed communications between other NGSO satellites and gateway earth stations, using frequencies in intersatellite service (ISS) and FSS spectrum bands.[750] In addition, the Commission authorized Karousel Satellite LLC to construct, deploy and operate an NGSO FSS system comprising twelve satellites for the provision of video and data distribution around the world.[751]

234. On November 15, 2018, the Commission adopted a number of Orders granting the applications of NGSO FSS LEO systems for market access. Specifically, the Commission (1) granted Kepler's request for U.S. market access to offer global connectivity for the Internet of Things using a proposed constellation of 140 NGSO LEO satellites;[752] (2) granted Telesat Canada's request to access the U.S. market to provide broadband services using a proposed constellation of 117 NGSO LEO satellites;[753] and (3) granted LeoSat's request for U.S. market access to provide satellite broadband services in the United States using a proposed constellation of 78 NGSO LEO satellites, including high-speed connectivity for enterprises.[754] The Commission also granted SpaceX's application to construct, deploy

[747] *Space Norway AS Order and Declaratory Ruling*, 32 FCC Rcd at 9649, 9659, paras. 1, 22; Space Norway AS, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission, IBFS File No. SAT-PDR-20161115-00111, Narrative at 1, 12-14 (filed Nov. 15, 2016) (Space Norway AS Petition).

[748] *Policy Branch Information, Satellite Space Actions Taken*, Public Notice, 32 FCC Rcd 10270 (2017) (granting in part and deferring in part, with conditions). According to Space Logistics, the MEV-1 "has the capability to service multiple in-orbit satellites in geosynchronous orbit ('GSO') by cooperatively docking with the satellites and performing the station keeping and attitude control functions for the satellites as a combined vehicle stack ('CVS')." Space Logistics, Application of Space Logistics, LLC for Authority to Launch and Operate a Mission Extension Vehicle, IBFS File No. SAT-LOA-20170224-00021, Narrative at 1 (filed Feb. 24, 2017).

[749] *O3b Modification Order*, 33 FCC Rcd at 5508, 5525 at paras. 1, 44. According to O3b, "O3b's system offers satellite capacity and low-latency, high-throughput connectivity—generally ten to one-hundred times the throughput of a traditional satellite—to Internet service providers, telecom operators, large enterprises and governments, to enable fast, flexible and affordable broadband connectivity in locations unserved or underserved by other broadband services, such as fiber and mobile networks." O3b Limited, Modification to U.S. Market Access Grant for the O3b MEO Satellite System, IBFS File No. SAT-MOD-20160624-00060, Narrative at 13-14 (filed June 24, 2016).

[750] *Audacy Authorization Order*, 33 FCC Rcd at 5554, para. 1. According to Audacy, anticipated users would include operators of Earth observation satellites, launch providers, and operators of large LEO constellations. Audacy Corporation, Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services, IBFS Filing No. SAT-LOA-20161115-00117, Narrative at 2 (filed Nov. 15, 2016); *Audacy Authorization Order*, 33 FCC Rcd at 5554, 5571, paras. 1, 38.

[751] *See Karousel Authorization Order*. The system would "deploy a novel video and data distribution service to rural consumers in the United States and around the world who lack access to adequate or affordable broadband connectivity." *Id.* at para. 1.

[752] *Kepler Communications Inc. Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System*, Order and Declaratory Ruling, FCC 18-162 (rel. Nov. 19, 2018) (*Kepler Order and Declaratory Ruling*).

[753] *See Telesat Canada V-Band NGSO Order and Declaratory Ruling*.

[754] *See LeoSat Order and Declaratory Ruling*. In its petition for declaratory ruling, LeoSat stated that it will "ensure access to new broadband services for remote and underserved communities in Alaska, Hawaii, Puerto Rico, and the (continued….)

and operate a proposed NGSO satellite system using frequencies in the V-band, which will provide SpaceX with additional flexibility to provide both diverse geographic coverage and the capacity to support a wide range of proposed broadband and communications services in the United States and globally.[755]

235. In addition, a number of applications for NGSO FSS MEO and LEO systems for market access are pending with the Commission: (1) ViaSat filed a petition for declaratory ruling requesting market access for a 24-satellite NGSO MEO system;[756] (2) New Spectrum filed a letter of intent requesting market access for a 15-satellite NGSO inclined elliptical orbit system that it intends to use to provide "state-of-the-art, affordable, digital fixed satellite services directly to users," including "high-speed Internet access at megabit rates, video and broadband data distribution, and two-way video conferencing and content delivery via streaming";[757] (3) OneWeb filed a petition for declaratory ruling requesting market access for its next-generation V-band satellites for its NGSO system to provide broadband connectivity;[758] and (4) Hiber applied for market access for a 24-satellite NGSO system for IoT using MSS frequencies.[759] Currently, one application is pending for licensing or market access for additional satellites or frequencies for approved NGSO EESS systems.[760]

G. Broadband Deployment

236. American consumers rely on the Internet for virtually every facet of daily life. Connection via high-speed broadband is an important gateway to employment, education, entertainment, healthcare, and economic development. Americans expect accessibility to broadband at home, at work, and while on the go. Efforts to close the digital divide—reducing regulatory barriers to the deployment of wireline and wireless infrastructure, increasing universal service funding, and expanding access to spectrum for broadband services—are essential to spur broadband deployment to all American communities.

237. This Chapter assesses the state of broadband deployment, including deployment of advanced telecommunications capability, fulfilling the statutory directive.[761] Overall, the available data

(Continued from previous page)
U.S. Virgin Islands" and that its network will deliver "enterprise-to-enterprise communications, Internet and 5G/4G cellular backhaul, video content delivery, oil field services and operations, and maritime communications." LeoSat, Petition for Declaratory Ruling to Permit U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System, IBFS File No. SAT-PDR-20161115-00112, Narrative at 1-4 (filed Nov. 15, 2016).

[755] *See SpaceX V-band NGSO Authorization Order*.

[756] ViaSat, Inc., Petition for Declaratory Ruling Granting Access to the U.S. for a Non-U.S.-Licensed Nongeostationary Orbit Satellite Network, IBFS File No. SAT-PDR-20161115-00120 (filed Nov. 15, 2016).

[757] New Spectrum Satellite, Ltd., Letter of Intent of New Spectrum Satellite, Ltd. For a Global Fixed Satellite Service System Employing Nongeostationary Satellites in Sub-Geosynchronous Elliptical Orbits, IBFS File No. SAT-PDR-20170726-00111, Narrative at 8 (filed Jul. 26, 2017).

[758] WorldVu Satellites Limited, Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb V-Band System, IBFS File No. SAT-LOI-20170301-00031 (filed Mar. 1, 2017).

[759] Hiber Inc., Petition for Declaratory Ruling to Access U.S. Market Using the Hiberband Low-Earth Orbit System, IBFS File No. SAT-PDR-20180910-00069 (filed Sept. 10, 2018).

[760] Theia Holdings A, Inc., Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service, and Earth Exploration Satellite Service, IBFS File No. SAT-LOA-20161115-00121 (filed Nov. 15, 2016).

[761] *See* 47 U.S.C. § 163(a), (b)(2). This Chapter is not intended to fulfill the Commission's statutory responsibility under section 706 of the Telecommunications Act of 1996 to "determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion." 47 U.S.C. § 1302(b). The Commission intends to complete the inquiry initiated in August by releasing a Broadband Deployment Report to fulfill this section 706 obligation. *See Fourteenth Notice*, FCC 18-119.

shows that Internet service providers deliver high-quality broadband to most Americans, but additional work remains to close the digital divide.

1. Scope of Reporting

238. To assess deployment, we employ a holistic examination of fixed and mobile services over a five year period (2013-2017) using the same four categories for evaluation that were presented in the *2018 Broadband Deployment Report*: (1) fixed services only; (2) mobile LTE services only; (3) fixed *and* mobile LTE services; and (4) fixed *or* mobile LTE services.[762]

239. To assess the state of deployment of advanced telecommunications capability, we rely on the *2018 Broadband Deployment Report*'s fixed service speed benchmark of 25 Mbps/3 Mbps adopted by the Commission.[763] The *2018 Broadband Deployment Report* found that fixed services meeting this speed benchmark satisfy the section 706 definition of advanced telecommunications capability; that is, such services "enable[] users to originate and receive high-quality voice, data, graphics and video telecommunications."[764] Because the RAY BAUM'S Act of 2018 requires a more holistic assessment of broadband deployment, we also provide deployment figures for 10 Mbps/1 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps fixed service. Showing broadband deployment in additional speed tiers year over year is helpful to assess the pace and patterns of deployment.[765]

240. With respect to mobile services, the *2018 Broadband Deployment Report* found that adoption of a single speed benchmark for advanced telecommunications capabilities is inappropriate given the inherent variability of the mobile experience,[766] combined with data limitations and methodological issues.[767] Therefore, consistent with the *2018 Report*, to reasonably evaluate the progress of high-speed mobile deployment, we present LTE coverage data based on the Form 477 minimum advertised speeds of 5 Mbps/1 Mbps, and then supplement our analysis with Ookla's actual speed test data with a median speed of 10 Mbps/3 Mbps or higher.[768] Given the limitations on mobile broadband speed data availability, at this point in time we are unable to present various speed thresholds that are similar to the data presentation for fixed broadband.[769]

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[762] *2018 Broadband Deployment Report*, 33 FCC Rcd at 1678, 1708, paras. 45-46. The Commission's holistic approach in the *2018 Broadband Deployment Report* considered improvements to deployment over time; however, the data for 2012 and 2013 are not directly comparable to the data collected by the Commission since 2014. *Id.* at 1678, paras. 45-46.

[763] *Id.* at 1667-68, para. 21.

[764] *Id.* at 1667-68, para. 21.

[765] *Id.* at 1667, 1678, 1686, paras. 20, 45, 57.

[766] *Id.* at 1670-71, 1673-74, paras. 27, 34. The Commission noted that network speed is one of the key characteristics of mobile wireless performance, and mobile broadband speeds experienced by consumers may vary greatly with a number of factors, including the service provider's received signal quality, cell traffic loading, and network capacity in different locations. In addition, mobile broadband speeds can vary with the capability of consumers' devices. *Id.* at 1672, para. 30.

[767] *Id.* at 1673-74, para. 34.

[768] *Id.* at 1670-71, 1672-74, paras. 27, 31-34, n.97.

[769] Unlike the Form 477 data for fixed services, wireless service providers submit coverage shape files and report the minimum advertised speed associated with the coverage area. We supplement the Form 477 data with crowd-sourced speed test data from Ookla. However, there are counties where few speed tests are observed in the Ookla data. Thus, we do not evaluate whether the median download and upload speeds exceed 10 Mbps/3 Mbps in these counties because the sample of tests is insufficient. In this regard, the Ookla data do not permit an evaluation of wireless service speeds for the overall population of Americans in the same manner as the Form 477 data.

2. Data Sources and Methodologies

241. We rely primarily upon the Commission's Form 477 data to evaluate deployment, which are the most accurate data available to the Commission.[770] For deployment data prior to 2014, we rely on data from the State Broadband Initiative (SBI), which, prior to the Commission's revision of the Form 477 data collection, were the most comprehensive and geographically granular deployment data publicly available.[771] Unless otherwise noted, we rely upon year-end data for our analysis.

242. The Form 477 fixed deployment data and the SBI data report service at the census block level.[772] For purposes of this Chapter, a whole census block is classified as served if Form 477 or SBI data indicate that service can be provided anywhere in the census block. Therefore, it is not necessarily the case that every household,[773] housing unit, or person will have coverage for a service in a census block that this Chapter indicates is served.[774] Furthermore, although staff examine Form 477 data for quality and consistency, the data may understate or overstate deployment of services to the extent that broadband providers fail to report or misreport data.[775] Staff evaluate deployment data for fixed terrestrial services using 2010 census block population data that the Commission staff has updated to account for population growth and economic development.[776] We present an analysis of deployment data for fixed terrestrial

[770] *See supra* Section II.D.

[771] *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. 11-121, Eighth Broadband Progress Report, 27 FCC Rcd 10342, 10364-65, para. 28 (2012). The SBI data were collected semi-annually through state-led efforts and maintained by the National Telecommunications and Information Administration for the National Broadband Map, in collaboration with the Commission. *Id.* at 10365, para. 28.

[772] For purposes of this form, fixed broadband connections are available in a census block if the provider does, or could, within a service interval that is typical for that type of connection—that is, without an extraordinary commitment of resources—provision two-way data transmission to and from the Internet with advertised speeds exceeding 200 kbps in at least one direction to end-user premises in the census block. FCC, FCC Form 477 Local Telephone Competition and Broadband Report Instructions at 17 (2016), https://transition.fcc.gov/form477/477inst.pdf.

[773] A household consists of all the people who occupy a housing unit. A house, an apartment or other group of rooms, or a single room, is regarded as a housing unit when it is occupied or intended for occupancy as separate living quarters; that is, when the occupants do not live with any other persons in the structure and there is direct access from the outside or through a common hall. U.S. Census, Current Population Survey Subject Definitions (Aug. 25, 2018), https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household.

[774] We note that these coverage estimates represent deployment of networks to consumers and do not indicate the extent to which service providers affirmatively offer service to residents in the covered areas. Further, this analysis likely overstates the coverage experienced by some consumers, especially in large or irregularly shaped census blocks. We therefore acknowledge that this analysis may overstate or understate the deployment of fixed and mobile services. *See 2018 Broadband Deployment Report*, 33 FCC Rcd at 1677, para. 43.

[775] *See* Federal Communications Commission, *Explanation of Broadband Deployment Data* (Nov. 20, 2017), https://www.fcc.gov/general/explanation-broadband-deployment-data (describing quality and consistency checks performed on providers' submitted data and explaining any adjustments made to the Form 477 data as filed).

[776] Commission Staff developed population estimates for 2011-2017 by updating the 2010 census block population estimates. These estimates are based upon annual U.S. Census mid-year county (or county-equivalent) level population and housing unit estimates for the fifty states, the District of Columbia, and Puerto Rico. These data are used in conjunction with U.S. Census Bureau Tiger data to indicate new roads, i.e., new housing development, to distribute population amongst the census blocks comprising each county (or county-equivalent). Federal Communications Commission, Staff Block Estimates, https://www.fcc.gov/reports-research/data/staff-block-estimates.

services and for mobile LTE. In general, we report data separately on the U.S. Territories because the data for 2017 may significantly overstate current deployment in Puerto Rico and the U.S. Virgin Islands, which account for over 92% of the total combined population of the U.S. Territories. We are uncertain as to the current deployment of broadband services in these areas given the damage to infrastructure in Puerto Rico and the U.S. Virgin Islands from Hurricanes Maria and Irma in 2017.

243. *Fixed Terrestrial Services.* Using the available Form 477 data since 2014, we evaluate deployment of fixed terrestrial services with a minimum advertised speed of 10 Mbps/1 Mbps, 25 Mbps/3 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps. For 2013, which pre-dates the current version of the Form 477 data collection, we evaluate deployment of fixed terrestrial services using SBI data. The SBI data collection compiled data on 25 Mbps/3 Mbps and 100 Mbps/10 Mbps, but not the other download and upload speed combinations reported in this Chapter.[777] Therefore, where applicable, we use the most comparable speed combinations collected in the 2013 SBI data as reasonable proxies. For 10 Mbps/1 Mbps, we use SBI reported speed of 10 Mbps/768 kbps, and for 50 Mbps/5 Mbps, we use the SBI reported speed of 50 Mbps/6 Mbps. The SBI data does not include a reasonable proxy for 250 Mbps/25 Mbps, so we do not report data at that speed for 2013. Finally, we use Form 477 subscriber data to calculate adoption rates for fixed terrestrial services.

244. *Satellite Services.* The Form 477 deployment data for satellite broadband indicate that satellite service offering 25 Mbps/3 Mbps speeds is available to nearly all the population.[778] These data could overstate the deployment of these services.[779] In Appendix F, we provide deployment estimates for all fixed services, including satellite, from 2014 to 2017.[780]

245. *Mobile services.* While recognizing certain limitations of the Form 477 data, our Form 477 LTE technology coverage data are the most reliable and comprehensive data that we have to assess the deployment of mobile LTE to American consumers at a minimum advertised speed of 5 Mbps/1 Mbps.[781] For 2013, we use SBI data, which only include a speed component for mobile services,[782] while

[777] The fixed terrestrial estimates using the SBI data 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), Fixed Terrestrial Wireless (provisioned/equipped over licensed spectrum or over spectrum used on an unlicensed basis), Electric Power Line, and All Other. For 2013, we exclude the satellite service data from our analysis because the SBI data for satellite services have significant inconsistencies in the data. *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, 1416, para. 76 (*2015 Report*).

[778] More specifically, the Form 477 deployment data for satellite broadband indicate that satellite service offering 25 Mbps/3 Mbps speeds is available to all but 0.03% of the population.

[779] *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51, n.148. While satellite signal coverage may enable operators to offer services to wide swaths of the country, overall satellite capacity may limit the number of consumers that can actually subscribe to satellite service at any one time. *See Fourteenth Notice*, FCC 18-119, para. 17, n.46.

[780] *See infra* Broadband Deployment Appendix D-6 (Deployment (Millions) of Fixed Services at Different Speed Tiers (2014-2017)).

[781] For fixed services, the Commission has been able to rely upon Form 477 reported maximum advertised speeds to track actual speeds. However, the relationship between actual speeds and the advertised speed reported in the Form 477 data for mobile services is more complex because minimum advertised speed is reported by the mobile providers, and different mobile providers estimate their minimum advertised speed based on various points of their actual speed distribution. *2018 Broadband Deployment Report*, 33 FCC Rcd at 1678, para. 46, n.133. By contrast, the Ookla data provide us with the actual speeds that consumers experience.

for 2014 through 2017, we use the Form 477 LTE deployment shapefiles with a minimum advertised speed of 5 Mbps/1 Mbps. SBI data are not available for 5 Mbps/1 Mbps, so our analysis of the 2013 data uses maximum advertised speeds of 6 Mbps/768 kbps, which are the most comparable speeds collected in the SBI data in this period. As the Commission has previously done, we employ the centroid methodology in evaluating the Form 477 deployment data for LTE.[783] We apply the same methodology as we use for fixed services and consider a census block to be covered by LTE services if there is at least one service provider serving that census block that reports 5 Mbps/1 Mbps as the minimum advertised speed, based on their Form 477 submission.

246. We recognize, however, that actual speeds tend to be much faster than the minimum advertised speed. Therefore, we also present estimates based on Ookla speed test data to evaluate the deployment of LTE with a median actual speed of 10 Mbps/3 Mbps or higher. We rely on the Ookla data[784] to supplement our Form 477 analysis, primarily because it allows us to better evaluate the extent to which the typical consumer receives speeds of 10 Mbps/3 Mbps or higher, and these data provide us with the greatest number of observations of actual speeds that customers receive.[785] Our analysis of the deployment of mobile LTE services with a median speed of 10 Mbps/1 Mbps, includes actual speed test data in counties with at least 300 test observations in each time frame.[786] The more densely populated counties have a higher likelihood of being included in this analysis because there generally are more observations in geographical areas with a higher population density. Although we do not have reliable,

(Continued from previous page)

[782] The SBI data for mobile services are not directly comparable to the Form 477 data. First, we are unable to limit the SBI data to LTE technology because the SBI data does not identify mobile services by technology. Second, the SBI data include mobile coverage area boundaries by *maximum* advertised download/upload speeds whereas the Form 477 collects data for mobile services by *minimum* advertised speeds. *2018 Broadband Deployment Report*, 33 FCC Rcd at 1679, para. 47.

[783] *See, e.g., id.* at 1678, para. 46.

[784] Generally, crowd-sourced data can provide a large volume of data at a very low cost and provides insights into actual consumer experience on a network in a wide variety of locations, including those indoors and outdoors. Crowd-sourced data, however, are often not collected using statistical sampling techniques, and may require adjustments to be representative. For instance, crowd-sourced mobile data come from a self-selected group of users, and there often is little control for most tests regarding parameters such as when people implement the test, whether the test is performed indoors or outdoors, the geographic location of the tester, and the vintage of the consumer's device. *Id.* at 1679, para. 47, n.139.

[785] The data collected by the Ookla Speedtest mobile app include test results for download speed, upload speed, and latency, as well as other information, such as the location of the test and operating system of the handset. The results presented in this Chapter are based on tests that were executed in the second half of the year for 2014, 2015, 2016 and 2017 on the smartphone's cellular connection, and using LTE technology. Test data was excluded if it had missing GPS locations data or if the reported download or upload speed was less than zero or greater than 100 Mbps. Multiple tests by a single phone in the same locality and in the same day were averaged (using the median).

[786] *2018 Broadband Deployment Report*, 32 FCC Rcd at 1679, para. 47. This sample size threshold applies to each county for each time frame (2H2014, 2H2015, 2H2016, and 2H2017): if a county does not have at least 300 observations during any of these time frames, it is not included in the actual speed analysis because the sample size is not sufficient. The 300 observations threshold is a conservative threshold and is based on a general mean and median sample size analysis. County geography is assigned using the latitude and longitude coordinates that are collected during each Ookla speed test, via the device's GPS. This allows us to evaluate actual median upload and download speeds at the county level, in each year of the four-year time period, for counties in which approximately 93% of the U.S. population live (not including the U.S. Territories). If a census block has LTE coverage of at least 5 Mbps/1 Mbps based on the Form 477 minimum advertised speeds, it is assigned the median upload and download speeds that are calculated for the county in which it is located, which allows us to evaluate the mobile broadband speeds for each census block within the United States.

on-the-ground speed data for every county in the United States, the Ookla data covers well over 90% of the population of the United States,[787] and as such, can reasonably be used to show progress over time.

3. Broadband Deployment Estimates

247. In Figures G-1 through G-3 below, we present our measurement of deployment, evaluating progress by comparing deployment in the present year to deployment in the previous four years.[788] For purposes of this Chapter, we aggregate federally recognized Tribal lands into 4 Tribal Lands categories, the Lower 48 States;[789] Tribal Statistical Areas,[790] Alaskan Villages,[791] and Hawaiian Homelands.[792] We report on deployment for each combination of fixed and mobile deployment.

a. Deployment of Fixed Advanced Telecommunications Capability

248. Figure G-1 shows the deployment of fixed terrestrial broadband at speeds of 25 Mbps/3 Mbps, the Commission's current benchmark for fixed advanced telecommunications capability. As of year-end 2017, 94% of the overall population had coverage of such services, up from 91.9% in 2016. Nonetheless, the gap in rural and Tribal America remains notable: over 24% of Americans in rural areas and 32% of Americans in Tribal lands lack coverage from fixed terrestrial 25 Mbps/3 Mbps broadband, as compared to only 1.5% of Americans in urban areas. The data demonstrate, however, that the gap between urban and rural or Tribal areas has narrowed each year over the last five years.

[787] The percentage of the population in our analysis is based on the total U.S. population, not including the U.S. Territories, for which we separately report our results. The Ookla speed data population in Figure G-2b is a subset of the total U.S. population evaluated in Figure G-2a and refers to the population in the counties for which we believe there are a statistically significant number of on-the-ground speed test observations. We do not have Ookla speed data for the U.S. Territories. In 2017, for example, the U.S. population, not including the U.S. territories, was 325.716 million, whereas in Figure G-2b, we use 302.940 million as the basis for our 2017 calculations. The population evaluated figure, 302.940 million, is the population for the U.S., excluding the U.S. Territories and the population in the counties without a sufficient number of reliable on-the-ground speed test data observations.

[788] Unless otherwise noted, the deployment percentage estimate for fixed terrestrial services and/or mobile services is the population in the census blocks with coverage for the service divided by the total population in the area being considered (e.g., United States, all rural areas, all urban areas). We present additional deployment data for each state, the District of Columbia, and the U.S. Territories in the Broadband Deployment Appendices. *See infra* Broadband Deployment Appendices D-1, D-2 and D-3 (reporting figures for each state and the District of Columbia) and Appendix D-4 (reporting figures for each U.S. Territory). We present additional deployment data for each Tribal lands and state in Appendix D-7.

[789] These areas include: (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; and (4) legal federally recognized American Indian area consisting of off-reservation trust land only.

[790] Tribal Statistical areas are Statistical American Indian areas. These are 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).

[791] Alaskan Native village statistical area.

[792] Hawaiian Home Lands established by the Hawaiian Homes Commission Act of 1921.

Fig. G-1
Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	263.971	83.6%	284.277	89.4%	287.853	89.9%	296.373	91.9%	306.328	94.0%
Rural Areas	29.077	47.6%	37.202	60.4%	38.271	61.5%	42.677	67.8%	48.288	75.7%
Urban Areas	234.893	92.3%	247.075	96.4%	249.582	96.7%	253.695	97.7%	258.040	98.5%
Tribal Lands	1.449	37.1%	2.250	57.2%	2.290	57.8%	2.520	63.1%	2.731	68.0%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

249. In 2016, 25 Mbps/3 Mbps satellite service was reported for the first time in the Form 477 data collection.[793] If we include satellite service in our estimate, fixed 25 Mbps/3 Mbps service is deployed to nearly every American as of December 2017.[794]

b. Deployment of Mobile LTE

250. Figure G-2a shows that as of year-end 2017, approximately 100% of the American population lives in geographical areas covered by mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps,[795] while approximately 98% had such coverage in 2013. Further, between 2013 and 2017, the percentage of Americans living in rural areas with coverage of LTE at 5 Mbps/1 Mbps increased from approximately 90% to approximately 99%.[796] The percentage of Americans living in Tribal lands with coverage of mobile LTE rose from approximately 87% in 2013, to 97% in 2017. Figure G-2b also shows some improvement since 2016 in the deployment of mobile LTE services at median speeds of 10 Mbps/3 Mbps for the United States and urban areas.

[793] *2018 Broadband Deployment Report*, 32 FCC Rcd at 1681, para. 51.

[794] *Id.* at 1681, para. 51, n.148; Broadband Deployment Appendix D-9 (Deployment (Millions) of Fixed Services at Different Speed Tiers (2014-2017)). These data could overstate the deployment of these services. The data indicate that fixed 25 Mbps/3 Mbps services are deployed to 93% of Americans residing in the U.S. Territories.

[795] We present additional deployment data for Mobile LTE services for each state, the District of Columbia, the U.S. Territories in the Broadband Deployment Appendices and each category of Tribal land in the appendix. *See infra* Broadband Deployment Appendices D-1, D-2 and D-3 (reporting figures for each state and the District of Columbia), Appendix D-4 (reporting figures for each U.S. Territory), and Broadband Deployment Appendix D-7 (reporting figures for Tribal lands and states).

[796] The results reported in Fig. G-2a for 2013 are based upon SBI data for mobile services at *maximum* advertised speeds of 6 Mbps/768 kbps as compared to the Form 477 data for mobile services which are based on *minimum* advertised speeds of 5 Mbps/1 Mbps.

Fig. G-2a

Deployment (Millions) of Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	308.527	97.8%	315.506	99.2%	318.923	99.6%	321.347	99.6%	325.117	99.8%
Rural Areas	55.044	90.2%	59.463	96.5%	60.969	97.9%	61.802	98.2%	63.204	99.1%
Urban Areas	253.483	99.6%	256.043	99.9%	257.954	100.0%	259.545	100.0%	261.912	100.0%
Tribal Lands	3.386	86.7%	3.626	92.2%	3.722	93.9%	3.788	94.9%	3.896	97.0%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

Fig. G-2b

Deployment (Millions) of Mobile LTE with a Median Speed of 10 Mbps/3 Mbps[797]

	2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	237.210	80.1%	245.843	82.5%	261.898	87.3%	269.494	89.0%
Rural Areas	32.638	70.3%	32.193	69.3%	32.962	70.1%	32.966	69.3%
Urban Areas	204.573	81.9%	213.650	85.0%	228.936	90.5%	236.528	92.6%
Pop. Evaluated	296.204	93.2%	297.899	93.0%	300.036	93.0%	302.940	93.0%

c. Deployment of Fixed Services and Mobile LTE

251. Figure G-3a shows deployment across all geographic areas for both fixed terrestrial 25 Mbps/3 Mbps services *and* 5 Mbps/1 Mbps mobile LTE.[798] Overall, as of year-end 2017, approximately 306 million Americans, or 94% of the population are covered by both 25 Mbps/3 Mbps fixed terrestrial

[797] The analyses in Figures G-2a, G-3a and G-3c include all areas of the United States. In contrast, the analyses in Figures G-2b, G-3b and G-3d exclude any county (and its associated census blocks) for which there is insufficient Ookla data. In addition, we do not report results for Tribal lands in Figures G-2b, G-3b, and G-3d because we have concerns with the representativeness of the Ookla data for these areas. Tribal areas not only typically have fewer speed tests, but there are also fewer of these areas relative to urban and rural areas. Thus, deployment estimates for tribal areas are more sensitive to sample variance. The population figure reported in the bottom row of these figures is the population evaluated for the reported time period and the percentage is the percentage of the U.S. population evaluated. Accordingly, the 302.94 population evaluated figure for 2017 in Figure G-2b represents 93% of the overall population in the 50 U.S. states (i.e., 302.94/325.716=0.93). Regardless of our deployment estimates for mobile LTE with a median speed of 10 Mbps/3 Mbps, Americans residing in the counties without sufficient Ookla data to create a statistically significant county sample to be included in Figures G-2b, G-3b, and G-3d, receive minimum advertised or expected speeds of 5 Mbps/1 Mbps, and likely receive mobile services with speeds higher than 5 Mbps/1 Mbps.

[798] We present additional deployment data for terrestrial fixed 25 Mbps/3 Mbps and/or Mobile LTE services in an appendix. *See infra* Broadband Deployment Appendices D-2 and D-3 (reporting figures for each state and the District of Columbia), Appendix D-5 (reporting figures for each state, the District of Columbia, and each county), and Appendix D-6 (reporting figures by urban and rural areas within each state, the District of Columbia and each county).

service and mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps, an increase from 91.7% in 2016.[799] In rural areas, 75.3% of Americans are covered by both services, as opposed to 98.5% of Americans in urban areas, up from 67.1% and 97.7%, respectively, in 2016. On Tribal lands, 67.7% of Americans have coverage for both services up from 62.4% in 2016. Figure G-3b shows deployment of fixed terrestrial speeds of 25 Mbps/3 Mbps and mobile LTE with median speed of 10 Mbps/3 Mbps. As of December 31, 2017, approximately 261 million Americans live in geographic areas covered by both services, an increase of 11.1 million Americans since 2016.

Fig. G-3a

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE Based on a Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	261.977	83.0%	283.417	89.1%	287.387	89.7%	295.905	91.7%	306.054	94.0%
Rural Areas	27.776	45.5%	36.517	59.2%	37.840	60.8%	42.231	67.1%	48.020	75.3%
Urban Areas	234.200	92.0%	246.900	96.3%	249.547	96.7%	253.674	97.7%	258.034	98.5%
Tribal Lands	1.385	35.5%	2.212	56.2%	2.258	57.0%	2.491	62.4%	2.720	67.7%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

Fig G-3b
Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE with a Median Speed of 10 Mbps/3 Mbps

	2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	221.255	74.7%	230.561	77.4%	249.817	83.3%	260.927	86.1%
Rural Areas	22.637	48.8%	22.554	48.5%	24.961	53.1%	27.185	57.2%
Urban Areas	198.617	79.5%	208.007	82.7%	224.856	88.9%	233.743	91.5%
Pop. Evaluated	296.204	93.2%	297.899	93.0%	300.036	93.0%	302.940	93.0%

252. Figure G-3c reports deployment of fixed terrestrial 25 Mbps/3 Mbps service *or* mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps and shows that services are deployed to approximately 100% of the American population as of year-end 2017. Figure G-3d shows that approximately 298 million Americans, or approximately 98.5% of the population in the evaluated areas, are covered by either 25 Mbps/3 Mbps fixed terrestrial service or Mobile LTE with a median speed of 10 Mbps/3 Mbps.

[799] The results reported for 2013 are based upon SBI data for mobile services at *maximum* advertised speeds of 6 Mbps/768 kbps as compared to the Form 477 data which are based on *minimum* advertised speeds of 5 Mbps/1 Mbps.

Fig. G-3c

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services or Mobile LTE Based on a Minimum Advertised Speed of 5 Mbps/ 1 Mbps

	2013		2014		2015		2016		2017	
Area	**Pop.**	**%**	**Pop.**	**%**	**Pop.**	**%**	**Pop.**	**%**	**Pop.**	**%**
United States	310.521	98.4%	316.366	99.5%	319.389	99.7%	321.815	99.8%	325.390	99.9%
Rural Areas	56.345	92.3%	60.148	97.6%	61.400	98.6%	62.249	98.9%	63.472	99.5%
Urban Areas	254.176	99.9%	256.218	100.0%	257.989	100.0%	259.567	100.0%	261.919	100.0%
Tribal Lands	3.449	88.3%	3.664	93.2%	3.753	94.7%	3.817	95.6%	3.907	97.3%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

Fig. G-3d

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services or Mobile LTE with a Median Speed of 10 Mbps/3 Mbps

	2014		2015		2016		2017	
	Pop.	**%**	**Pop.**	**%**	**Pop.**	**%**	**Pop.**	**%**
United States	288.119	97.3%	290.355	97.5%	293.862	97.9%	298.449	98.5%
Rural Areas	40.332	86.9%	40.660	87.5%	41.895	89.1%	43.652	91.8%
Urban Areas	247.787	99.2%	249.695	99.3%	251.968	99.6%	254.796	99.8%
Pop. Evaluated	296.204	93.2%	297.899	93.0%	300.036	93.0%	302.940	93.0%

d. Additional Deployment Estimates

253. Figure G-4 shows deployment of fixed terrestrial services at various speed tiers since 2013.[800] As of December 2017, fixed terrestrial service of 10 Mbps/1 Mbps is deployed to 97.3% of all Americans, up from 95.8% in 2016, and deployment of fixed terrestrial 50 Mbps/5 Mbps service is deployed to 92.3% of the population, up from 90.3% in 2016. From 2016 to 2017, the deployment of 100 Mbps/10 Mbps increased from 75.7% to over 89.3% of the population, and the deployment of 250 Mbps/25 Mbps increased from 43.7% to 63% of the population. Deployment in rural areas and on Tribal lands lags behind deployment in urban areas at all five speed tiers, but the data show year-over-year improvements for all speeds in these areas.

[800] We present deployment estimates for all fixed services including satellite broadband in an appendix. *See infra* Broadband Deployment Appendix D-9 (Deployment (Millions) of Fixed Services at Different Speed Tiers (2014-2017).

Fig. G-4
Deployment (Millions) of Fixed Terrestrial Services at Different Speed Tiers

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
10 Mbps/1 Mbps										
United States	294.244	93.2%	297.826	93.7%	302.138	94.3%	309.109	95.8%	316.811	97.3%
Rural Areas	42.573	69.7%	46.219	75.0%	48.361	77.7%	52.437	83.3%	56.934	89.3%
Urban Areas	251.671	98.9%	251.608	98.2%	253.777	98.4%	256.672	98.9%	259.878	99.2%
Tribal Lands	2.622	67.1%	2.709	68.9%	2.886	72.8%	3.201	80.2%	3.329	82.9%
25 Mbps/ 3 Mbps										
United States	263.971	83.6%	284.277	89.4%	287.853	89.9%	296.373	91.9%	306.328	94.0%
Rural Areas	29.077	47.6%	37.202	60.4%	38.271	61.5%	42.677	67.8%	48.288	75.7%
Urban Areas	234.893	92.3%	247.075	96.4%	249.582	96.7%	253.695	97.7%	258.040	98.5%
Tribal Lands	1.449	37.1%	2.250	57.2%	2.290	57.8%	2.520	63.1%	2.731	68.0%
50 Mbps/5 Mbps										
United States	187.416	59.4%	270.771	85.2%	283.329	88.5%	291.380	90.3%	300.474	92.3%
Rural Areas	15.571	25.5%	32.127	52.1%	35.316	56.7%	39.260	62.4%	43.985	69.0%
Urban Areas	171.844	67.5%	238.644	93.1%	248.013	96.1%	252.119	97.1%	256.489	97.9%
Tribal Lands	1.161	29.7%	1.919	48.8%	2.116	53.4%	2.269	56.9%	2.465	61.4%
100 Mbps/10 Mbps										
United States	165.184	52.3%	201.905	63.5%	215.582	67.3%	244.297	75.7%	290.884	89.3%
Rural Areas	12.568	20.6%	16.484	26.7%	20.481	32.9%	25.925	41.2%	39.160	61.4%
Urban Areas	152.616	60.0%	185.422	72.3%	195.101	75.6%	218.372	84.1%	251.724	96.1%
Tribal Lands	1.058	27.1%	1.320	33.6%	1.669	42.1%	1.875	47.0%	2.202	54.8%
250 Mbps/ 25 Mbps										
United States	NA	NA	15.674	4.9%	67.912	21.2%	140.795	43.7%	205.237	63.0%
Rural Areas	NA	NA	2.020	3.3%	5.460	8.8%	10.029	15.9%	23.870	37.4%
Urban Areas	NA	NA	13.654	5.3%	62.452	24.2%	130.766	50.4%	181.367	69.2%
Tribal Lands	NA	NA	0.047	1.2%	0.276	7.0%	1.330	33.3%	1.621	40.3%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

254. Figure G-5 presents deployment data for fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a speed of at least 5 Mbps/1 Mbps from 2013 through 2017 for the U.S.

Territories.[801] As of 2017, Puerto Rico and the U.S. Virgin Islands accounted for over 92% of the population in the U.S. Territories. The data suggest that as of December 2017, 85.8% of Americans in the U.S. Territories were covered by 25 Mbps/3 Mbps fixed terrestrial service and 5 Mbps/1 Mbps mobile LTE, which represented an increase of approximately 20 percentage points since 2013. The 2017 data may significantly overstate current deployment in the U.S. Territories, however, given the deployment data provided by providers do not appear to reflect infrastructure damage caused by Hurricanes Maria and Irma in 2017 even though the December 2017 data postdates the hurricanes and should reflect such damage. Aside from the potential impact of the hurricanes, there appear to be anomalies in the underlying data presented in Figure G-5.[802] Thus, the changes in reported deployment in the Form 477 data may not reflect actual changes in deployment.

Fig. G-5
Deployment (Millions) in U.S. Territories of Terrestrial Fixed 25 Mbps/3 Mbps Services and Mobile LTE Based on a Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Fixed Terrestrial 25 Mbps/3 Mbps Fixed										
U.S. Territories	2.627	66.2%	3.217	82.4%	2.368	61.5%	3.151	83.2%	3.192	85.9%
Rural Areas	0.218	85.5%	0.135	53.5%	0.095	38.1%	0.143	57.9%	0.151	61.6%
Urban Areas	2.409	64.9%	3.082	84.4%	2.273	63.1%	3.008	85.0%	3.040	87.6%
Mobile LTE with a Speed of 5 Mbps/1 Mbps										
U.S. Territories	3.866	97.5%	3.762	96.3%	3.701	96.1%	3.717	98.2%	3.658	98.4%
Rural Areas	0.228	89.5%	0.226	89.4%	0.224	89.5%	0.230	93.0%	0.233	94.8%
Urban Areas	3.638	98.1%	3.537	96.8%	3.477	96.5%	3.487	98.6%	3.425	98.7%
Fixed Terrestrial 25 Mbps/3 Mbps and Mobile LTE with a Speed of 5 Mbps/1 Mbps										
U.S. Territories	2.576	65.0%	3.214	82.3%	2.365	61.4%	3.147	83.1%	3.188	85.8%
Rural Areas	0.199	78.0%	0.132	52.3%	0.093	37.0%	0.139	56.2%	0.148	60.3%
Urban Areas	2.377	64.1%	3.082	84.3%	2.272	63.1%	3.008	85.0%	3.040	87.6%
Fixed Terrestrial 25 Mbps/3 Mbps or Mobile LTE with a Speed of 5 Mbps/1 Mbps										
U.S. Territories	3.917	98.8%	3.766	96.4%	3.704	96.1%	3.722	98.3%	3.661	98.5%
Rural Areas	0.247	97.0%	0.229	90.5%	0.227	90.5%	0.234	94.6%	0.236	96.2%
Urban Areas	3.669	98.9%	3.537	96.8%	3.477	96.5%	3.488	98.6%	3.425	98.7%
Pop. Evaluated	3.965	100.0%	3.906	100.0%	3.853	100.0%	3.786	100.0%	3.716	100.0%

[801] We present additional deployment data on the territories in the Appendix. *See infra* Broadband Deployment Appendix D-4 (Deployment of Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE 5 Mbps/1 Mbps by U.S. Territory).

[802] For instance, the data in 2015 appears to show a significant drop in deployment for fixed and mobile services that is not continued in 2016.

4. Demographic Data

255. Figures G-6 and G-7 compare the available demographic data for Americans with and without coverage to fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE.[803] Figure G-6 presents this analysis for the United States as a whole, urban areas, rural areas, and Tribal lands for fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps in 2017.[804] The data show that generally, Americans in areas where these services are deployed typically live in census block groups with a lower percentage of households living in poverty, and with higher average populations, population densities, per capita incomes, and median household incomes than Americans living in areas without coverage by these services.

Fig. G-6
Comparison of Demographic Data Between Areas Where Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps Have Been Deployed and Where These Services Have Not Been Deployed (As of December 31, 2017)

	Average Population	Average Population Density	Average Per Capita Income ($2016)	Average Median Household Income ($2016)	Average Poverty Rate
United States (All Areas)					
With Deployment	1,509.0***	7,427.6***	$30,631.03***	$62,736.73***	15.0%***
Without Deployment	1,424.3	992.3	$25,119.73	$50,133.83	16.0%
U.S. Rural Areas					
With Deployment	1,418.3***	190.8***	$29,438.84***	$60,091.87***	11.5%***
Without Deployment	1,333.7	74.6	$25,151.25	$50,274.03	14.7%
U.S. Urban Areas					
With Deployment	1,520.1***	8,318.1***	$30,777.72***	$63,066.05***	15.5%***
Without Deployment	1,644.1	3,217.8	$25,042.81	$49,782.62	19.2%

[803] To compare the demographic data between areas where these services are and are not deployed, we aggregate the census block data up to the census block group level, the lowest aggregation level for which demographic information is available. This aggregation can result in census blocks being grouped together that may not be uniformly deployed or be uniformly categorized as urban, rural, or on Tribal lands. We designate a census block group as without deployment if more than 5% of the population in the census block group is without services; we designate a census block group as rural if more than 50% of the population in the census block group resides in census blocks designated as rural, and we designate a census block group as Tribal lands if more than 50% of the land area in the census block group is designated as Tribal lands. Population Density is the total population residing in the census block group divided by the square miles of land in the census block group. The estimate of land area is based upon the 2010 Census. We use the American Community Survey (ACS) Five-Year Estimates 2012–2016 for income and poverty measures. Per capita income and median household income in the past twelve months are measured in 2016 Inflation-Adjusted Dollars. The poverty rate is the proportion of households living below the poverty level.

[804] We provide more granular state-by-state and county-by-county deployment information in an Appendix. *See infra* Broadband Deployment Appendices D-5 and D-6.

	Average Population	Average Population Density	Average Per Capita Income ($2016)	Average Median Household Income ($2016)	Average Poverty Rate
Tribal Lands					
With Deployment	1,351.4	2,170.3***	$25,461.83***	$49,535.37***	17.2%***
Without Deployment	1,359.7	244.9	$21,197.64	$43,858.52	20.9%
Tribal Rural Areas					
With Deployment	1,334.3	178.4***	$24,756.76***	$49,302.17***	17.0%***
Without Deployment	1,345.1	76.9	$21,452.79	$44,185.76	20.5%
Tribal Urban Areas					
With Deployment	1,355.4	2,643.4***	$25,626.78***	$49,589.85***	17.3%***
Without Deployment	1,417.4	904.7	$20,199.10	$42,570.14	22.6%

We test for a statistical difference in the reported means between areas with and without deployment of these services. The level of statistical significance is indicated by a superscript: The absence of a star indicates no statistical difference between the reported figures. * signifies statistical significance at a 90% level of confidence, ** signifies statistical significance at a 95% level of confidence, and *** signifies statistical significance at a 99% level of confidence.

256. Figure G-7 compares the available demographic data across urban and rural areas for Americans with and without coverage by both fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a median speed of 10 Mbps/3 Mbps in 2017.[805] Like Figure G-6, Figure G-7 shows that Americans living in areas where these services are deployed typically live in census block groups where there is a lower percentage of households living in poverty, and where there are higher average populations, population densities, per capita incomes, and median household incomes.

Fig. G-7

Comparison of Demographic Data Between Areas Where Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE with a Median Speed of 10 Mbps/3 Mbps Has Been Deployed and Where These Services Have Not Been Deployed (As of December 31, 2017)

	Average Population	Average Population Density	Average Per Capita Income ($2016)	Average Median Household Income ($2016)	Average Poverty Rate
United States (All Areas)					
With Deployment	1,530.4***	8,313.9***	$31,627.62***	$65,047.18***	14.6%***
Without Deployment	1,430.7	1,591.3	$25,489.18	$51,213.31	16.3%
U.S. Rural Areas					
With Deployment	1,424.9***	189.8***	$31,426.04***	$65,372.88***	10.1%***
Without Deployment	1,300.2	98.5	$26,379.11	$53,263.10	13.6%

[805] As is the case with other 10 Mbps/3 Mbps Ookla data for Tribal lands, we do not report results because of concerns with the representativeness of the Ookla data for these areas. *See supra* Sections II.G.2 and II.G.3.b.

	Average Population	Average Population Density	Average Per Capita Income ($2016)	Average Median Household Income ($2016)	Average Poverty Rate
U.S. Urban Areas					
With Deployment	1,539.0***	8,978.6***	$31,644.09***	$65,020.27***	15.0%***
Without Deployment	1,565.3	3,131.8	$24,569.35	$49,052.07	19.1%
We test for a statistical difference in the reported means between areas with and without deployment of these services. The level of statistical significance is indicated by a superscript: The absence of a star indicates no statistical difference between the reported figures. A * signifies statistical significance at a 90% level of confidence, ** signifies statistical significance at a 95% level of confidence, and *** signifies statistical significance at a 99% level of confidence.					

257. Figure G-8 shows, for 2017, how the average proportion of the population with coverage by fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a minimum advertised speed of 5 Mbps/1 Mbps varies with census block group-level median household income, census block group-level population density, and census block group-level poverty rate.[806] On average, deployment is highest in census block groups with the highest median household income, the highest population density and the lowest poverty rate.

Fig. G-8

Average Percentage of Population with Fixed Terrestrial 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps with a Minimum Advertised Speed of 5 Mbps/1 Mbps by Census Block Group Level Demographic Variable (As of December 31, 2017)

	Fixed	Mobile LTE	Both Fixed and Mobile LTE
Median Household Income($2016)			
First Quartile (Lowest Median Household Income)	91.9%	99.5%	91.6%
Second Quartile	90.5%	99.6%	90.3%
Third Quartile	93.2%	99.8%	93.1%
Fourth Quartile (Highest Median Household Income)	97.9%	100%	97.9%
Population Density			
First Quartile (Lowest Pop. Density)	76.9%	98.9%	76.4%
Second Quartile	97.8%	100%	97.8%
Third Quartile	99.1%	100%	99.1%
Fourth Quartile (Highest Pop. Density)	99.2%	100%	99.2%

[806] We present these results at the census block group, the smallest geographic areas for which income data is available, to accurately examine how the deployment rate varies with income measures in the geographic area.

	Fixed	Mobile LTE	Both Fixed and Mobile LTE
Household Poverty Rate			
First Quartile (Lowest Poverty Rate)	96.2%	99.9%	96.1%
Second Quartile	93.1%	99.8%	93.0%
Third Quartile	91.1%	99.6%	90.9%
Fourth Quartile (Highest Poverty Rate)	93.1%	99.6%	92.9%

258. Figure G-9 shows, for 2017, how the average proportion of the population with coverage of fixed terrestrial services by speed tier varies with census block-level median household income, census block-level population density, and census block-level poverty rate. On average, deployment is highest in census block groups with the highest median household income, the highest population density and the lowest poverty rate.

Fig. G-9

Average Percentage of Population with Fixed Terrestrial Services by Census Block Group Level Demographic Variable (As of December 31, 2017)

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
Median Household Income($2016)					
First Quartile (Lowest Median Household Income)	96.1%	91.9%	90.2%	86.1%	54.9%
Second Quartile	95.8%	90.5%	88.0%	83.9%	55.9%
Third Quartile	97.2%	93.2%	90.8%	87.8%	62.7%
Fourth Quartile (Highest Median Household Income)	99.0%	97.9%	97.0%	95.8%	76.5%
Population Density					
First Quartile (Lowest Pop. Density)	89.8%	76.9%	71.0%	63.6%	38.6%
Second Quartile	99.0%	97.8%	96.8%	93.6%	62.8%
Third Quartile	99.5%	99.1%	98.7%	97.5%	70.7%
Fourth Quartile (Highest Pop. Density)	99.5%	99.2%	99.1%	98.6%	77.6%
Poverty Rate					
First Quartile (Lowest Poverty Rate)	98.3%	96.2%	94.8%	93.0%	71.5%
Second Quartile	97.1%	93.1%	91.0%	88.0%	63.0%
Third Quartile	96.1%	91.1%	88.8%	84.9%	57.6%
Fourth Quartile (Highest Poverty Rate)	96.6%	93.1%	91.4%	87.9%	58.1%

5. Tribal Lands Data

259. In Figures G-10 and G-11 we present additional deployment estimates for Americans living on Tribal lands by Tribal lands category.[807] The Commission's data indicate that deployment in rural Tribal lands continue to lag deployment in urban Tribal lands.

260. Figure G-10 presents deployment on Tribal lands from 2013 to 2017 of both fixed terrestrial 25 Mbps/3 Mbps services and mobile LTE service with a speed of at least 5 Mbps/1 Mbps. Overall, in 2017, 67.7% of Tribal lands are covered by fixed terrestrial 25 Mbps/3 Mbps services and mobile LTE with a speed of 5 Mbps/1 Mbps based on Form 477 data. Rural Tribal lands continue to lag behind urban Tribal lands, with only 45.6% of all Tribal lands in rural areas having deployment of both services, as compared to 91.6% of Tribal lands in urban areas.

Fig. G-10
Deployment (Millions) on Tribal Lands of Fixed 25 Mbps/3 Mbps Fixed Terrestrial Services and Mobile LTE Services with a Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Tribal Lands	1.385	35.5%	2.212	56.2%	2.258	57.0%	2.491	62.4%	2.720	67.7%
Rural Areas	0.283	14.1%	0.597	29.5%	0.614	30.1%	0.780	37.8%	0.951	45.6%
Urban Areas	1.102	57.9%	1.615	84.5%	1.644	85.6%	1.711	88.8%	1.768	91.6%
Alaskan Villages	0.071	28.2%	0.113	44.4%	0.110	42.7%	0.135	51.5%	0.151	57.0%
Rural Areas	0.021	13.1%	0.042	25.8%	0.039	23.7%	0.061	36.2%	0.073	42.4%
Urban Areas	0.050	54.9%	0.071	77.4%	0.071	76.7%	0.074	79.0%	0.079	83.3%
Hawaiian Homelands	0.029	90.6%	0.032	96.9%	0.030	88.9%	0.030	88.6%	0.030	89.4%
Rural Areas	0.002	45.0%	0.005	83.0%	0.002	43.9%	0.002	43.5%	0.003	47.7%
Urban Areas	0.027	99.4%	0.027	99.8%	0.027	98.0%	0.027	98.0%	0.027	98.2%
Lower 48 States	0.321	30.0%	0.419	38.8%	0.452	41.5%	0.508	46.1%	0.598	53.5%
Rural Areas	0.134	18.9%	0.185	25.8%	0.207	28.4%	0.239	32.3%	0.314	41.7%
Urban Areas	0.187	51.9%	0.233	64.8%	0.245	67.8%	0.270	74.1%	0.284	78.1%
Tribal Statistical Areas	0.964	37.8%	1.648	64.2%	1.666	64.5%	1.818	70.2%	1.940	74.6%

[807] We group tribal lands as designated by their 2010 census block delineations. Alaskan Villages include census blocks that are designated as Alaskan Native village statistical areas. Hawaiian Home Lands include census blocks that were established by the Hawaiian Homes Commission Act of 1921. Tribal Statistical areas are Statistical American Indian areas. These are 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). The Lower 48 States category includes census blocks designated as: (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; and (4) legal federally recognized American Indian area consisting of off-reservation trust land only. We present more granular state-by-state Tribal lands data in an appendix. *See infra* Broadband Deployment Appendix D-7 (Deployment of Fixed Terrestrial 25 Mbps/3 Mbps Services and/or Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps on Tribal Lands by State).

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Rural Areas	0.126	11.2%	0.365	32.1%	0.365	32.0%	0.478	41.5%	0.562	48.6%
Urban Areas	0.838	58.8%	1.283	89.7%	1.301	90.3%	1.341	93.0%	1.378	95.4%
Pop. Evaluated	3.905	100%	3.933	100%	3.964	100%	3.991	100%	4.017	100%

261. In Figure G-11 we present deployment estimates for fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a speed of at least 5 Mbps/1 Mbps on Tribal lands. As of December 31, 2017, fixed terrestrial 25 Mbps/3 Mbps services is deployed to 68% of Americans on Tribal Lands, 97% are covered by mobile LTE 5 Mbps/1 Mbps and 67.7% of Americans on Tribal lands are covered by both services. The figures show variability in deployment across the Tribal lands categories, with the least deployment occurring in Alaskan Villages and the Lower 48 states.

Fig. G-11

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services and/or Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps on Tribal Lands (As of December 31, 2017)

	Total Pop.	Fixed 25 Mbps/ 3 Mbps		Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps	
		Pop.	%	Pop.	%	Pop.	%	Pop.	%
Tribal Lands	4.017	2.731	68.0%	3.896	97.0%	2.720	67.7%	3.907	97.3%
Alaskan Villages	0.265	0.154	58.0%	0.197	74.3%	0.151	57.0%	0.200	75.4%
Hawaiian Homelands	0.034	0.030	89.4%	0.034	99.9%	0.030	89.4%	0.034	99.9%
Lower 48 States	1.117	0.607	54.3%	1.069	95.7%	0.598	53.5%	1.078	96.5%
Tribal Statistical Areas	2.601	1.941	74.6%	2.596	99.8%	1.940	74.6%	2.596	99.8%

6. Adoption Data

262. We also include an assessment of adoption because adoption of services is necessarily a lower bound on fixed deployment.[808] We report adoption rates based upon data as of December 2013 to December 2017. The reported adoption rates are the ratio of residential Form 477 data subscriptions to fixed terrestrial services at the designated speed divided by the total number of households in the area where our Form 477 deployment data indicated that fixed terrestrial services are deployed.[809]

[808] We present adoption data for each state and the District of Columbia in an Appendix. *See infra* Broadband Deployment Appendix D-8 (Overall Adoption Rate for Fixed Terrestrial Services by State and District of Columbia (2017)).

[809] The subscriber data is reported for the census tract, not census block. Thus, we aggregate the deployment data up to the census tract. We calculate adoption rates for the following geographic areas: the U.S. as a whole, all urban core census tracts, all non-urban core census tracts, the county (or county equivalent), and for each state and the District of Columbia. 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. A census tract is designated as "Non-Urban Core" if we have not designated the census tract as Urban Core. A census tract is designated Tribal lands if more than 50% of the land area is Tribal land.

263. Figure G-12 shows the overall adoption rates, [810] using Form 477 subscribership data, from 2013 through 2017 for fixed terrestrial services for the U.S. as a whole, urban and non-urban core areas, and Tribal lands. The data show year-to-year increases across the vast majority of areas, including Tribal lands, for adoption of 10 Mbps/3 Mbps, 25 Mbps/3 Mbps, 50 Mbps/3 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps fixed terrestrial services.[811]

Fig. G-12

Adoption Rates for Fixed Terrestrial Services

	2013	2014	2015	2016	2017
10 Mbps/1 Mbps					
United States	53.4%	56.0%	62.2%	66.3%	69.4%
Non-Urban Core Areas	48.9%	49.7%	55.8%	60.2%	63.0%
Urban Core Areas	56.7%	60.7%	67.0%	71.0%	74.6%
Tribal Lands	33.0%	35.5%	42.4%	42.7%	46.6%
Non-Urban Core Areas	28.9%	30.6%	36.1%	36.5%	40.8%
Urban Core Areas	41.6%	46.0%	56.8%	59.0%	62.3%
25 Mbps/3 Mbps					
United States	29.7%	38.5%	48.1%	53.5%	59.8%
Non-Urban Core Areas	28.5%	34.4%	43.2%	48.9%	54.5%
Urban Core Areas	30.4%	41.3%	51.5%	56.9%	63.9%
Tribal Lands	31.9%	27.2%	31.7%	33.4%	37.9%
Non-Urban Core Areas	27.8%	23.3%	28.5%	30.2%	34.5%
Urban Core Areas	36.6%	33.9%	37.1%	39.4%	45.1%
50 Mbps/ 5 Mbps					
United States	NA	24.8%	33.9%	44.4%	54.4%
Non-Urban Core Areas	NA	19.9%	27.8%	41.1%	50.0%
Urban Core Areas	NA	28.0%	38.0%	46.7%	57.7%
Tribal Lands	NA	22.6%	25.0%	28.9%	34.2%

[810] We have insufficient information to determine the proportion of the population for which 50 Mbps/5 Mbps service is deployed prior to December 31, 2014. *See 2015 Report*, 30 FCC Rcd at 1413, para. 69, n.278. The reported adoption rates for 2014 to 2017 are based upon the Form 477 deployment data and subscriber data as of December 31, 2014, December 31, 2015, December 31, 2016, and December 31, 2017. The reported adoption rates for 2013 are based upon the SBI Deployment data as of December 31, 2013, and the Form 477 subscriber data as of December 31, 2013. For the 2013, a 768 kbps upload speed is used as a proxy for a 1 Mbps upload speed because this is the speed closest to 1 Mbps that was collected in the SBI data collection and the FCC's Form 477 data collection during this time period. *See id.*, 30 FCC Rcd at 1413.

[811] Prior to the Commission's revision of the Form 477 data collection, which is reflected for the first time in the 2014 data, Form 477 filers did not report subscribers specifically at the 50 Mbps/5 Mbps or the 250 Mbps/25 Mbps service tiers. This does not indicate there were no subscribers to these services in 2013.

	2013	2014	2015	2016	2017
Non-Urban Core Areas	NA	17.9%	20.4%	25.3%	30.8%
Urban Core Areas	NA	28.9%	32.0%	34.9%	40.5%
100 Mbps/10 Mbps					
United States	0.9%	11.2%	16.7%	19.2%	29.4%
Non-Urban Core Areas	0.8%	11.7%	16.4%	17.8%	26.5%
Urban Core Areas	0.9%	11.0%	16.9%	20.0%	31.3%
Tribal Lands	0.3%	7.1%	7.4%	10.5%	18.3%
Non-Urban Core Areas	0.3%	7.4%	6.4%	9.8%	17.0%
Urban Core Areas	0.3%	6.8%	8.7%	11.6%	20.4%
250 Mbps/25 Mbps					
United States	NA	2.6%	4.2%	1.8%	3.8%
Non-Urban Core Areas	NA	3.0%	6.7%	2.3%	3.5%
Urban Core Areas	NA	2.3%	3.1%	1.6%	3.9%
Tribal Lands	NA	0.1%	1.4%	1.8%	4.4%
Non-Urban Core Areas	NA	0.1%	1.7%	2.1%	4.4%
Urban Core Areas	NA	0.0%	0.2%	1.5%	4.3%

264. Figure G-13 reports average county level overall adoption rates for fixed terrestrial services by speed tier against the quartile ranking for median household income, population density, the poverty rate, and the proportion of the population that resides in a rural area. These data suggest that the average household adoption rate increases with median household income and population density, although the adoption rate decreases as the poverty rate and rural population rate increase.

Fig. G-13

Average County Overall Adoption Rate for Fixed Terrestrial Services by County Level Demographic Variable (As of December 31, 2017)

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
County Median Household Income ($2016)					
First Quartile (Lowest Median Household Income)	33.6%	23.7%	22.0%	15.4%	1.8%
Second Quartile	42.4%	40.2%	28.8%	14.9%	3.8%
Third Quartile	48.7%	37.2%	32.7%	16.1%	4.4%
Fourth Quartile (Highest Median Household Income)	62.3%	52.8%	47.2%	22.8%	4.3%

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
County Population Density					
First Quartile (Lowest Population Density)	40.0%	25.6%	21.6%	9.5%	5.0%
Second Quartile	34.3%	33.8%	23.3%	11.2%	2.4%
Third Quartile	44.2%	36.4%	33.1%	20.9%	3.0%
Fourth Quartile (Highest Population Density)	68.3%	57.6%	51.7%	26.6%	4.4%
County Poverty Rate					
Fourth Quartile (Lowest Poverty Rate)	57.9%	47.0%	42.0%	20.6%	4.5%
Third Quartile	48.4%	45.6%	33.7%	17.2%	3.8%
Second Quartile	45.1%	35.4%	32.9%	20.7%	4.3%
First Quartile (Highest Poverty Rate)	35.5%	25.8%	21.9%	10.8%	1.8%
County Rural Population Rate					
Fourth Quartile (Lowest Rural Population Rate)	67.1%	57.5%	51.4%	25.2%	5.3%
Third Quartile	48.1%	38.8%	34.7%	16.2%	2.8%
Second Quartile	36.3%	34.7%	24.3%	17.5%	2.8%
First Quartile (Highest Rural Population Rate)	35.3%	22.6%	19.5%	9.6%	3.4%

H. International Broadband Data Report

265. We next provide comparative international information on broadband services and, where possible, a year-to-year measure of the extent of broadband service capability in the United States and select communities and countries abroad.[812] In this chapter, we present updated data and information on broadband service capability since the International Bureau released the *2018 Sixth IBDR* on February 2, 2018.[813] In particular, we compare fixed and mobile broadband, including LTE speeds in the United States, with the selected countries. We assess whether there were indications of statistically significant changes in fixed and mobile broadband prices since the *2018 Sixth IBDR* by reviewing a smaller subset of eight countries. We include a comparison of high-speed fixed and mobile broadband deployment in the United States and in Europe. Finally, we present demographic, market, and other regulatory information relating to broadband service capability. We include the highlights of our findings in this chapter and present the detailed data sources and additional discussion in the relevant appendices.

1. Background

266. As part of its assessment in the *Communications Marketplace Report*, the Commission must 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

[812] 47 U.S.C. § 1303(b). The Broadband Data Improvement Act, Pub. L. No. 110-385, 122 Stat. 4096 (2008), is codified in Title 47, Chapter 12 of the United States Code. 47 U.S.C. § 1301 *et seq.*

[813] *International Comparison Requirements Pursuant to the Broadband Data Improvement Act; International Broadband Data Report*, Sixth Report, 33 FCC Rcd 978 (IB 2018) (*2018 Sixth IBDR*).

to reflect different speed tiers."[814] We must choose international communities comparable to various communities in the United States with respect to population size, population density, topography, and demographic profile.[815] The Commission is required to include "a geographically diverse selection of countries" and "communities including the capital cities of such countries."[816] The Commission must "identify relevant similarities and differences in each community, including their market structures, the number of competitors, the number of facilities-based providers, the types of technologies deployed by such providers, the applications and services those technologies enable, the regulatory model under which broadband service capability is provided, the types of applications and services used, business and residential use of such services, and other media available to consumers."[817]

2. Discussion

267. *Selection of Countries for Comparison*. The *2018 Sixth IBDR* selected 28 foreign countries[818] to meet the statutory directive of developing a geographically diverse set of countries for comparison with the United States concerning international broadband service capability.[819] Consistent with the *2018 Sixth IBDR*, the same 28 foreign countries are used in this International Broadband Data Report (IBDR) for the comparison of broadband speed and demographics.[820] The countries selected in alphabetical order are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Latvia, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, and United Kingdom.[821] Maintaining the same set of countries for comparison will facilitate and enhance assessments of international broadband developments over time. For fixed and mobile broadband price comparison, we rely on a smaller subset of eight countries for our analysis. For the comparison of fixed high-speed and mobile broadband deployment, we rely on the 21 European countries (the "EU21").

a. Broadband Speed Comparison

268. Based on our review of data on actual[822] fixed and mobile broadband speeds gathered by Ookla, fixed and mobile broadband speeds in the United States have improved over time compared to broadband speeds in the 28 comparison countries. We rank speeds from fastest (1st) to slowest (29th). The methodology for our broadband speed comparison is set forth in Appendix E-2.

269. *Fixed Broadband Speed Results*. In 2017, the United States ranked 5th out of 29 countries (73.79 Mbps) in terms of actual download speeds—an improvement over 11th in 2016 (55.07 Mbps). Actual mean fixed download speeds in the United States increased by 34% from 2016 to 2017. With respect to the alternate speed measure, median weighted fixed download speeds, the United States ranked 5th in 2017 (73.99 Mbps), also an improvement over 11th in 2016 (55.44 Mbps) out of the 29 countries.

[814] 47 U.S.C. § 1303(b)(1).

[815] *Id.* § 1303(b)(2).

[816] *Id.*

[817] *Id.* § 1303(b)(3).

[818] *2018 Sixth IBDR*, 33 FCC Rcd 980-81, paras. 5-6.

[819] 47 U.S.C. § 1303(b)(2).

[820] *See* Appendix E-1 for the full list of countries examined.

[821] *2018 Sixth IBDR*, 33 FCC Rcd 980-81, paras. 5-6.

[822] In this analysis, "actual speed" here refers to mean actual speed unless otherwise specified. The means are weighted by the number of tests performed in each city. *See id.* at 996, Appx. B, para. 2, n.4.

270. *Mobile Broadband Speed Results*. In 2017, the United States ranked 23rd (24.78 Mbps), an improvement over 25th in 2016 (19.97 Mbps) out of the 29 countries. Actual mean mobile download speeds in the United States increased by 24% from 2016 to 2017. With respect to the alternate measure, median weighted mobile download speeds, the United States ranked 23rd in 2017 (24.66 Mbps), also an improvement over 25th in 2016 (19.62 Mbps) out of 29 countries.

271. *Historical Overview of U.S. Fixed Broadband Speed*. The data from prior International Broadband Data Reports indicate that fixed speeds for the United States have been on a rising trend since 2012, and the U.S. rank among the selected countries has been on a rising trend since 2012.[823] Based on mean speed measurement, the United States ranked 19th fastest of 28 countries in 2012 (14.5 Mbps). The mean U.S. speed rank has since risen to 10th fastest of 28 countries in 2016 (55.07 Mbps) and 5th fastest of 28 countries in 2017 (73.79 Mbps).

b. Broadband Price Comparison

272. The *2018 Sixth IBDR* examined in detail advertised broadband prices for fixed and mobile service plans in the United States and up to 28 countries.[824] Given the recent nature of that analysis, we limit the scope of our analysis here to whether there were indications of statistically significant changes in broadband prices since the *2018 Sixth IBDR* by reviewing a smaller subset of eight countries, including the United States.[825] Based on our analysis, we find statistically significant quality-adjusted price changes in four of the eight countries. The methodology for our broadband price comparison is set forth in Appendix E-3.

273. *Fixed Broadband Statistical Test Pricing Results*. Based on our statistical test, we find that one of the eight countries (Germany) displays a statistically significant change in quality-adjusted fixed broadband prices from 2017 to 2018. In Germany, quality-adjusted prices have decreased. For the United States, we find a statistically insignificant decrease in quality-adjusted prices.

274. *Mobile Broadband Statistical Test Pricing Results*. We find that four of the eight countries (Denmark, Estonia, Germany, and South Korea) display a statistically significant change in quality-adjusted mobile broadband prices from 2017 to 2018. Of these four countries, quality-adjusted prices have decreased in Denmark, Estonia, Germany, and South Korea. For the United States, we find a statistically insignificant decrease in quality-adjusted prices.

c. High-Speed Broadband Deployment Comparison with Europe

275. Based on data gathered by the FCC and the European Commission (EC) in June 2016 and June 2017,[826] we observe that the United States has greater fixed high-speed and mobile LTE broadband

[823] The *Fourth International Broadband Data Report* and the *Fifth International Broadband Data Report* relied on Ookla speed data for 2012 to 2014 that consisted of daily speed test results for cities in a total of 40 countries (to which we refer as the "previous methodology"). The *2018 Sixth IBDR* relied on Ookla speed data for 2014 to 2016 that consist of city speed test results averaged up to the yearly level, which has far fewer observations than the previous methodology (new methodology). As in the *2018 Sixth IBDR*, we here present: (1) speed data for 2012 to 2013 under the previous methodology; (2) speed data for 2015 to 2017 under the new methodology; and (3) speed data for 2014 under both methodologies. Additional discussion of these methodologies is provided in the *2018 Sixth IBDR*. *Id.* at 1018-19, Appx. B, paras. 24-25.

[824] *Id.* at 1020, Appx. C, para. 1.

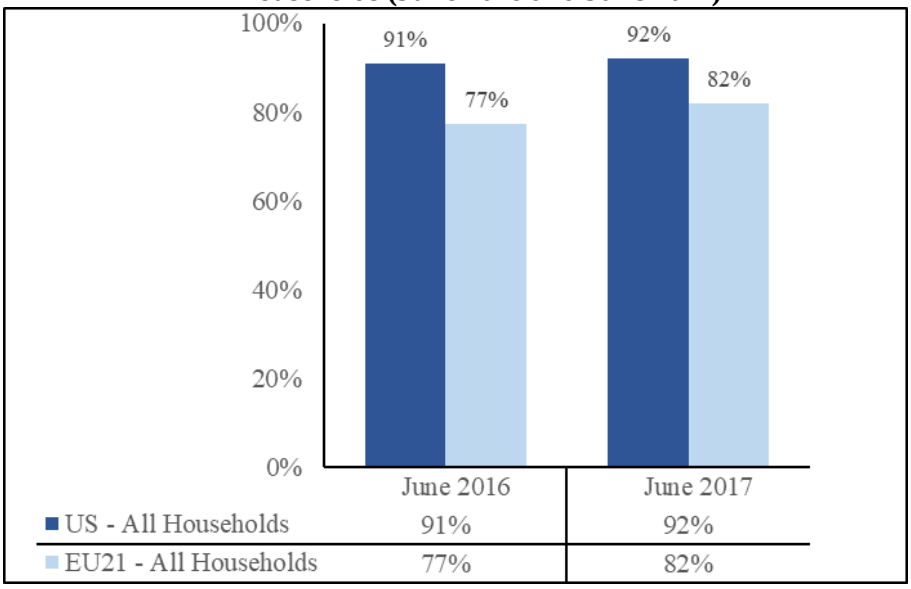
[825] For fixed broadband, we collected advertised prices and terms for fixed broadband plans in the following countries and cities: Denmark (Copenhagen); Estonia (Tallinn); France (Paris); Germany (Berlin); Mexico (Mexico City and Guadalajara); South Korea (Seoul); United Kingdom (London); and the United States (Washington, D.C. and Los Angeles). Mobile broadband plans are collected at the national level.

[826] We assess deployment as of June 2017 and June 2016 to match the time period in the *EC Broadband Report*. European Commission, Broadband Coverage in Europe 2017 at 5 (2018) (*EC Broadband Report*), https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017.

coverage than Europe. This result is consistent with our longer term comparison of fixed deployment in the United States and the EU21 from 2012 to 2017. The methodology for our fixed high-speed and mobile LTE broadband deployment comparison is set forth in Appendix E-4 along with maps that show fixed high-speed broadband deployment in the United States and Europe.

276. *Fixed High-Speed Broadband, 2016-2017.* In the United States and the EU21, fixed high-speed broadband deployment increased from June 2016 to June 2017 with respect to all households.

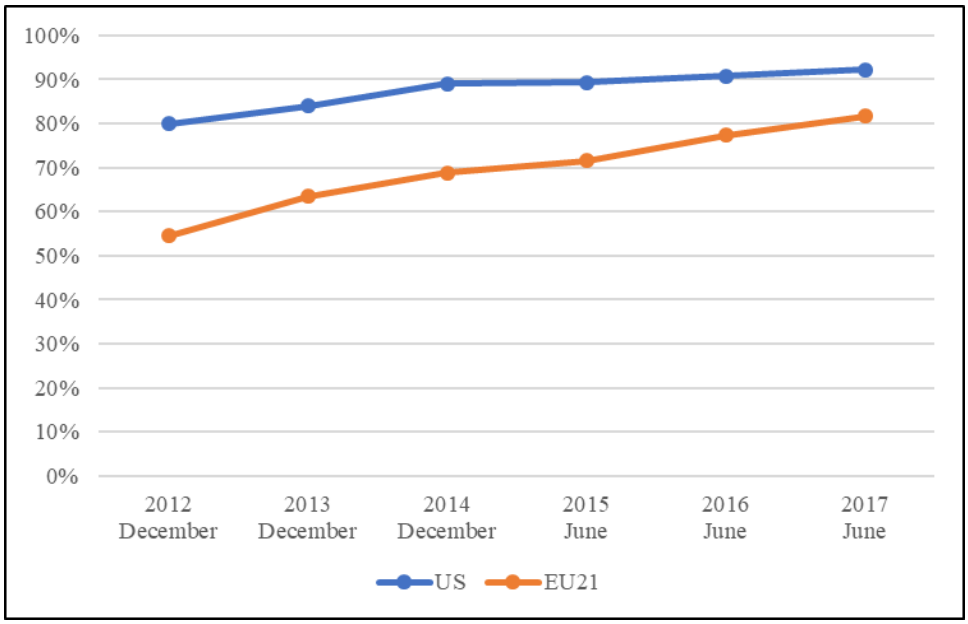
Fig. H-1
Fixed High-Speed Broadband Deployment
All Households (June 2016 and June 2017)



277. *Fixed High-Speed Broadband Historical Overview.* Our historical overview for 2012 to 2017 shows that the United States had higher deployment rates than the EU21 countries as a whole during the period both generally and separately in rural and non-rural areas.[827]

[827] *See* Appendix E-4 at Figs. 13-15.

Fig. H-2
Fixed High-Speed Deployment
All Households



278. *Mobile LTE Broadband*. In the United States, mobile LTE coverage was already nearly ubiquitous as of June 2017, reaching almost 100% of all households and 99% of rural households.[828] In the EU21, during the same period, mobile LTE coverage reached 98% of all households and 91% of rural households.

d. Demographics Dataset

279. In Appendix E-5, we present updated data since the release of the *2018 Sixth IBDR* on the population size, population density, and other indicators such as gross domestic product (GDP) and educational attainment for the United States and the comparison countries and, in the aggregate, of almost 300 province/county communities. Based on OECD data, Denmark, Mexico, Norway, and Sweden demonstrated a 5% or greater increase from 2015 to 2016 in the percentage of households that have at least one subscription to access fixed and/or mobile broadband.[829]

e. Market and Regulatory Developments

280. Below, we discuss several new market and regulatory developments, including national broadband, satellite, and 5G developments.[830] We limit our discussion to recent developments that occurred since the *2018 Sixth IBDR*, which identified the relevant similarities and differences between the United States and the 28 comparison countries with respect to multiple criteria.

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[828] *See id.* at Figs. 11-12.

[829] OECD, *OECD.Stats: Regions and Cities* (*OECD Regions and Cities*), http://stats.oecd.org/. We note that only Mexico and South Korea have updated their OECD data on households with broadband as of 2016 since the *2018 Sixth IBDR*, and that the OECD data do not include any data on household broadband penetration for 2017.

[830] 47 U.S.C. § 1303(b)(3) ("The Commission shall identify relevant similarities and differences in each community, including their market structures, the number of competitors, the number of facilities-based providers, the types of technologies deployed by such providers, the applications and services those technologies enable, the regulatory model under which broadband service capability is provided, the types of applications and services used, business and residential use of such services, and other media available to consumers.").

281. *Market Developments*. In 2018, providers in a number of countries launched new broadband services through the deployment of additional broadband technologies.[831] For example, in 2018, Shaw Communications in Canada, Unitymedia in Germany, Nos in Portugal, and Com Hem in Sweden launched new services offering broadband at higher speeds via DOCSIS 3.1.[832] In April 2018, TalkTalk in the United Kingdom announced the launch of broadband connectivity with download speeds of up to 300 Mbps using DSL G.fast technology to new customers.[833] In July 2018, Cosmote, Wind Hellas, and Vodafone in Greece launched commercial fiber-to-the-home services.[834]

282. The use of Internet services such as online news, video on demand, voice and video calling, participating in social networks, or online shopping, has also grown in certain countries. For example, the proportion of Internet users in Ireland that read news online increased from 49% in 2016 to 65% in 2017.[835] The proportion of Internet users in Austria that use video calls increased from 32% in 2016 to 42% in 2017.[836] The proportion of Internet users in Canada that shop online increased from 46% as of February 2016 to 52% as of March 2018.[837]

283. *National Broadband Developments*.[838] Many countries continue to develop comprehensive digital agendas,[839] increasingly with a view towards future applications and services such

[831] TeleGeography GlobalComms Database (*TeleGeography GlobalComms Database*), www.telegeography.com (last updated June 2018).

[832] *Id*.; Broadband Technology Report, *Shaw Launches 300 Mbps Tier Based on DOCSIS 3.1* (July 13, 2018), https://www.broadbandtechreport.com/articles/2018/07/shaw-launches-300-mbps-tier-based-on-docsis-3-1.html; TeleGeography, *Unitymedia Set for Bochum DOCSIS 3.1 Launch Next Month* (Apr. 27, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/04/27/unitymedia-set-for-bochum-docsis-3-1-launch-next-month/; Andrew McDonald, *Unitymedia Launches 1 Gbps Broadband in Germany* (May 8, 2018), https://www.digitaltveurope.com/2018/05/08/unitymedia-launches-1-gbps-broadband-in-germany/; Stuart Thompson, *Half of NOS Subs Taking Convergence Products as TV Base Grows* (July 23, 2018), https://www.digitaltveurope.com/2018/07/23/half-of-nos-subs-taking-convergence-products-as-tv-base-grows/; TeleGeography, *Com Hem Launches a 1.2 Gbps Service* (Aug. 16, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/08/16/com-hem-launches-1-2gbps-service/.

[833] *TeleGeography GlobalComms Database*; TeleGeography, TalkTalk Expands Availability of Its G.fast-Based Plans to All Customers (Apr. 25, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/04/25/talktalk-expands-availability-of-its-g-fast-based-plans-to-all-customers/.

[834] *TeleGeography GlobalComms Database*; TeleGeography, *Cosmote Launches FTTH* (July 11, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/07/11/cosmote-launches-ftth/; TeleGeography, *Wind Hellas Adds Fibre Services* (July 13, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/07/13/wind-hellas-adds-fibre-services/; Telecompaper, *Vodafone Joins Greece FTTH Market* (July 13, 2018), https://www.telecompaper.com/news/vodafone-joins-greek-ftth-market--1252590; Vodafone, *Vodafone Super Fiber*, https://www.vodafone.gr/eshop/vodafone-home/vodafone-super-fiber/.

[835] *See* European Commission, Digital Single Market: Digital Economy & Society Index 2018, Country Report Ireland at 7 (2018) (*DESI 2018*), https://ec.europa.eu/digital-single-market/en/news/digital-economy-and-society-index-2018-report.

[836] *See id.*, Country Report Austria at 6.

[837] Canadian Internet Registration Authority (CIRA), CIRA Internet Factbook 2018 (2018), https://cira.ca/factbook/canada%E2%80%99s-internet-factbook-2018#section-1; *2018 Sixth IBDR*, 33 FCC Rcd at 1122, Appx. E, Tbl. 5.

[838] Many countries continue to adopt national broadband plans to expand broadband access and use. According to the ITU, as of September 2018, 159 countries have national broadband plans. Broadband Commission for Sustainable Development, The State of Broadband: Broadband Catalyzing Sustainable Development at 35 (2018) (*State of Broadband Report 2018*), https://www.itu.int/dms_pub/itu-s/opb/pol/S-POL-BROADBAND.19-2018-

(continued….)

as 5G, the Internet of Things (IoT), and artificial intelligence (AI), as seen recently in Brazil[840] and India,[841] among others. For example, in March 2018, Latvia adopted a new Electronic Communications Sector Policy Plan 2018-2020, which incorporates common European Union (EU) gigabit broadband targets.[842] Similarly, in April 2018, Denmark announced its Strategy for Denmark's Digital Growth, which seeks to leverage broadband infrastructure to position Denmark as a digital frontrunner in new technologies.[843] Meanwhile, in October 2018, Ireland launched a public consultation for a new National Digital Strategy, which will update a previous policy from 2013.[844] Likewise, New Zealand is currently engaging with stakeholders to develop a digital government strategy to replace the Government ICT Strategy 2015.[845]

284. *Satellite Developments*. Many countries are also increasingly recognizing the possible impact of innovative satellite technologies, such as non-geostationary orbit (NGSO) constellations, in the provision of broadband services, particularly in rural and remote areas.[846] In March 2018, the Commission authorized SpaceX to provide broadband satellite services, the first approval of a U.S.-licensed satellite constellation to provide broadband services using a new generation of LEO satellite technologies.[847] In recent years, the Commission has authorized a number of NGSO FSS systems

(Continued from previous page)
PDF-E.pdf. The United Nations' Broadband Commission for Sustainable Development "has set seven ambitious yet achievable 2025 targets in support of 'Connecting the Other Half' of the world's population," including a target for all countries to have a funded national broadband plan or strategy, or to include broadband in their universal access and services definition by 2025. Press Release, ITU, UN Broadband Commission Sets Global Broadband Targets to Bring Online the World's 3.8 Billion Not Connected to the Internet (Jan. 23, 2018), https://www.itu.int/en/mediacentre/Pages/2018-PR01.aspx.

[839] Broadband Commission for Sustainable Development, The State of Broadband: Broadband Catalyzing Sustainable Development at 44 (Sept. 2017) (*State of Broadband Report 2017*), https://www.itu.int/dms_pub/itu-s/opb/pol/S-POL-BROADBAND.18-2017-PDF-E.pdf; *see also* OECD, OECD Digital Economy Outlook 2017 at 34 (2017) (noting that "[national digital strategies] have become the norm across OECD countries") (*OECD Report 2017*), http://www.oecd.org/internet/oecd-digital-economy-outlook-2017-9789264276284-en.htm.

[840] Ministry of Sci., Tech., Innovation & Commnc'n, Estratégia Brasiliera Para A Transformação Digital (E-Digital) (2018), http://www.mctic.gov.br/mctic/export/sites/institucional/estrategiadigital.pdf.

[841] Dep't of Telecomm., Draft National Digital Communications Policy 2018 (2018), http://dot.gov.in/sites/default/files/2018%2005%2025%20NDCP%202018%20Draft%20for%20Consultation_0.pdf.

[842] Euro. Comm'n, *Digital Single Market: Country Information–Latvia*, https://ec.europa.eu/digital-single-market/en/country-information-latvia. According to the EU's common broadband targets, by 2025, all schools, transport hubs, and main providers of public services, as well as digitally intensive enterprises, should have access to Internet connections with download/upload speeds of 1 Gbps/second. Additionally, all European households should have access to networks offering a download speed of at least 100 Mbps, which can be upgraded to 1 Gbps. *See* Euro. Comm'n, *Digital Single Market: Connectivity for a European Gigabit Society*, https://ec.europa.eu/digital-single-market/en/policies/improving-connectivity-and-access.

[843] Ministry of Indus., Bus. & Fin. Affairs, Strategy for Denmark's Digital Growth (2018), https://em.dk/english/publications/2018/strategy-for-denmarks-digital-growth.

[844] Dep't of the Taoiseach, *Public Consultation on Ireland's New National Digital Strategy*, https://www.taoiseach.gov.ie/DOT/eng/Publications/Publications_2018/Public_Consultation_on_Ireland%E2%80%99s_new_National_Digital_Strategy.html.

[845] New Zealand Gov't, *Progress Towards a Digital Government Strategy* (last updated Oct. 9, 2018), https://www.digital.govt.nz/digital-government/strategy/progress-towards-a-digital-government-strategy/.

[846] *See supra* Section II.F.4; *State of Broadband Report 2017* at 34-38.

[847] Press Release, FCC, FCC Authorizes SpaceX to Provide Broadband Satellite Service (Mar. 29, 2018), https://www.fcc.gov/document/fcc-authorizes-spacex-provide-broadband-satellite-services; *see generally SpaceX Authorization Order*.

designed to deliver broadband services, such as OneWeb, Space Norway, Telesat Canada, and LeoSat.[848] These approvals enable these systems to pursue their plans of expanding broadband to communities across the United States.

285. Other regulators are likewise examining how best to deploy this new generation of satellite technologies, both independently and collectively. In October 2018, for example, the UK Space Agency introduced a pre-application licensing scheme, the Traffic Light System (TLS), which will provide prospective satellite operators (particularly new operators) with a more tailored, streamlined regulatory process.[849] In June 2018, the Australian Communications and Media Authority (ACMA) closed the public consultation on its draft Five-Year Spectrum Outlook 2018-2022 and among other topics, the ACMA solicited stakeholder input on its proposed efforts to support the deployment of novel satellite systems.[850] Similarly, as of March 2018, the Swedish Post and Telecom Authority (PTS) has been considering possible new license exceptions in several frequency bands for mobile satellite systems (among other technologies).[851] At the pan-European level, in July 2018, CEPT's Electronic Communications Committee (ECC) approved a regulatory framework for the harmonized use of Earth Stations in Motion (ESIM) operating with NGSO fixed satellite service (FSS) in the 10.7-12.75 GHz and 14.0-14.5 GHz bands.[852]

286. *5G Developments.* Countries have been examining regulatory frameworks to consider and address possible barriers to broadband infrastructure investment and deployment, with a particular focus on 5G infrastructure. Approaches to 5G development and the status of development efforts vary across countries. The Commission's 5G strategy encompasses a forward-looking spectrum policy, modern infrastructure policy and market-based network regulation, reducing unnecessary barriers to the investment and deployment of next generation wireless networks.[853] Some countries and regions have developed or are developing 5G plans that cover a range of policy initiatives, such as the European Commission's 2016 5G Action Plan, and Chile's July 2018 consultation to develop a national 5G plan.[854]

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[848] *See, e.g.*, *WorldVu Order and Declaratory Ruling*; *Space Norway AS Order and Declaratory Ruling*; *2017 Telesat Canada Order and Declaratory Ruling*; *Telesat Canada V-band NGSO Order and Declaratory Ruling*; *LeoSat Order and Declaratory Ruling*. On November 15, 2018, the Commission also adopted an Order granting SpaceX's application to construct, deploy and operate a proposed NGSO satellite system using frequencies in the V-band, which will provide SpaceX with additional flexibility to provide both diverse geographic coverage and the capacity to support a wide range of proposed broadband and communications services in the United States and globally. *See SpaceX V-band NGSO Authorization Order*. *See also supra* Section II.F.4.b.

[849] UK Space Agency, Modern Regulation to Support UK's Growing Space Sector (Oct. 1, 2018), https://www.gov.uk/government/news/modern-regulation-to-support-uks-growing-space-sector.

[850] Australian Commc'ns & Media Auth., *Draft Five-Year Spectrum Outlook 2018-2022*, https://www.acma.gov.au/theACMA/draft-five-year-spectrum-outlook-2018-22.

[851] Swedish Post & Telecom Auth., PTS Orientation Plan for Spectrum Management (Mar. 29, 2018), https://pts.se/en/news/radio/2018/pts-orientation-plan-for-spectrum-management/.

[852] Elec. Commnc'n Comm., ECC Decision 18(05) (July 6, 2018), https://www.ecodocdb.dk/download/a885e3f1-0c26/ECCDec1805.pdf. The ECC is part of the Conference of European Postal and Telecommunications Administrations (CEPT), a voluntary association of regulators from 48 countries (including, of the IBDR comparison countries, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK).

[853] *See, e.g.*, *Wireless Infrastructure Third Report and Order*; *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Fourth Further Notice of Proposed Rulemaking, FCC 18-110 (Aug. 3, 2018) (*Spectrum Frontiers Fourth Further Notice*); FCC, The FCC's 5G FAST Plan (Sept. 28, 2018), https://www.fcc.gov/document/fccs-5g-fast-plan (*FCC's 5G FAST Plan*).

[854] TeleGeography CommsUpdate, *Subtel opens consultation on 5G plan*, (July 26, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/07/26/subtel-opens-consultation-on-5g-plan/.

Additionally, as part of Europe's Digital Single Market Strategy and reform of its Electronic Communications Code, the European Commission is aiming to stimulate infrastructure investment and streamline procedures to facilitate the deployment of small cells, which the EC defines as small size mobile base stations that can reach several meters.[855]

287. The United States has taken steps to make available low-, mid-, and high-band spectrum for next-generation wireless networks. With respect to low-band spectrum, in 2017, the Commission completed a first-of-its-kind two-part incentive auction to repurpose 84 megahertz of spectrum in the 600 MHz band, laying the groundwork for 5G applications and services.[856] In terms of mid-band spectrum, in July 2018, the Commission adopted a Notice of Proposed Rulemaking identifying new opportunities for flexible use in up to 500 megahertz of spectrum between 3.7 and 4.2 GHz.[857] In October 2018, the Commission made modifications to its rules governing the Citizens Broadband Radio Service in the 3.5 GHz band to spur additional investment and broader deployment in the band, promote robust and efficient spectrum use, and help ensure the rapid deployment of advanced wireless technologies—including 5G—in the United States.[858] Additionally, in October 2018, the Commission adopted a Notice of Proposed Rulemaking proposing rules to allow unlicensed devices to operate in the 6 GHz band (5.925-7.125 GHz) without interfering with the operation of the licensed services that will continue to use this spectrum.[859] Finally, with respect to high-band spectrum, through its *Spectrum Frontiers* proceedings, the Commission has made available nearly 13 total gigahertz of licensed and unlicensed high-band millimeter wave (mmW) spectrum.[860] In June 2018, the Commission finalized the rules for these previously identified mmW bands and began exploring the possibility of making available an additional 2.75 gigahertz of spectrum in the 26 GHz and 42 GHz bands.[861] In November 2018, the Commission began auctioning

[855] European Commission Fact Sheet: *Digital Single Market: Political Agreement on the Rules Shaping the Telecommunication Markets in the 5G Era* (June 6, 2018), http://europa.eu/rapid/press-release_MEMO-18-4084_en.htm.

[856] *See generally* FCC, *Broadcast Incentive Auction and Post-Auction Transition* (last updated May 9, 2017), https://www.fcc.gov/about-fcc/fcc-initiatives/incentive-auctions.

[857] *Expanding Flexible Use of the 3.7 GHz to 4.2 GHz Band et al.*, GN Docket No. 18-122 *et al.*, Order and Notice of Proposed Rulemaking, FCC 18-91 (July 13, 2018) (*Mid-Band Order and NPRM)*. This NPRM builds upon an earlier Notice of Inquiry (NOI) seeking comment on ways to expand next-generation wireless broadband services in spectrum bands between 3.7 GHz and 24 GHz. *See Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd 6373 (2017).

[858] *Promoting Investment in the 3550-3700 MHz Band*, GN Docket No. 17-258, Report and Order, FCC 18-149 (rel. Oct. 24, 2018) (*Investment in 3.5 GHz Band Report and Order)*; Press Release, FCC, FCC Takes Action to Encourage Increased Investment and Deployment in the 3.5 GHz Band (Oct. 23, 2018), https://docs.fcc.gov/public/attachments/DOC-354694A1.pdf.

[859] Press Release, FCC, FCC Proposes More Spectrum for Unlicensed Use (Oct. 23, 2018), https://docs.fcc.gov/public/attachments/DOC-354692A1.pdf; *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, ET Docket No. 18-295, GN Docket No. 17-183, Notice of Proposed Rulemaking, FCC 18-147 (rel. Oct. 24, 2018) (*6 GHz NPRM*).

[860] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988, 10990, para. 2 (2017) (*Spectrum Frontiers Second Report and Order*); *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, et. al*., Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016) (*Spectrum Frontiers Report and Order*).

[861] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, 33 FCC Rcd 5576 (2018) (*Spectrum Frontiers Third Report and Order*); Press Release, FCC, FCC Takes Next Steps to Make High-Band Spectrum Frontiers Available for 5G Use (June 7, 2018), https://docs.fcc.gov/public/attachments/DOC-351388A1.pdf.

spectrum in the 28 GHz band, to be followed immediately by the auction of the 24 GHz band;[862] the Commission intends to move forward with a single auction of three more mmW bands (37 GHz, 39 GHz, and 47 GHz) in the second half of 2019.[863]

288. Regulators around the world are also in the midst of allocating, auctioning and/or licensing additional spectrum across various bands to support 5G services.[864] Notably, in June 2018, Korea's Ministry of Science & ICT (MSIT) concluded a 5G auction in the 3.5 GHz and 28 GHz bands, which is expected to facilitate early 5G commercialization by a target date of March 2019.[865]

289. In line with the European Commission's 5G Action Plan, [866] EU Member States are focusing on several "pioneer band[s]" to harmonize the initial launch of 5G services across Europe,[867] with an initial emphasis on the 3.4-3.6 GHz band.[868] For example, in April 2018, the UK auctioned 150 megahertz of spectrum from the 3.4-3.6 GHz band.[869] In July 2018, Finland invited applications for its upcoming 3.5 GHz auction, to be held later in 2018.[870] Similarly, in May 2018, Germany announced

[862] The Commission finalized the bidding procedures and other rules for the auctions in August 2018. *Auctions of Upper Microwave Flexible Use Licenses for Next-Generation Wireless Services et al.*, AU Docket No. 18-85, Public Notice, FCC-18-109 (Aug. 3, 2018). *See generally* FCC, *Auction 101: Spectrum Frontiers–28 GHz*, https://www.fcc.gov/auction/101; FCC, *Auction 102: Spectrum Frontiers–24 GHz*, https://www.fcc.gov/auction/102.

[863] *See Spectrum Frontiers Fourth Further Notice*; Press Release, FCC, FCC Proposes Steps Towards Auction of 37 GHz, 39 GHz, and 47 GHz Bands (Aug. 2, 2018), https://docs.fcc.gov/public/attachments/DOC-353229A1.pdf.

[864] *See generally* David Abecassis, Chris Nickerson and Janette Stewart, Final Report for CTIA: Global Race to 5G–Spectrum and Infrastructure Plans and Priorities (2018), https://api.ctia.org/wp-content/uploads/2018/04/Analysys-Mason-Global-Race-To-5G_2018.pdf (detailing 5G spectrum policies in ten leading markets: Canada, China, France, Germany, Russia, Japan, Singapore, South Korea, the United Kingdom, and the United States).

[865] TeleGeography CommsUpdate, *MSIT Announces Results of 5G Spectrum Auction* (June 19, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/06/19/msit-announces-results-of-5g-spectrum-auction/. *See also* Analysys Mason, Analysys Mason 2018 July Report at 1 (2018), https://api.ctia.org/wp-content/uploads/2018/04/Analysys-Mason-Global-Race-To-5G_2018.pdf (noting that the U.S. sharing approach in 3.5 GHz differs from all other benchmark countries noted in the report which have developed plans for exclusive assignment to mobile).

[866] *See generally* European Commission, 5G for Europe: An Action Plan (2016), https://ec.europa.eu/digital-single-market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document.

[867] *See* Radio Spectrum Policy Group, Strategic Roadmap Towards 5G for Europe: Opinion of Spectrum-Related Aspects for Next-Generation Wireless Systems (5G) (2016), http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf (identifying the following "pioneer band[s]": 3400-3800 MHz; below 1 GHz, particularly the 700 MHz band; 24.25-27.5 GHz; and upper bands, including 31.8-33.4 GHz and 40.5-43.5 GHz).

[868] *See* Radio Spectrum Policy Group, Strategic Spectrum Roadmap Towards 5G in Europe: RSPG Second Opinion on 5G Networks (2018), https://circabc.europa.eu/sd/a/fe1a3338-b751-43e3-9ed8-a5632f051d1f/RSPG18-005final-2nd_opinion_on_5G.pdf (identifying the 3.4-3.8 GHz band as the "key for success of 5G in Europe").

[869] David Abecassis, Janette Stewart, Michael Kende, Chris Nickerson, Final Report for CTIA: Mid-band spectrum geographical licensing approaches at 3 (2018) (*Mid-band Spectrum Report*), https://api.ctia.org/wp-content/uploads/2018/07/Analysys-Mason-mid-band-5G-spectrum-paper-7-03-18.pdf.

[870] Press Release, Finnish Communications Regulatory Authority, Finland's Path to Becoming a Leading 5G Country: Registration Open for the 3.5 GHz Auction (July 11, 2018), https://www.viestintavirasto.fi/en/ficora/news/2018/finland8217spathtobecomingaleading5gcountryregistrationopenforthe3.5ghzauction.html.

plans to auction spectrum in the 3.6 GHz band (along with the 2 GHz band) for 5G use in early 2019.[871] Germany also plans to award 400 megahertz of spectrum in the 3.4-3.8 GHz band in early 2019.[872]

III. COMMISSION ACTIONS ALREADY TAKEN TO CLOSE DIGITAL DIVIDE, ENHANCE COMPETITION, AND ENCOURAGE DEPLOYMENT OF COMMUNICATIONS SERVICES

290. RAY BAUM'S Act also requires the Commission to describe the actions it has taken over the previous two years in addressing the challenges and opportunities in the communications marketplace.[873] In this *Report*, we take this opportunity to describe the significant steps the Commission has taken over the previous two years to close the digital divide, enhance competition and encourage the deployment of communications services.

A. The Mobile Wireless Market

1. Universal Support Challenges and Commission Actions

291. The Commission has taken several steps over the past two years to make universal service support available to mobile providers. For example, a unanimous Commission adopted rules and took several other steps to allocate up to $4.53 billion over the next decade to advance the deployment of 4G LTE service to areas that are so costly that the private sector has not yet deployed there and to preserve such service where it might not otherwise exist.[874] The Commission's 2017 Order found that "[d]espite a surge in private investment in mobile deployment, recent analysis shows that at least 575,000 square miles (approximately 750,000 road miles and 3 million people) either lack 4G LTE service or are being served only by subsidized 4G LTE providers."[875] The Commission further explained that funding for this effort will come from the redirection of legacy subsidies and distributed using a market-based, multi-round reverse auction and will come with defined, concrete compliance requirements so that rural consumers will be adequately served by the mobile carriers receiving universal service support. in support available to unserved and underserved areas.[876]

292. In addition, the Commission issued an Order and Notice of Proposed Rulemaking in May 2018, making available universal service support in Puerto Rico and the U.S. Virgin Islands to restore communications networks that hurricanes ravaged.[877] In that Order, the Commission stated that, through the Uniendo a Puerto Rico Fund, it will make available up to $254 million over a 3-year period for 4G Long-Term Evolution (LTE) mobile voice and broadband.[878] Through the Connect USVI Fund, the

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[871] Bundesnetzagentur, *President's Chamber Decision of 14 May 2018 on the Order For and Choice of Proceedings for the Award of Spectrum in the 2 GHz and 3.6 GHz Bands for Mobile/Fixed Communications Networks (MFCN)* (May 14, 2018), https://www.bundesnetzagentur.de/EN/Areas/Telecommunications/Companies/FrequencyManagement/ElectronicCommunicationsServices/ElectronicCommunicationServices_node.html.

[872] *Mid-band Spectrum Report* at 3. Each of the three mobile network operators in Germany has been assigned 42 megahertz of spectrum in the 3.4 GHz band on a nationwide basis. *Id*. at 3, n.3.

[873] *See* RAY BAUM'S Act.

[874] *Connect America Fund, Universal Service Reform – Mobility Fund*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 2152, 2154, para. 2 (2017).

[875] *Id*. at 2156, para. 14.

[876] *Id*. at 2154, para. 2

[877] *The Uniendo a Puerto Rico Fund and the Connect USVI Fund*, Order and Notice of Proposed Rulemaking, WC Docket 18-143, et al., 33 FCC Rcd 5404, 5405, para. 2 (2018) (*Uniendo and Connect USVI Funds Order and NPRM*).

[878] *Id*. at 5405, para. 3.

Commission will make available up to $4.4 million over a 3-year period for 4G LTE mobile voice and broadband.[879]

2. Spectrum Challenges and Commission Actions.

293. Recognizing the importance of spectrum in the provision of mobile wireless services, Congress, under the Communications Act, requires that the Commission implement spectrum policies that promote competition, innovation, and the efficient use of spectrum to serve the public interest, convenience, and necessity.[880] Consistent with this statutory mandate, the Commission has established policies to make spectrum available to existing mobile service providers and potential new entrants through initial licensing, primarily by competitive bidding,[881] and through secondary market transactions.[882]

294. In recent years the Commission has made available a significant amount of additional spectrum across a range of frequencies. For example, the Commission in 2017 made available 70 megahertz of licensed low-band spectrum in the 600 MHz band in the broadcast television spectrum incentive auction.[883] In 2018, the Commission released the *Third Report and Order* in the *Spectrum Frontiers* proceeding.[884] In a series of three orders, the Commission adopted rules to facilitate flexible terrestrial wireless use of 4950 megahertz of mmW spectrum across five bands, which will be licensed in multiple blocks of different sizes and geographic areas.[885] Also, in the Citizens Broadband Radio service (3.5 GHz band), the Commission has established service rules for 150 megahertz of spectrum for licensed and unlicensed sharing with federal incumbents.[886]

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[879] *Id*. at 5405, para. 4.

[880] 47 U.S.C. § 309(j)(3)(B).

[881] Note that the Commission generally provides a bidding credit – or discount – to promote participation by small businesses and rural service providers, including businesses owned by members of minority groups and women (collectively "designated entities"). 47 U.S.C. § 309(j)(3)(B), (j)(4)(D); *see also* 47 CFR § 1.2110. Updating Part 1 Competitive Bidding Rules; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions; Petition of DIRECTV Group, Inc. and EchoStar LLC for Expedited Rulemaking to Amend Section 1.2105(a)(2)(xi) and 1.2106(a) of the Commission's Rules and/or for Interim Conditional Waiver; Implementation of the Commercial Spectrum Enhancement Act and Modernization of the Commission's Competitive Bidding Rules and Procedures, WT Docket No. 14-170, GN Docket No. 12-268, RM 11395, WT Docket No. 05-211, *Report and Order, Order on Reconsideration of the First Report and Order, Third Order on Reconsideration of the Second Report and Order, and Third Report and Order*, 30 FCC Rcd 7493 (2015) (*Part 1 Report and Order*) (modified by Erratum; Aug. 25, 2015).

[882] *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6143-44, 6167-68, 6190, 6193, 6221-22, 6223-24, paras. 17, 67-69, 135, 144, 225-27, 231-32. The Commission generally has adopted "flexible use" policies, thereby allowing licensees to decide which services to offer and what technologies to deploy on spectrum used for the provision of mobile wireless services.

[883] *Incentive Auction Closing and Channel Reassignment Public Notice; The Broadcast Television Incentive Auction Closes; Reverse Auction and Forward Auction Results Announced; Final Television Band Channel Assignments Announced; Post-Auction Deadlines Announced*, Public Notice, 32 FCC Rcd 2786 (MB, WTB 2017) (*Closing and Channel Reassignment Public Notice)*.

[884] *See generally Spectrum Frontiers Third Report and Order.*

[885] *Spectrum Frontiers Third Report and* Order, 33 FCC Rcd at 5589-90, para. 33; *see also Spectrum Frontiers Second Report and Order; Spectrum Frontiers Report and Order.*

[886] *See generally Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959, at 3962, para. 4 (2015) (*3.5 GHz Report and Order*).

295. The Commission also has created incentives for efficient relocation, which allows spectrum to be put to its best use as technology changes while compensating incumbents. For example, in the broadcast television incentive auction the Commission implemented an auction framework that allowed for incumbent broadcast television licensees to sell licenses for commercial wireless use while also compensating remaining broadcast television licensees for spectrum repacking.[887] Further, the Commission is addressing entry barriers in spectrum policy by implementing innovative spectrum sharing frameworks. For example, in the 3.5 GHz band, the Commission introduced dynamic sharing whereby Spectrum Access Systems (SASs) will optimize frequency use to allow maximum capacity and co-existence in the band.[888] The SAS will also incorporate information from the Environmental Sensing Capability, which will be used to increase available spectrum in coastal areas while continuing to protect incumbent Department of Defense radar systems.[889] The SAS will enable a three-tiered priority sharing framework, in which incumbent federal users, priority access licensees, and general authorized access (GAA) users can share the same spectrum band.[890] Where competitive rivalry for spectrum access is low, the GAA tier will provide a low-cost entry point to the band, similar to unlicensed access.[891] This sharing framework has the potential to lower the barriers to entry significantly for innovative entrepreneurs and smaller businesses. The Commission has also increased the license area, lengthened the license terms, and changed the performance requirements for the 70 megahertz of priority access licenses in order to spur additional investment and broader deployment in the 3.5 GHz band, promote robust and efficient spectrum use, and help ensure the rapid deployment of advanced wireless technologies.[892]

296. In recent years, the Commission has expanded the amount of spectrum available for wireless use and is making use of multiple innovative policy tools to make more spectrum available such as incentivizing efficient relocation of incumbent licensees or implementing sharing frameworks between potential entrants and licensees. Overall, this expanded availability of spectrum in various bands will facilitate entry of next generation wireless services and promote continued development of innovative uses of spectrum.

3. Wireless Infrastructure Siting Challenges and Commission Actions

297. Federal, state, and local rules all impose regulatory costs on the deployment of wireless infrastructure, costs that have become even more significant in light of the massive new deployments needed to support 5G services. With its *2017 Wireless Infrastructure NPRM and NOI*, the Commission began a fundamental rethinking of wireless infrastructure policy and launched a comprehensive rulemaking proceeding designed to identify regulatory barriers to wireless infrastructure deployment and eliminate or reduce as many of them as possible.[893] The Commission has made tremendous progress in modernizing its wireless infrastructure rules with that proceeding, particularly by adopting two major orders. The first reformed the federal government's review process pertaining to wireless infrastructure,[894] while the second addressed barriers to wireless infrastructure deployment erected by

[887] *See Closing and Channel Reassignment Public Notice*.

[888] *3.5 GHz Report and Order*, 30 FCC Rcd at 3962, para. 5.

[889] *Id.*, at 3962-63, para. 7.

[890] *Id.* at 3962, para. 5.

[891] *Id.*

[892] *Investment in 3.5 GHz Band Report and Order*, FCC 18-149, at 2, para. 2.

[893] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Deployment*, Notice of Proposed Rulemaking and Notice of Inquiry, 32 FCC Rcd 3330 (2017) (*Wireless Infrastructure NPRM*).

[894] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Deployment*, Second Report and Order, FCC 18-30 (rel. Mar. 30, 2018) (*Wireless Infrastructure Second Report and Order*).

state and local governments.[895] In addition, the Commission has reformed and streamlined pole attachment and copper network retirement policies which will help facilitate the buildout of advanced services including 5G wireless broadband.[896]

298. In March 2018, the Commission adopted the *Wireless Infrastructure Second Report and Order*, which: (1) excluded from National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) review certain small wireless facilities;[897] (2) clarified procedures for engaging Tribal Nations and Native Hawaiian Organizations (NHOs) in historic preservation review;[898] and (3) exempted from NEPA review requirements certain structures placed on flood plains.[899] That decision is already expediting the deployment of wireless infrastructure. And according to an Accenture analysis, this Order will reduce small cell deployment costs by about $1.6 billion over the next 8 years.[900] In August 2018, the Commission adopted One-Touch Make Ready rules[901] and issued a Declaratory Ruling making clear that state and local moratoria, which are plainly a barrier to entry, violate section 253(a) of the Communications Act.[902]

299. In September 2018, the Commission adopted the *Wireless Infrastructure Declaratory Ruling and Third Report and Order*, addressing state and local barriers to deployment.[903] State and local zoning rules for erecting towers and other structures or attaching equipment to pre-existing towers and structures (*e.g.*, rooftops, water tanks, power lines, and utility poles) can affect the timing and cost of deploying mobile wireless networks. Regulatory delay can slow entry, and local regulatory fees can represent sunk costs that can deter or diminish entry. Thus, regulatory fees and regulatory delays can be a significant barrier to entry.[904] Siting fees such as excessive one-time application fees, annual recurring fees, unreasonable or discriminatory gross revenue fees, and franchise or use fees may be especially burdensome to smaller providers and may prevent or discourage investment. In addition, review processes designed for large macro cells may be applied to small cell deployments in some localities.[905] These review processes could pose significant barriers to entry or expansion because of the large number

[895] *See generally Wireless Infrastructure Third Report and Order*.

[896] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket No. 17-79, Report and Order, 32 FCC Rcd 9760 (2017) (*Wireless Infrastructure First Report and Order*), and *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Report and Order, Declaratory Ruling, and Further Notice of Proposed Rulemaking, 32 FCC Rcd 11128 (2017) (*Wireline Infrastructure First Report and Order*).

[897] *Wireless Infrastructure Second Report and Order* at 3, para. 4.

[898] *Id.* at 3, para. 6.

[899] *Id.* at 4, para. 8.

[900] Accenture Strategy, "Impact of Federal Regulatory Reviews on Small Cell Deployment," March 12, 2018, https://api.ctia.org/docs/default-source/default-document-library/small-cell-deployment-regulatory-review-costs_3-12-2018.pdf.

[901] "One-Touch Make Ready" means that it must be possible for a single construction team to make a pole ready for a new attachment.

[902] *See Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, Third Report and Order and Declaratory Ruling, 33 FCC Rcd 7705, 7775, para. 140 (2018) (*Wireline Infrastructure Third Report and Order*).

[903] *See generally Wireless Infrastructure Third Report and Order*.

[904] *Sixteenth Report*, 28 FCC Rcd at 3765, para.76.

[905] *Wireless Infrastructure NPRM*, 32 FCC Rcd at 3343, paras. 32-34.

of small cells that need to be deployed relative to large towers.[906] The review processes may be less important for small cells because their deployment causes less disruption to an area than the deployment of large towers.[907] In addition, state and local zoning requirements may prevent or delay entry and expansion by requiring that all facilities along rights-of-way (ROW) be underground, or by imposing burdensome and/or unpublished aesthetic restrictions.[908]

300. In the *Declaratory Ruling*, the Commission reaffirmed that a state or local legal requirement constitutes an effective prohibition if it "materially limits or inhibits the ability of any competitor or potential competitor to compete in a fair and balanced legal and regulatory environment."[909] The *Declaratory Ruling* also concluded that state and local application fees, fees for access to the ROW, and fees for use of government-owned facilities in the ROW are preempted unless (1) the fees are a reasonable approximation of the state or local government's costs, (2) only objectively reasonable costs are factored into those fees, and (3) the fees are no higher than the fees charged to similarly-situated actual or possible competitors in similar situations.[910] The *Third Report and Order* established two new "shot clocks" for small wireless facilities, codified existing shot clocks for other wireless facilities, and clarified that failure to act within the shot clock period presumptively has the effect of prohibiting personal wireless services, in violation of Section 332(c) of the Communications Act.[911]

B. The Fixed Communications Market

301. The Commission has taken numerous steps to accelerate the deployment of broadband networks and facilities. The Broadband Deployment Advisory Committee's (BDAC), for example, was chartered on March 1, 2017 and makes recommendations to the Commission on how to accelerate broadband deployment by reducing and/or removing regulatory barriers to infrastructure investment.[912] The BDAC provides a means for stakeholders to exchange ideas and develop recommendations to the Commission on broadband deployment, thereby enhancing the Commission's ability to carry out its statutory responsibility to encourage broadband deployment to all Americans.[913] Since the Commission released the *2018 Broadband Deployment Report*, the BDAC has met three times, first on April 25, 2018[914] then on July 26-27, 2018,[915] and again on December 6-7, 2018.[916]

302. In 2018, the BDAC considered reports and recommendations from its various working groups, including draft model codes for states and municipalities to encourage the development and

[906] An estimated 100,000 to 150,000 small cells will be constructed by the end of 2018, and these numbers are projected to reach 455,000 by 2020, and 800,000 by 2026. *Wireline Infrastructure Third Report and Order*, at 2, para. 1.

[907] *Wireless Infrastructure Third Report and Order* at 3, para. 3.

[908] *Id.* at 43-46, paras. 84-91.

[909] *Id.* at 15, para. 35.

[910] *Id.* at 25-26, para. 50.

[911] *Id.* at 5, para. 13.

[912] FCC, *Broadband Deployment Advisory Committee Charter, Committee's Objective and Scope of its Activities* (Mar. 1, 2017), https://www.fcc.gov/sites/default/files/bdac-charter.pdf.

[913] *Id.*

[914] *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-138 (Feb. 12, 2018).

[915] *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-706 (July 6, 2018).

[916] *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-1160 (Nov. 14, 2018).

deployment of broadband infrastructure.[917] The BDAC adopted the model code for municipalities at the July 2018 meeting and finalized the model code for states at the December 2018 meeting. In August, the BDAC solicited nominations for membership on a new Disaster Response and Recovery Working Group, which will be charged with making recommendations on additional measures that can be taken before a disaster to improve resiliency of broadband infrastructure, strategies that can be used during the response to a disaster to minimize the downtime of broadband networks, and actions that can be taken to restore broadband infrastructure during disaster recovery.[918] On December 10, the Commission announced its intent to re-charter the BDAC for an additional two years, starting on or about March 1, 2019.[919]

303. The BDAC's efforts have been particularly influential in the Commission's infrastructure proceedings. A number of the BDAC's recommendations[920] provided the framework for many of the Commission's actions in the August 2018 *Third Report and Order and Declaratory Ruling*,[921] including the BDAC's January 2018 proposal to streamline pole attachment make-ready workflows under a "one-touch make-ready" (OTMR) model.[922] Similarly, the BDAC's findings, reports, and recommendations[923]

[917] BDAC Model Code for States Working Group, State Model Code for Accelerating Broadband Infrastructure Deployment and Investment, Final Approved Sections (Dec. 6, 2018), https://www.fcc.gov/sites/default/files/bdac-12-0607-2018-model-code-states-final-approved-sections.pdf; BDAC Model Code for States Working Group, State Model Code for Accelerating Broadband Infrastructure Deployment and Investment, Discussion Draft (Dec. 6, 2018), https://www.fcc.gov/sites/default/files/bdac-12-0607-2018-model-code-states-discussion-doc.pdf; BDAC Model Code for States Working Group, State Model Code for Accelerating Broadband Infrastructure Deployment and Investment (July 19, 2018), https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-harmonization-wg-model-code-states.pdf; BDAC Model Code for Municipalities Working Group, Model Code for Municipalities (July 19, 2018), https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-harmonization-wg-model-code-muni.pdf.

[918] *FCC Solicits Nominations for New Disaster Response and Recovery Working Group of the Broadband Deployment Advisory Committee*, Public Notice, GN Docket No. 17-83, DA 18-837 (Aug. 9, 2018).

[919] *See FCC Announces the Re-Charter of the Broadband Deployment Advisory Committee and Solicits Nominations for Membership*, GN Docket No. 17-83, Public Notice, DA 18-1239 (Dec. 10, 2018).

[920] *See, e.g.*, Letter from Paul D'Ari, Designated Federal Officer, Broadband Deployment Advisory Committee, FCC, to Marlene H. Dortch, Secretary, FCC, WC Docket No. 17-84 (filed July 3, 2018), at Attach. Broadband Deployment Advisory Committee, FCC, Report of the Competitive Access to Broadband Infrastructure Working Group, at 19-22, 26-27, 29, 37, 39 (2018), https://ecfsapi.fcc.gov/file/107030255502405/Competitive%20Access%20to%20Broadband%20Infrastructure%20Report.pdf (BDAC January 2018 Recommendations); BDAC, Addendum to the Report of the Competitive Access to Broadband Infrastructure Working Group (April 25, 2018), https://www.fcc.gov/sites/default/files/bdac-cabi-report-04252018.pdf.

[921] *See Wireline Infrastructure Third Report and Order*, 33 FCC Rcd at 7706, para. 2.

[922] *See* BDAC January 2018 Recommendations at 18-31. By some estimates, OTMR alone could result in approximately 8.3 million incremental premises passed with fiber, and about $12.6 billion in incremental fiber capital expenditures. *See* Letter from Thomas J. Navin, Counsel to Corning, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 17-84, at Attach. A; Ed Naef and Alex King, CMA Strategy Consulting, *Assessing the Impact of Removing Regulatory Barriers on Next Generation Wireless and Wireline Broadband Infrastructure Investment: Annex 1, Model Sensitivities* at 5-6 (filed Feb. 26, 2018).

[923] *See, e.g.*, BDAC, Model Code for Municipalities Working Group, Model Code for Municipalities (July 19, 2018), https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-harmonization-wg-model-code-muni.pdf; BDAC, Report of the Removal of State and Local Regulatory Barriers Working Group (Jan. 10, 2018), https://www.fcc.gov/sites/default/files/bdac-regulatorybarriers-01232018.pdf; BDAC, Rates and Fees Committee, Draft Final Report to the BDAC (v 2.5) (July 24, 2018), https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-rates-fees-wg-report-07242018.pdf.

informed the conclusions in the Commission's September 2018 *Wireless Infrastructure Declaratory Ruling and Third Report and Order*.[924]

304. The Commission has also been at the forefront of supporting areas affected by natural disasters. In October 2017, the Commission pledged to repair communications networks in Puerto Rico and the U.S. Virgin Islands damaged by Hurricane Maria[925] and in May 2018, the Commission approved additional funding to accelerate the restoration of communications networks in those territories.[926] It also sought comment on providing almost $900 million in medium- and long-term funding into expanding and improving broadband access on the islands.[927] The *Order and Notice of Proposed Rulemaking* includes an immediate infusion of approximately $64 million in additional funding for short-term restoration efforts, and sought public comment on a proposal to allocate approximately $444.5 million in funding for Puerto Rico and $186.5 million for the U.S. Virgin Islands over the next decade for the expansion of fixed broadband connectivity.[928]

305. Universal service also played an essential role in deployment of broadband networks and encouraging competition. The Commission's Universal Service Fund (USF) provides funding to increase the availability of fixed and mobile broadband services in unserved and rural areas.[929] The Fund targets support to these areas and, as part of its oversight responsibilities, the Commission routinely considers ways to maximize the impact of available USF funding to support broadband deployment.[930]

306. Over the past two years, for example, the Commission has successfully conducted the Connect America Fund Phase II auction to award funding to service providers that commit to offer voice and broadband services to fixed locations in unserved high-cost areas. In February 2017, the Commission adopted a *Report and Order and Order on Reconsideration* finalizing bidding rules and establishing weights to compare bids in the auction.[931] In August 2017, the Commission released a *Public Notice* proposing procedures to implement the Phase II auction. The Phase II auction, which offered up to nearly $2 billion over the next decade to expand fixed, high-speed Internet service to unserved rural areas, ran from July 24, 2018 to August 21, 2018.[932] At its conclusion, 103 bidders won $1.49 billion over 10 years

[924] *See Wireless Infrastructure Third Report and Order*, at 11, para. 27.

[925] *Connect America Fund*, WC Docket No. 10-90, Order, 32 FCC Rcd 7981 (2017).

[926] *See generally Uniendo and Connect USVI Funds Order and NPRM*, 33 FCC Rcd 5404.

[927] *Id.* at 5405, paras. 3-5.

[928] *Id.* at 5413, paras. 30-33.

[929] *Connect America Fund et al*., Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663, 17668-69, paras. 1-5 (2011) (*USF/ICC Transformation Order), aff'd sub nom, In re: FCC 11-161*, 753 F.3d 1015 (10th Cir. 2014).

[930] *Connect America Fund, et al.*, Report and Order, Third Order on Reconsideration, and Notice of Proposed Rulemaking, FCC 18-29, para. 4 (2018) (taking several steps to increase broadband deployment in rural areas through the High Cost program, including maximizing available funding for broadband networks); *Bridging the Digital Divide for Low-Income Americans*, Fourth Report and Order, Order on Reconsideration, Memorandum Opinion and Order, Notice of Proposed Rulemaking, Notice of Inquiry, 32 FCC Rcd. 10475, para. 1 (2018) (directing Lifeline funds to the areas in which they are most needed, to encourage investment in broadband-capable networks); *Promoting Telehealth in Rural America*, Report and Order, FCC 18-82, para. 1 (2018) (increased the funding cap for the Rural Healthcare program to $571 million to prevent pro-rata funding reductions that could have disproportionally impacted rural health care providers, especially those in Alaska).

[931] *Connect America Fund et al.*, WC Docket Nos. 10-90 et al., Report and Order and Order on Reconsideration, 32 FCC Rcd 1624 (2017).

[932] *Connect America Fund Phase II Auction Scheduled for July 24, 2018 Notice and Filing Requirements and Other Procedures for Auction* 903, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, 33 FCC Rcd 1428 (2018); *220 Applicants Qualified to Bid in the Connect America Fund Phase II Auction (Auction 903); Bidding to* (continued….)

to provide fixed broadband and voice services to over 700,000 locations in 45 states.[933] Separately, the Commission provided small, rural carriers with an infusion of over $500 million to promote more high-speed broadband deployment in rural areas in March 2018.[934]

307. In December 2017, the Commission issued a *Notice of Proposed Rulemaking* to review the Rural Health Care program and sought comment on ways to improve connectivity for health care providers in rural areas including whether to lift the program's funding cap to make additional money available for broadband to rural health care providers. In an accompanying *Order*, the Commission granted relief to rural health care providers facing potential funding cuts in funding year 2017.[935] In June 2018, the Commission increased the funding cap for the Rural Health Care program from $400 million to $571 million to prevent pro-rata funding reductions that could have disproportionally impacted rural health care providers, especially those in Alaska.[936]

308. In June 2018, the Commission set aside enforcement of rules that were unfairly driving up the cost of broadband service for the customers of some rural providers.[937] Unlike all other ISPs, our rules require certain small, rural providers to pay into the USF fees on the revenues they earn from broadband Internet access transmission service.[938] These fees ultimately get passed on to their customers. To level the playing the field and reduce the cost of broadband in many rural areas, the Commission granted a petition for forbearance effectively waiving that requirement for these rural carriers.[939]

309. To remove the impediments that Title II classification had placed on broadband investment and deployment, in May 2017, the Commission proposed to restore the pre-2015 "information service" classification of broadband Internet access service.[940] In December 2017, the Commission adopted a *Declaratory Ruling, Report and Order, and Order* that reinstated the pre-2015 "information service" classification of broadband Internet access service[941] and restored the determination that mobile broadband is not a "commercial mobile service."[942] The Commission found that these measures would

(Continued from previous page)
Begin on July 24, 2018, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, DA 18-658 (WCB/WTB June 25, 2018) (announcing the qualified bidders for the auction and confirming timing); *Connect America Fund Phase II Auction (Auction 903) Closes; Winning Bidders Announced*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, DA 18-887 (WCB/WTB Aug. 28, 2018).

[933] News Release, FCC, Connect America Fund Auction to Expand Broadband to Over 700,000 Rural Homes and Businesses (Aug. 28, 2018), https://docs.fcc.gov/public/attachments/DOC-353840A1.pdf.

[934] *Connect America Fund, et al.*, WC Docket Nos. 10-90, 14-58, 07-135, CC Docket No. 01-92, Report and Order, Third Order on Reconsideration, and Notice of Proposed Rulemaking, FCC 18-29, at 3, para. 4 (Mar. 23, 2018).

[935] *Promoting Telehealth in Rural America*, WC Docket No. 17-310, Notice of Proposed Rulemaking and Order, 32 FCC Rcd 10631 (2017).

[936] *Promoting Telehealth in Rural America*, WC Docket No. 17-310, Report and Order, 33 FCC Rcd 6574, 6574, para. 1 (2018).

[937] *Petition of NTCA—The Rural Broadband Association and the United States Telecom Association for Forbearance Pursuant to 47 U.S.C. § 160(c) from Application of Contribution Obligations on Broadband Internet Access Transmission Services*, WC Docket No. 17-206, Order, 33 FCC Rcd 5712 (2018).

[938] *See* 47 U.S.C. § 254(d), 47 CFR § 54.706.

[939] *Auctions of Upper Microwave Flexible Use Licenses for Next-Generation Wireless Services*, AU Docket No. 18-85, Public Notice, 33 FCC Rcd 7575 (2018).

[940] *Restoring Internet Freedom*, WC Docket No. 17-108, Notice of Proposed Rulemaking, 32 FCC Rcd 4434 (2017).

[941] *Restoring Internet Freedom Order*, 33 FCC Rcd at 318-52, paras. 20-64.

[942] *Id.* at 352-62, paras. 65-85.

"encourage broadband investment and innovation, furthering our goal of making broadband available to all Americans."[943]

310. The Commission has also taken steps to remove impediments to deployment and network transitions. In April 2017, the Commission sought comment on addressing barriers to investment in and deployment of wireline infrastructure.[944] In November 2017, the Commission addressed pole attachment, copper retirement and discontinuance issues and sought further comment on reducing barriers to broadband deployment.[945] In June 2018, the Commission eliminated unnecessary impediments and costs to timely network upgrades, while maintaining protections for consumers and enabling providers to invest in next-generation networks.[946] The Commission took these actions to build on the work begun in 2017 to reform our copper retirement, network change disclosure, and discontinuance processes and remove regulatory barriers causing unnecessary costs or delay to deployment of next-generation networks.[947]

311. In August 2018, the Commission adopted measures to expedite the process and reduce the costs of attaching new network facilities to utility poles.[948] Consistent with the recommendations of the BDAC,[949] the Commission established a new pole attachment process that allows the party with the strongest incentive to prepare the pole quickly for new attachments, rather than spreading the work across multiple parties.[950] The Commission also addressed two forms of state and local regulatory barriers to deployment, clarifying that (1) it will preempt, on a case-by-case basis, state and local laws that inhibit the rebuilding or restoration of broadband infrastructure after a disaster; and (2) state and local moratoria on the deployment of telecommunications services and facilities are barred section 253(a) by the Communications Act because they "prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service."[951]

312. The Commission also removed regulatory barriers in the competitive market for business data services. In April 2017, the Commission recognized widespread competition in the business data services market and eliminated pricing regulation and tariffing requirements for most types of business data services.[952]

C. The Video and Audio Markets

313. *Broadcast Ownership Rules*. The Commission's rules contain structural limits governing ownership of television stations. Section 202(h) of the Telecommunications Act of 1996 requires the

[943] *Id.* at 362-63, para. 86.

[944] *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Notice of Proposed Rulemaking, Notice of Inquiry, and Request for Comment, 32 FCC Rcd 3266 (2017).

[945] *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Report and Order, Declaratory Ruling, and Further Notice of Proposed Rulemaking, 32 FCC Rcd 11128 (2017) (*Wireline Infrastructure First Report and Order*).

[946] *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Second Report and Order, 33 FCC Rcd 5660 (2018).

[947] *See Wireline Infrastructure First Report and Order*, 32 FCC at 11187-94, paras. 156-79.

[948] *See Wireline Infrastructure Third Report and Order*, 33 FCC Rcd at 7711-74, paras. 13-136.

[949] *See* BDAC January 2018 Recommendations at 18-31.

[950] *Wireline Infrastructure Third Report and Order*, 33 FCC Rcd at 7706, 7714-25, paras. 2, 16-35.

[951] *Id.* at 7707, 7774-75, paras. 4, 137-39.

[952] *See generally Business Data Services in an Internet Protocol Environment*, WC Docket Nos. 16-143, 05-25, GN Docket No. 13-5, RM-10593, Report and Order, 32 FCC Rcd 3459, 3463, paras. 1-9 (2017) (taking several steps to reduce government intervention and allow market forces to further spur entry, innovation, and competition in business data services markets served by price cap carriers) .

Commission to review its media ownership rules every four years to determine whether they remain "necessary in the public interest as a result of competition."[953] Rule modifications enacted by the Commission after such reviews may enhance competition and reduce barriers to entry in the media marketplace.

314. On August 10, 2016, the Commission adopted a Second Report and Order that completed the 2010 and 2014 quadrennial reviews of the media ownership rules (*Quadrennial Review Order*).[954] On November 20, 2017, the Commission released an Order on Reconsideration that reversed certain elements of the earlier Order, most notably by repealing the long-standing Newspaper/Broadcast Cross-Ownership Rule and Radio/Television Cross-Ownership Rule.[955] The Order on Reconsideration also revised the Local Television Ownership Rule[956] and eliminated the attribution rule for television joint sales agreements (JSAs).[957] Under the revised Local Television Rule, an entity may own two television stations in the same DMA if (1) the digital noise limited service contours of the stations (as determined by Section 73.622(e)) do not overlap; or (2) at least one of the stations is not ranked among the top four stations in the market.[958] Under the revised Local Television Ownership Rule, the Commission will consider combinations otherwise barred by the top-four prohibition on a case-by-case basis.[959]

315. The Commission also repealed the attribution rule for television JSAs. As a result, the Commission will no longer consider TV JSAs of any type to be attributable ownership interests for the purposes of its media ownership rules.[960] The Commission stated that the repeal effectively removes a regulatory disincentive for entering into JSAs and enables the stations to better serve their communities.[961]

316. In addition to modifying the local television ownership rules, the Commission recently sought comment on whether to repeal or modify the national television audience reach rule.[962] This rule prohibits a single entity from owning television stations that collectively reach more than 39% of the total nationwide audience.[963] To compensate for the technical limitations of analog UHF signals, the rule previously allowed the licensee of a UHF station to count only 50% of the television households in its

[953] Telecommunications Act of 1996, Pub. L. No. 104-104, § 202(h), 110 Stat. 56, 111-12 (1996) (1996 Act); Consolidated Appropriations Act, 2004, Pub. L. No. 108-199, § 629, 118 Stat. 3, 99-100 (2004) (Appropriations Act) (amending Sections 202(c) and 202(h) of the 1996 Act). In 2004, Congress revised the then-biennial review requirement to require such reviews quadrennially. *See* Appropriations Act § 629, 118 Stat. at 100.

[954] *2014 Quadrennial Second Report and Order*.

[955] *2014 Quadrennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, Order on Reconsideration and Notice of Proposed Rulemaking, 32 FCC Rcd 9802, 9803, para. 2 (2017) (*Quadrennial Review Reconsideration*). Elimination of the Newspaper/Broadcast Cross-Ownership and Radio/Television Cross-Ownership Rules removed all restrictions prohibiting a single entity from owning a newspaper and broadcast stations in the same market. *Id.* at 9806-07, 9824-25, paras. 8, 49. Although the cross-ownership restrictions have been repealed, broadcast ownership remains subject to the Local Television Ownership Rule and Local Radio Ownership Rule. *Id.* at 9824-25, para. 49.

[956] *Id*. at 9803, para. 2.

[957] *Id.*

[958] *Id.* at 9831, para. 66.

[959] *Id.* at 9836, para. 78.

[960] *Id.* at 9848, para. 101.

[961] *Id*. at 9881, Appendix B, para. 29.

[962] 47 CFR § 73.3555(e).

[963] *Id.* § 73.3555(e)(2).

market area for purposes of assessing compliance with the 39% cap.[964] In 2016, the Commission eliminated this UHF discount, finding that the nation's transition from analog to digital television eliminated the technical justification for the discount.[965] In 2017, the Commission reversed this decision on reconsideration, finding that when the UHF discount was eliminated, the Commission failed to consider whether the resulting *de facto* tightening of the national cap was in the public interest and justified by current marketplace conditions.[966] On reconsideration, the Commission reinstated the UHF discount and stated that the Commission would conduct a comprehensive rulemaking proceeding to determine whether to retain the discount and/or modify the national cap.[967]

317. On August 2, 2018, the Commission adopted a Report and Order establishing the requirements that will govern an incubator program that seeks to promote the entry of new and diverse voices into the broadcast industry.[968] Under the incubator program, an established broadcaster can provide financial and operational support, including training and mentoring, to a new or small broadcaster.[969] At the end of a successful incubation relationship, if the new or small broadcaster either owns and operates a new station independently or the previously struggling broadcaster's station is on a firmer footing,[970] the established broadcaster is eligible to receive a waiver of the Commission's Local Radio Ownership Rule that it can use either in the incubated market or in a comparable market, subject to certain requirements.[971] Participation in the incubator program initially will be limited to full-service AM and FM broadcast radio stations, as the costs of obtaining and operating radio stations make the radio sector a significantly more accessible entry point than television for entities with limited capital resources and operational experience.[972] The incubator program addresses the need for more innovative approaches to provide access to capital, as well as technical, operational, and management training, to new entrants and small broadcasters that otherwise would not be able to own a full-service broadcast radio station, acquire an additional station, or remain in the broadcasting business.[973]

318. *Next Generation Broadcast Television Transmission Standard*. On November 20, 2017, the Commission released a Report and Order and Further Notice of Proposed Rulemaking adopting proposals to authorize broadcasters to use the new Advanced Television Systems Committee (ATSC) 3.0 broadcast transmission standard.[974] This enhanced transmission standard has the potential to enable

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[964] *Id.*; *Amendment of Section 73.3555(e) of the Commission's Rules, National Television Multiple Ownership Rule*, Report and Order, 31 FCC Rcd 10213, 10215, para. 5 (2016).

[965] *Id.* at 10214, para. 2 (2016).

[966] *Amendment of Section 73.3555(e) of the Commission's Rules, National Television Multiple Ownership Rule*, Order on Reconsideration, 32 FCC Rcd 3390, 3390, para. 1 (2017).

[967] *Id.* at 3391, para. 1.

[968] *Rules and Policies to Promote New Entry and Ownership Diversity in the Broadcasting Services*, MB Docket No. 17-289, Report and Order, at 1, para. 1 (2018) (*Incubator R&O*).

[969] *Incubator R&O* at 2, para 6.

[970] *Id.* at 2, para 6.

[971] *Id.*

[972] *Id.* at 2, para 7.

[973] *Id.* at 1, para 1.

[974] *Authorizing Permissive Use of the "Next Generation" Broadcast Television Standard*, GN Docket No. 16-142, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 9930, 9931-33, para. 2 (2017) (*Next Gen TV Order*). The rules adopted in the *Next Gen TV Order* took effect on March 5, 2018, except for rule sections 73.3801, 73.6029, and 74.782, which require OMB approval. *Media Bureau Announces* Next Gen TV Order *Published in Federal Register*, GN Docket No. 16-142, Public Notice, DA 18-103 (MB Feb. 2, 2018). The rules requiring OMB approval took effect on July 17, 2018. *Next Gen TV Rules Receive OMB Approval*, GN Docket No. 16-142, Public Notice, DA 18-736 (MB July 17, 2018). In the accompanying Further Notice of Proposed

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broadcast television stations to serve consumers and advertisers in new, innovative ways that may allow such stations to compete with features offered by MVPDs and OVDs. Advocates of ATSC 3.0 assert that the new standard could greatly improve broadcast signal reception, particularly on mobile devices and television receivers without outdoor antennas.[975] Advocates also state that ATSC 3.0 will enable broadcasters to offer enhanced and innovative new features to consumers, including Ultra High Definition (UHD) picture and immersive audio, more localized programming content, an advanced emergency alert system (EAS) capable of waking up sleeping devices to warn consumers of imminent emergencies, better accessibility options, and interactive services.[976] In the recent Order, the Commission authorized voluntary use of the ATSC 3.0 transmission standard and found that 3.0 transmissions meet the definition of "broadcasting" in the Communications Act.[977] The Order requires broadcasters who transmit in ATSC 3.0 to simulcast the primary video programming stream of their 3.0 channels in an ATSC 1.0 format, so that viewers will continue to receive ATSC 1.0 service.[978]

319. The Order states that an ATSC 3.0 broadcaster's ATSC 1.0 signal will retain mandatory carriage rights, but that the station's 3.0 signal will not have mandatory carriage rights while the Commission requires local simulcasting.[979] Thus, MVPDs are required to continue to carry broadcasters' 1.0 signals but are not required to carry 3.0 signals. The Commission did not adopt new rules to govern carriage of 3.0 signals pursuant to retransmission consent and found that voluntary carriage of 3.0 signals is best left to marketplace negotiations between broadcasters and MVPDs.[980] Television stations transmitting signals in ATSC 3.0 are subject to the public interest obligations currently applicable to television broadcasters.[981] In addition, the Commission concluded that it is unnecessary to adopt an ATSC 3.0 tuner mandate for new television receivers.[982] The Commission requires broadcasters to provide advance on-air notifications to educate consumers about ATSC 3.0 service deployment and simulcasting.[983] Lastly, the Order adopts specific technical aspects of the ATSC 3.0 standard.[984]

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Rulemaking, the Commission sought further comment on: (1) issues related to exceptions to and waivers of the local simulcasting requirement, (2) whether the Commission should let full power broadcasters use channels in the television broadcast band that are vacant to facilitate the transition to 3.0, and (3) its tentative conclusion that local simulcasting should not change the significantly viewed status of a station transmitting in ATSC 3.0. *Next Gen TV Order*, 32 FCC Rcd at 9989, paras. 122-31.

[975] *Authorizing Permissive Use of the "Next Generation" Broadcast Television Standard*, GN Docket No. 16-142, Notice of Proposed Rulemaking, 32 FCC Rcd 1670, 1671, para. 1 (2017).

[976] *Id.*

[977] *Next Gen TV Order*, 32 FCC Rcd at 9934-37, paras. 6-7, 9.

[978] *Id.* at 9931-33, para. 2. The programming aired on the ATSC 1.0 simulcast channel must be "substantially similar" to the programming aired on the 3.0 channel. This requirement means that the programming must be the same, except for programming features that are based on the enhanced capabilities of ATSC 3.0, advertisements, and promotions for upcoming programs. *Id.* The substantially similar requirement will sunset in five years from its effective date absent further action by the Commission to extend it. *Id.*

[979] *Id.* at 9958, para. 61.

[980] *Id.* at 9969-70, paras. 77-78.

[981] *Id.* at 9970, para. 79.

[982] *Id.* at 9973, para. 83.

[983] *Id.* at 9975, para. 86.

[984] *Id.* at 9978, para. 94. The Commission incorporates two parts of the ATSC 3.0 "physical layer" standard into its rules: (1) ATSC A/321:2016 "System Discovery & Signaling" (A/321), which is the standard used to communicate the RF signal type that the ATSC 3.0 signal will use, and (2) A/322:2017 "Physical Layer Protocol" (A/322), which is the standard that defines the waveforms that ATSC 3.0 signals may take. *Id.* at 9978, para. 95. The Commission also adopts the service and interference protection rules that were proposed in the *Next Gen TV NPRM*. *Id.* at 9982,
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320. *Modifying or Eliminating Unnecessary Regulations.* In 2017, the Commission began an effort to modernize its regulations affecting media outlets by eliminating or modifying a number of obsolete, burdensome, or outmoded rules.[985] This effort has resulted in the elimination or modification of several requirements, including the following:

- In January 2018, the Commission eliminated the main studio rule, which had long required each television broadcast station to maintain a main studio located in or near its community of license.[986] The Commission found that the widespread availability of electronic communication enables stations to participate in their communities of license and allows members of the community to contact broadcast stations without the need for the physical presence of a local broadcast studio.[987] Likewise, because the Commission adopted online public inspection file requirements for broadcast stations, community members no longer need to visit a television station's main studio to access its public inspection file.[988] Given these changes, the Commission found the main studio rule to be outdated and unnecessarily burdensome on broadcast licensees.[989] The Commission also eliminated the requirement that the main studio have full-time management and staff present during normal business hours as well as the requirement that the studio be capable of originating programming.[990] Repeal of this rule is expected to give broadcasters cost savings and greater flexibility in their station operations.[991]
- In February 2018, the Commission eliminated rules that required certain broadcast and cable entities to maintain paper copies of the Commission's regulations.[992]

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para. 105. The Commission also concludes that broadcast television stations may operate ATSC 3.0 Single Frequency Networks (SFNs) pursuant to its current rules authorizing Distributed Transmission Systems (DTS). *Id.* at 9987, para. 115.

[985] *Commission Launches Modernization of Media Regulation Initiative*, MB Docket No. 17-105, Public Notice, 32 FCC Rcd 4406 (2017) (*Media Modernization Notice*).

[986] *Elimination of Main Studio Rule*, MB Docket No. 17-106, Report and Order, 32 FCC 8158, 8158, para. 1 (2017) (*Main Studio Order*); *see also Elimination of Main Studio Rule*, Notice of Proposed Rulemaking, 32 FCC Rcd 4415 (2017).

[987] *Main Studio Order*, 32 FCC Rcd at 8163, para. 9.

[988] *Id.*

[989] *Id.* at 8165, para. 13.

[990] *Id.* at 8168, 8169, paras. 17, 19. Although not codified in regulations, the Commission had held that a main studio must have a "meaningful management and staff presence" to fulfill the main studio's function, which at a minimum required "management and staff presence on a full-time basis during normal business hours." *See Amendment of Sections 73.1125 and 73.1130 of the Commission's Rules, the Main Studio and Program Origination Rules for Radio and Television Broadcast Stations*, Memorandum Opinion and Order, 3 FCC Rcd 5024, 5026, para. 24 (1988) (*1988 Main Studio and Program Origination Reconsideration Order*); *Application for Review of Jones Eastern of the Outer Banks, Inc. Licensee, Radio Station WRSF(FM) Columbia, North Carolina*, Memorandum Opinion and Order, 6 FCC Rcd 3615, 3616, n.2 (1991). Stations were also required to maintain production and transmission facilities. *1988 Main Studio and Program Origination Reconsideration Order*, 3 FCC Rcd at 5026, para. 24. The Commission found that requiring a main studio to maintain staff sufficient to accommodate visits from community members could not be justified because of current technology. *Main Studio Order* at 8168-69, para. 18.

[991] *Id.* at 8168, 8169, paras. 17, 19.

[992] *Amendment of Parts 74, 76 and 78 of the Commission's Rules Regarding Maintenance of Copies of FCC Rules*, Report and Order, 33 FCC Rcd 2425 (2018). The rules required (1) licensees or permittees of low power TV, TV translators, and TV booster stations to maintain "a current copy of Volume I and Volume III of the Commission's
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- As initially adopted, Section 73.624(g) of the Commission's rules required DTV broadcast stations to submit an annual report concerning provision of ancillary or supplementary services to the Commission, even if they provided no ancillary or supplementary services[993] during the relevant reporting period.[994] In April 2018, the Commission limited this reporting requirement to the small number of broadcast stations that actually provided feeable ancillary or supplementary services during the previous twelve months.[995]
- In September 2018, the Commission eliminated FCC Form 325, which collected certain operational information from cable television systems, finding that the form's limited utility was outweighed by the burden placed on cable operators to file, and on the Commission to process, the form.[996]
- In October 2018, the Commission eliminated the requirement that broadcast licensees and permittees file paper copies of certain documents with the Commission.[997]

D. The Satellite Market

321. On September 26, 2017, the Commission adopted an updated regulatory framework to facilitate the delivery of broadband services through satellite constellations.[998] In that Order, the Commission updated, clarified and streamlined the current rules governing NGSO FSS systems to better reflect current technology and promote additional operational flexibility. That action paves the way for greater broadband offerings in the United States, particularly in remote and rural areas. In March 2018, to facilitate the efficient and effective use of spectrum, the Commission approved the first U.S.-licensed satellite constellation to provide broadband services using a new generation of LEO satellite technologies in the *SpaceX Authorization Order*.[999]

322. In addition to SpaceX, the Commission has approved a number of NGSO FSS MEO and LEO systems for operation in the U.S. market that plan to serve a variety of purposes, such as the provision of high-throughput, low-latency broadband services to remote locations, satellite mission extension services, and inter-satellite connectivity. For example, in 2017, the Commission adopted an order granting market access to WorldVu d/b/a OneWeb for its NGSO FSS system of 720 satellites,

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rules and (2) licensees and permittees of FM translator and FM booster stations to maintain a current copy of Volumes I (Parts 0, 1, 2 and 17) and III (Parts 73 and 74) of the Commission's rules. *Id.* at 2425-46, para. 2 and ns. 3 & 4 (internal citations omitted).

[993] *See supra* note 261.

[994] *Amendment of Section 73.624(g) of the Commission's Rules Regarding Submission of FCC Form 2100, Schedule G, Used to Report TV Stations' Ancillary or Supplementary Services*, MB Docket No. 17-264, Report and Order, FCC 18-41 at para. 3 (Apr. 13, 2018) (citing 47 CFR § 73.624(g)(2)(i); *Fees for Ancillary or Supplementary Use of Digital Television Spectrum Pursuant to Section 336(e)(1) of the Telecommunications Act of 1996*, Report and Order, 14 FCC Rcd 3259 (1998) (*Ancillary or Supplementary Services Report and Order*), *recon. denied*, Memorandum Opinion and Order, 14 FCC Rcd 19931 (1999)).

[995] *Id.* at para. 1 (citing 47 CFR § 73.624(g)(2); *Amendment of Section 73.624(g) of the Commission's Rules Regarding Submission of FCC Form 2100, Schedule G, Used to Report TV Stations' Ancillary or Supplementary Services et al.*, MB Docket No. 17-264 *et al.*, Notice of Proposed Rulemaking, FCC 17-138 (Oct. 24, 2017)).

[996] *FCC Form 325 Collection*, MB Docket No. 17-290, Report and Order, FCC 18-136 (Sept. 26, 2018).

[997] *Amendment of Section 73.3613 of the Commission's Rules Regarding Filing of Contracts*, MB Docket No. 18-4, Report and Order, FCC 18-145 (Oct. 23, 2018).

[998] *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed Satellite Service Systems and Related Matters*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809 (2017).

[999] *See SpaceX Authorization Order*.

which OneWeb plans to use to further its goal to "provide high-speed, affordable broadband connectivity to anyone, anywhere" in the United States.[1000] Also, the Commission granted the request of Space Norway AS (Space Norway) to access the U.S. market using a two-satellite NGSO FSS system, in a highly-elliptical orbit, to enable Space Norway to pursue its goal of providing broadband Internet access to currently unserved and underserved communities in the Arctic region of the United States.[1001] The authorization of these and other systems furthers the Commission's efforts to close the digital divide across the United States.[1002]

323. On November 15, 2018, the Commission adopted a number of Orders granting the applications of NGSO FSS LEO systems for market access. The Commission granted Kepler's request for U.S. market access to offer global connectivity for the Internet of Things using a proposed constellation of 140 NGSO LEO satellites.[1003] The Commission also granted the applications of Telesat Canada and LeoSat for U.S. market access to provide broadband services.[1004] The Commission also granted SpaceX's application to construct, deploy and operate a proposed NGSO satellite system using frequencies in the V-band, which will provide SpaceX with additional flexibility to provide both diverse geographic coverage and the capacity to support a wide range of proposed broadband and communications services in the United States and globally.[1005]

324. On April 17, 2018, the Commission proposed revisions to its rules to facilitate deployment of a class of satellites known colloquially as "small satellites."[1006] These types of satellites, which have relatively short duration missions, have been advancing scientific research and are increasingly being used for commercial endeavors such as gathering Earth observation data. The proposed rules were designed to lower the regulatory burden involved in licensing small satellites and reduce application processing times, while offering protection for critical communication links and enabling efficient use of spectrum for this dynamic sector.[1007]

325. Finally, on September 26, 2018, the Commission streamlined, consolidated, and harmonized the rules governing earth stations used to provide satellite-based GSO FSS services on ships, airplanes and vehicles.[1008] These actions simplify the regulatory approval process for this rapidly growing segment of the satellite communications market and expand the FSS frequency bands where these operations can be conducted.[1009] On November 15, 2018, the Commission proposed similar rules with respect to governing earth stations used to provide satellite-based GSO FSS services on ships, airplanes and vehicles.[1010] Finally, on November 15, 2018, the Commission adopted a Notice of Proposed

[1000] *WorldVu Order and Declaratory Ruling*, 32 FCC Rcd at 5366, para. 1; WorldVu Petition at 1.

[1001] *Space Norway AS Order and Declaratory Ruling*, 32 FCC Rcd at 9649, 9659, paras. 1, 22; Space Norway AS Petition at 1, 12-14.

[1002] *See also O3b Limited Modification Order*; *Karousel Authorization Order*.

[1003] *See Kepler Order and Declaratory Ruling*.

[1004] *See Telesat Canada V-Band NGSO Order and Declaratory Ruling*; *LeoSat Order and Declaratory Ruling*.

[1005] *See SpaceX V-band NGSO Authorization Order*.

[1006] *See Small Satellites NPRM*.

[1007] *Id.* at para. 1.

[1008] *See ESIMs Order*.

[1009] *Id.*

[1010] *See Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, IB Docket No. 18-315, Notice of Proposed Rulemaking, FCC 18-160 (rel. Nov. 16, 2018) (*ESIMs NPRM*).

Rulemaking proposing to further streamline the Commission's Part 25 rules governing satellite services, including through consolidated licensing and reporting proposals.[1011]

IV. COMMISSION AGENDA TO FURTHER ENCOURAGE INVESTMENT, INNOVATION, DEPLOYMENT, AND COMPETITION

326. RAY BAUM'S Act also requires the Commission to describe the agenda of the Commission for the next 2-year period for addressing challenges and opportunities in the communications marketplace.[1012] We note that because this is the first *Communications Marketplace Report*, the Commission did not have the opportunity to describe its agenda in a previous *Communications Marketplace Report*. This section of the *Report* helps to articulate the Commission's agenda for the next 2-year period.

A. The Mobile Wireless Market

327. *Spectrum*. Incumbent service providers need additional spectrum to increase their coverage or capacity, while new entrants need access to spectrum to enter a geographic area. In addition, average data usage per connection has been substantially increasing in recent years, and this growth is expected to continue, in turn increasing service providers' need for additional spectrum. Forward-thinking spectrum policy is critical for next generation wireless networks. To spur greater investment in the mobile wireless industry, the Commission will continue to make available a significant amount of additional spectrum over the next two years across a range of low-, mid-, and high-band frequencies to ensure a vibrantly competitive mobile wireless services marketplace.

328. *High-band*. The FCC has made auctioning high-band, millimeter-wave spectrum a priority. In the *Spectrum Frontiers* proceedings, the Commission has proposed rules for facilitating the reconfiguration of existing 39 GHz spectrum holdings into more contiguous license blocks and areas conducive to wireless broadband deployments.[1013] To accomplish this reconfiguration, the Commission has proposed an incentive auction and sought comment on a proposal for an optional voucher exchange that will allow incumbent licensees to consolidate their holdings prior to the incentive auction.[1014]

329. The 28 GHz auction (Auction 101) began on-November 14, 2018. Short forms have been filed for the 24 GHz auction (Auction 102), which will start after Auction 101 is complete. FCC Chairman, Ajit Pai, has announced his intent to start the auction process for the Upper 37 GHz (37.6-38.6 GHz), 39 GHz (38.6-40 GHz), and 47 GHz (47.2-48.2 GHz) bands in the second half of 2019.[1015] With these auctions, the FCC will release almost 5 gigahertz of 5G spectrum into the market—more than all other flexible use bands combined. And we are working to free up additional spectrum for 5G in millimeter wave frequencies, including the 26 GHz and 42 GHz bands.[1016]

330. *Mid-band*. Mid-band spectrum is very well-suited for next generation 5G wireless services due to the combination of favorable propagation characteristics (as compared to high bands, like mmW spectrum bands) and the opportunity for additional channel re-use (as compared to low bands).[1017] To facilitate additional access to mid-band spectrum, the Commission will conduct an auction for Priority

[1011] *Further Streamlining Part 25 Rules Governing Satellite Services*, IB Docket No. 18-314, Notice of Proposed Rulemaking, FCC 18-165 (rel. Nov. 19, 2018) (*Further Streamlining Part 25 Rules NPRM*).

[1012] *See* RAY BAUM'S Act.

[1013] *Spectrum Frontiers Fourth Further Notice*, at 2, para. 2.

[1014] *Id.*

[1015] *FCC's 5G FAST Plan.*

[1016] *Id.*

[1017] *Mid-Band Order and NPRM*, at 3, para. 5.

Access Licenses (PALs) in the 3.5 GHz band.[1018] Separately, in the Mid-Band proceeding, the Commission identifies potential opportunities for additional terrestrial use of 500 megahertz of mid-band spectrum between 3.7 GHz to 4.2 GHz.[1019] The Commission is also seeking comment on potential changes to the Commission's rules in the 3.7 GHz to 4.2 GHz band to promote more efficient and intensive fixed use of the band on a shared basis.[1020] With our work on the 2.5 GHz, 3.5 GHz, and 3.7 GHz to 4.2 GHz bands, we could make up to 844 megahertz available for 5G deployments.[1021]

331. *Low-band*. The FCC is acting to improve use of low-band spectrum (useful for wider coverage) for 5G services, with targeted changes to the 600 MHz, 800 MHz, and 900 MHz bands.[1022]

332. *Unlicensed*. Recognizing that unlicensed spectrum will be important for 5G, the Commission recently proposed rules, in the 6 GHz band, that will promote new opportunities for unlicensed use in portions of 1200 megahertz of spectrum while ensuring current licensed services in operation continue to thrive.[1023] The agency is also creating new opportunities for unlicensed use above 95 GHz.[1024]

333. *Expanding Wireless Access in Rural Areas.* We will proceed with the Mobility Fund Phase II Auction, a reverse auction of up to $4.53 billion in funding support for deployment of 4G LTE mobile service where it is currently lacking.

334. *Infrastructure.* To meet rapidly increasing demand for wireless services and prepare our national infrastructure for 5G, the Commission will continue to pursue an agenda to reduce regulatory impediments to help facilitate wireless infrastructure investment and deployment. Supporting the deployment of 5G and other next-generation wireless services through smart infrastructure policy is critical. 5G can enable increased competition for a range of services—including broadband—support new healthcare and Internet of Things applications, speed the transition to life-saving connected car technologies, and create jobs. Just as we have done in the past two years in reexamining the Commission's rules and procedures for wireless infrastructure deployment, we will continue to look for ways in which we can promote the rapid deployment of advanced wireless broadband services, whether through Commission processes, local and state review, or otherwise. In addition to reexamining our own procedures, we will continue to work with other U.S. government agencies as well as states and local governments, to facilitate the deployment of advanced wireless broadband services.

B. The Fixed Communications Market

335. The Commission's policymaking efforts over the last two years have targeted promoting greater broadband deployment, and the data demonstrate that more Americans have coverage from multiple fixed broadband providers than ever before.[1025] We are optimistic that competition will continue to flourish as the Commission's recent efforts to increase broadband deployment by breaking down regulatory barriers spurs additional Internet service provider investment. The Commission will continue to monitor the marketplace to encourage broadband deployment and bring the benefits of competition to as many Americans as possible.

[1018] *Investment in 3.5 GHz Band Report and Order*, at 4, para. 7.

[1019] *See generally Mid-Band Order and NPRM*.

[1020] *Id.*, at 2, para. 2.

[1021] *Id*.

[1022] *FCC's 5G FAST Plan*.

[1023] *See generally 6 GHz NPRM*.

[1024] *Spectrum Horizons*, Notice of Proposed Rulemaking, 33 FCC Rcd 2438 (2018).

[1025] *See supra* Section III.D.

336. Over the next two years, the Commission will continue to focus our efforts on creating a regulatory environment that reduces barriers to investment and encourages the private sector to build, maintain, and upgrade next-generation networks so that the benefits of broadband are available to all Americans. The work of the BDAC will also continue to play a crucial role in informing our efforts to streamline broadband deployment and close the digital divide.[1026] The recently established Disaster Response and Recovery Working Group is already at work exploring additional measures that public and private actors can take before a disaster to improve resiliency of broadband infrastructure, strategies they can use during the response to a disaster to minimize the downtime of broadband networks, and actions they can take to restore broadband infrastructure during disaster recovery.[1027]

337. The Commission will also continue to review outdated regulations that burden incumbent providers and stifle competition. For instance, we will reexamine our rate floor rules for rate-of-return carriers, which artificially inflate prices for rural consumers. The Commission will also work towards removing unnecessary tariffing rules and encouraging carriers' transition of their business data services to light-touch incentive regulation. Where competition warrants it, we will encourage carriers to transition away from ex ante pricing regulation. We will also work to identify and eliminate arbitrage opportunities in our intercarrier compensation system through enforcement proceedings, tariff investigations, and rulemakings as we continue the Commission's longer-term efforts to fully move to a bill-and-keep regime.

338. The Commission will also prioritize proceedings that advance the goals of universal service and target the digital divide. Specifically, we will focus on providing long term funding for restoration and expansion of fixed broadband connectivity in Puerto Rico and the U.S. Virgin Islands through the Universal Service Fund. The Commission will also use its auction authority to continue providing high-speed Internet access to many unserved Americans, including through the Connect American Fund Phase II auction, in which Commission staff will soon conclude reviews of winning bidders' long-form applications so that service providers can begin deploying new networks to serve rural Americans.[1028] Finally, we will undertake much needed changes to the universal service Rural Health Care Program and explore a "Connected Care Pilot Program" to support the delivery of telehealth services to low-income Americans, with a focus on the delivery of such services to patients beyond the doors of brick-and-mortar health care facilities.

C. The Video and Audio Markets

339. As part of its ongoing *Modernization of Media Regulation Initiative*, the Commission will continue to modernize its regulations affecting media outlets by eliminating or modifying obsolete, burdensome, or outmoded rules, including by completing several previously initiated rulemakings.[1029] The Commission has commenced a number of rulemaking proceedings as part of this initiative in order to reduce burdens on licensees, while simultaneously enhancing competition and service to the public.[1030]

[1026] *See FCC Announces the Re-Charter of the Broadband Deployment Advisory Committee and Solicits Nominations for Membership*, GN Docket No. 17-83, Public Notice, DA 18-1239 (Dec. 10, 2018) (announcing the Commission's intent to renew the BDAC's charter for a period of two years, starting on or about March 1, 2019).

[1027] *See FCC Announces Membership of the Broadband Deployment Advisory Committee's Disaster Response and Recovery Working Group*, GN Docket No. 17-83, Public Notice, DA 18-1121 (Nov. 1, 2018); *FCC Solicits Nominations for New Disaster Response and Recovery Working Group of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-837 (Aug. 9, 2018)

[1028] FCC Strategic Plan at 6.

[1029] *See Media Modernization Notice*.

[1030] *See, e.g.*, *Elimination of Obligation to File Broadcast MidTerm Report (Form 397) Under Section 73.2080(f)(2)*, MB Docket No. 18-23, Notice of Proposed Rulemaking, 33 FCC Rcd 2570 (2018); *Channel Lineup Requirements* – (continued….)

340. In addition, the Commission is engaged in ongoing efforts to enhance competition and improve public service in the video marketplace in a variety of other ways. For example, the Commission is addressing two issues raised by a remand of the U.S. Court of Appeals for the Sixth Circuit.[1031] The first concerns the ability of local franchising authorities to regulate non-cable services, such as broadband Internet access service, and the second relates to the appropriate treatment of cable-related "in kind" contributions.[1032]

341. Furthermore, with respect to television broadcast stations, the Commission has authorized the voluntary adoption of a new transmission standard, ATSC 3.0, that is intended to allow broadcasters to provide additional programming and innovative services to consumers, thereby enhancing competition in the video marketplace.[1033] The Commission is currently examining several remaining issues to facilitate the introduction of service with the new standard.[1034]

342. The Commission also continues to examine its broadcast ownership regulations. For example the Commission has recently commenced its statutory quadrennial review of the media ownership rules to determine whether they remain "necessary in the public interest as a result of competition."[1035] The Commission's review will consider whether three key structural ownership rules remain in the public interest in light of the current media marketplace or whether, alternatively, the public interest would benefit from modification or elimination of these rules.[1036] Retention, modification, or elimination of these structural ownership rules may impact competition in the video and/or audio marketplace. In addition, a rulemaking proceeding is pending to examine the national television audience reach cap.[1037]

343. Also with respect to the audio marketplace, the Commission's AM revitalization effort aims to "help AM broadcasters better serve the public, thereby advancing the Commission's fundamental goals of localism, competition, and diversity in broadcast media."[1038] Pursuant to this effort, the

(Continued from previous page)
Sections 76.1705 and 76.1700(a)(4), MB Docket No. 18-92, Notice of Proposed Rulemaking, 33 FCC Rcd 4323 (2018).

[1031] *Montgomery County, Md. et al. v. FCC*, 863 F.3d 485 (6th Cir. 2017)

[1032] *Implementation of Section 621(a)(1) of the Cable Communications Policy Act of 1984 as Amended by the Cable Television Consumer Protection and Competition Act of 1992*. MB Docket No. 05-311, Second Further Notice of Proposed Rulemaking, FCC 18-131, paras. 16, 25 (Sep. 25, 2018)

[1033] *Next Gen TV Order*, 32 FCC Rcd at 9931-33, para. 2.

[1034] Specifically, the Commission will address the remaining pending issues regarding: (1) possible exceptions to and waivers of the local simulcasting requirement, (2) whether the Commission should let full power broadcasters use channels in the television broadcast band that are vacant to facilitate the transition to 3.0, and (3) the Commission's tentative conclusion that local simulcasting should not change the significantly viewed status of a station transmitting in ATSC 3.0. *Id*. at 9989, paras. 122-31. The Commission will also address pending petitions for reconsideration of the initial order filed by NTCA – The Internet & Television Alliance and American Television Alliance, respectively. Petition for Reconsideration of NTCA – The Internet & Television Alliance, Docket GN 16-142 (filed Mar. 5, 2018); Petition for Reconsideration of American Television Alliance, Docket GN 16-142 (filed Mar. 5, 2018).

[1035] *See supra* note 953.

[1036] In addition, the proceeding will examine several potential pro-diversity initiatives raised in the Commission's combined 2010/2014 Quadrennial Review proceeding. *See 2014 Quadrennial Second Report and Order*, 31 FCC Rcd at 10006-07, paras. 330-32.

[1037] *Amendment of Section 73.3555(e) of the Commission's Rules, National Television Multiple Ownership Rule*, MB Docket No. 17-138, Notice of Proposed Rulemaking, 32 FCC Rcd 10785 (2017).

[1038] *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Notice of Proposed Rulemaking, 28 FCC Rcd 15221, 15222, para. 1 (2013).

Commission has taken several steps designed to improve AM broadcasting, including opening FM translator filing windows exclusively for AM licensees and permittees, modifying technical rules to ease regulatory burdens, and providing AM licensees with more operational flexibility to improve service to the public.[1039] This effort is ongoing, and the Commission anticipates taking additional steps to enhance and improve the AM service, enhancing the ability of AM broadcasters to compete and serve the public.[1040] In addition, the Commission has commenced a rulemaking proceeding seeking to "streamline the rules relating to interference caused by FM translators and expedite the translator complaint resolution process."[1041] Adoption of streamlined interference rules may enhance the ability of FM broadcasters to compete in the audio marketplace.

D. The Satellite Market

344. The Commission plans to pursue an agenda over the next two years to further encourage investment and innovation in the provision of satellite services. Those actions will also facilitate the further deployment of satellite services, thereby expanding connectivity in rural, high-cost areas of the country and promoting competitive choices throughout the nation. Specifically, the Commission expects to consider final rules in a number of separate rulemaking proceedings, all of which are designed to promote and protect innovation and investment in the commercial satellite industry.

345. First, the Commission plans to consider final rules to facilitate the deployment of small satellites, which are relatively inexpensive and have demonstrated their utility and capabilities across a wide range of satellite services.[1042] These proposals are designed to lower the regulatory burden involved in licensing small satellites and reduce application processing times. They will also offer protection for critical communication links and enable efficient use of spectrum for this dynamic sector.

346. Second, the Commission plans to further streamline and consolidate the Part 25 rules governing satellite communications, including application and licensing processes for both space and earth stations. For example, the Commission plans to consider consolidated space station and earth station licensing,[1043] which would likely facilitate the design of new systems by providing for simultaneous, rather than sequential, planning of space station and gateway earth stations. The Commission also plans to simplify and harmonize rules governing earth stations used to provide satellite-based FSS services on ships, airplanes, and vehicles, a rapidly growing segment of the satellite communications market.[1044]

347. Third, the Commission plans to consider final rules providing FSS with additional capacity for satellite services of millimeter wave band spectrum while permitting substantial terrestrial use. For instance, it has proposed to permit licensing of individual FSS earth stations in the 50.4-51.4 GHz band.[1045] This proposal is part of an overall strategy to have a balanced approach for sharing

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[1039] *See id.*; *Revitalization of the AM Radio Service*, MB Docket No. 13-249, First Report and Order, Further Notice of Proposed Rulemaking, and Notice of Inquiry, 30 FCC Rcd 12145 (2015); *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Second Report and Order, 32 FCC Rcd 1724 (2017); *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Third Report and Order, 32 FCC Rcd 7736 (2017).

[1040] *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Second Further Notice of Proposed Rulemaking, FCC 18-139 (Oct. 5, 2018) (presenting a proposal to modify the protection of Class A AM stations).

[1041] *Amendment of Part 74 of the Commission's Rules Regarding FM Translator Interference*, MB Docket No. 18-119, Notice of Proposed Rulemaking, FCC 18-60 at 1, para. 1 (May 10, 2018).

[1042] *See Small Satellites NPRM*.

[1043] *See Further Streamlining Part 25 Rules NPRM*.

[1044] *See ESIMs Order*; *ESIMs NPRM*.

[1045] *See Spectrum Frontiers Third Report and Order*. We note that Boeing has petitioned for FSS access to 51.4-52.4 GHz. Our proposal applies only to 50.4 - 51.4 GHz, where there currently is an FSS allocation, and does not address Boeing's petition.

between terrestrial and satellite services in V-band, and would build on prior decisions to provide FSS with exclusive access to the 40-42 GHz and 48.2-50.2 GHz bands, as well as shared access to the 37.5-40 GHz and 28 GHz bands. Through these actions, the Commission has sought to provide certainty to satellite providers for them to offer services in shared spectrum bands.

348. Finally, the Commission plans to update its rules and policies regarding orbital debris.[1046] Orbital debris, also known as "space debris" consists of artificial objects orbiting the Earth that are not functional spacecraft, and can be created under a variety of scenarios involving satellite systems.[1047] Orbital debris can affect the cost, reliability, integrity, and capability of new satellite systems and valuable services to the public, and it has the potential to cause physical harm to both people and property.[1048] The current period of innovation in the space industry has resulted and will likely continue to result in a significant increase in the number of satellites and types of operations in orbit, both of which have the potential to increase the amount of orbital debris.[1049] In these circumstances, continuing to rely on clearly outdated rules and policies increases both risks to continued safe operations in space and the uncertainty surrounding future satellite operations. Mitigating the growth of orbital debris through updated orbital debris rules and policies is more critical than ever to facilitate space commerce investments and innovation. As the Commission has previously found, consideration of orbital debris issues plays an important role in preserving access to space for the long term and in ensuring the safety of persons and property in space and on the surface of the Earth.[1050]

V. PROCEDURAL MATTERS

349. This Communications Marketplace Report is issued pursuant to Section 401 of the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (codified at 47 U.S.C. § 163), Section 103(b) of the Broadband Data Improvement Act (codified at 47 U.S.C. § 1303(b), and Section 623(k) of the Communications Act of 1934, as amended (codified at 47 U.S.C. § 543(k).

350. It is ORDERED that this Communications Marketplace Report shall be published on the website of the Federal Communications Commission and that the Office of Legislative Affairs shall submit copies of this Communications Marketplace Report to the Committee on Energy and Commerce of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate.

[1046] Additionally, in the future, Hughes and ViaSat will be expanding broadband services in remote areas with funding from the Connect America Fund. *See supra* Section II.D.1, note 583 (noting that Hughes was awarded funding to serve 76,873 units in New York state, while ViaSat was a winning bidder in 20 states, potentially serving 190,575 locations).

[1047] *Orbital Debris NPRM* at para. 2.

[1048] *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11575, para. 14 (2004) (*Orbital Debris Order*).

[1049] *Orbital Debris NPRM* at para. 2.

[1050] *Orbital Debris Order*, 19 FCC Rcd at 11575, para. 14.

351. It is FURTHER ORDERED that the proceeding in GN Docket No. 18-237, WT Docket No. 18-203, MB Docket Nos. 17-217 and 18-227, and IB Docket No. 18-251 is TERMINATED.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Communications Marketplace Report*, GN Docket No. 18-231; *The State of Mobile Wireless Competition*, WT Docket No. 18-203; *Status of Competition in the Market for the Delivery of Video Programming*, MB Docket No. 17-214; *Status of Competition in the Marketplace for Delivery of Audio Programming*, MB Docket No. 18-227; *Satellite Communications Services for the Communications Marketplace Report*, IB Docket No. 18-251.

Up until this year, the FCC was required by statute to issue an annual ORBIT Act report. The ORBIT Act required the Commission to report annually to Congress on its progress toward ensuring the privatization of INTELSAT and Inmarsat. But this reporting obligation remained in effect for more than a decade after that privatization took place.[1] In *Office Space* parlance, releasing this report was about as consequential as putting a new cover sheet on a TPS report. That's why I repeatedly supported Congress's efforts to consolidate and streamline the Commission's reporting obligations.

Thankfully, as part of RAY BAUM'S Act, Congress has done just that. It eliminated obsolete and unnecessary reporting requirements, like the one contained in the ORBIT Act, while consolidating many of our most useful reports into the new, biennial Communications Marketplace Report—or CMR. By addressing the state of the mobile, wireless, video, audio, broadband, and satellite marketplaces in one place, the CMR is a destination for one-stop shopping for interested members of Congress, policymakers, academics, and the public. It also gives us the chance to take a comprehensive view of the actions we've taken over the past two years to promote competition and reduce burdens to market entry, and to discuss our prospective plans to advance those same objectives.

There's a lot of interesting information contained in this report, and I encourage everyone to read it. But in case you don't, I wanted to highlight a few statistics that show the progress that we made in 2017 to increase broadband deployment and competition. For example, in 2017, the number of Americans without access to fixed terrestrial broadband service of 100/10 Mbps plummeted from 78.9 million to 34.8 million—a stunning 56% drop in just one year. And in 2017, the number of Americans lacking access to fixed terrestrial 25/3 Mbps service dropped from 24.8 million to 19.4 million. In other words, the digital divide is closing.

When it comes to competition, there's a lot of good news as well. For example, in 2017, the percentage of Americans with access to two or more fixed terrestrial broadband options of at least 100/10 Mbps more than doubled, increasing from 26% to 54.5%.

On the mobile side, there is also positive news to report. Capital investment by wireless providers went up in 2017, reversing declines in recent years, while prices went down. Specifically, the Wireless Telephone Services Consumer Price Index fell by 11%. That's more money in consumers' pockets.

As we head into 2019, we are on the right track, and we aim to keep these positive trends going. We will continue to close the digital divide and bring better, faster, cheaper broadband to all Americans by continuing to eliminate barriers to infrastructure investment and broadband deployment and promoting innovation.

Compiling this first-of-its-kind report and the numerous appendices required a tremendous amount of work and was a true team effort. I therefore want to extend my sincere thanks to the many

[1] *See* Statement of Commissioner Ajit Pai, Fourteenth Orbit Act Report (2013), http://go.usa.gov/chBuC; Statement of Commissioner Ajit Pai, Fifteenth Orbit Act Report (2014), http://go.usa.gov/chBuF; Statement of Commissioner Ajit Pai, Sixteenth Orbit Act Report (2015), http://go.usa.gov/chBJT; Statement of Commissioner Ajit Pai, Seventeenth Orbit Act Report (2016), https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-73A2.pdf; And Statement of Chairman Ajit Pai, Eighteenth Orbit Act Report (2017), https://docs.fcc.gov/public/attachments/FCC-17-69A2.pdf.

staff throughout the agency that contributed to the Communications Marketplace Report in seven different Bureaus and Offices: Annick Banoun, Joseph Calascione, Adam Copeland, Alex Espinoza, Alex Johns, Trent Harkrader, Dan Kahn, Celia Lewis, Ken Lynch, Pam Megna, Kris Monteith, and Steve Rosenberg from the Wireline Competition Bureau; Matt Collins, Judith Dempsey, Ben Freeman, Garnet Hanly, Pramesh Jobanputra, Kate Matraves, Sara Mechanic, Murtaza Nasafi, Louis Peraertz, Dana Shaffer, Don Stockdale, Patrick Sun, Weiren Wang, Joe Wyer, and Morasha Younger from the Wireless Telecommunications Bureau; Dan Bring, Kevin Green, Chad Guo, Brendan Holland, Jamile Kadre, Kim Makuch, Jake Riehm, John Scott, Tom Tanasovich, and Andrew Wise from the Media Bureau; Jose Albuquerque, Peter Alexander, Denise Coca, Ena Dekanic, Stephen Duall, Jerry Duvall, Francis Gutierrez, Karl Kensinger, Gabrielle Kim, Heidi Kroll, Arthur Lechtman, Kerry Murray, Kelly O'Keefe, Jim Schlichting, Daniel Shiman, Marilyn Simon, Walt Strack, Tom Sullivan, Lindsay Tello, Tracey Weisler, and Stacey Wise-Ashton of the International Bureau; Babette Boliek, Eric Burger, Nicholas Copeland, Evan Kwerel, Paul Lafontaine, Jonathan Levy, Giulia McHenry, and Sean Sullivan from the former Office of Strategic Planning and Policy Analysis; Walter Johnston, James Miller, Aspasia Paroutsas, and Rajender Razdan from the Office Engineering and Technology; and Susan Aaron, Deborah Broderson, Valerie Hill, David Horowitz, Dave Konczal, Keith McCrickard, Royce Sherlock, from the Office of General Counsel.

STATEMENT OF
COMMISSIONER MICHAEL O'RIELLY

Re: *Communications Marketplace Report*, GN Docket No. 18-231; *The State of Mobile Wireless Competition*, WT Docket No. 18-203; *Status of Competition in the Market for the Delivery of Video Programming*, MB Docket No. 17-214; *Status of Competition in the Marketplace for Delivery of Audio Programming*, MB Docket No. 18-227; *Satellite Communications Services for the Communications Marketplace Report*, IB Docket No. 18-251.

The 2018 Communications Marketplace Report is a product of Congress' directive in the 2018 RAY BAUM'S Act to streamline the Commission's reporting requirements. My primary responsibility as a Commissioner is to follow statutory authority and I will always be loyal to the will of Congress. In addition to executing the letter of the law, the new report is a welcome first step in simplifying FCC assessment of communications competition and deployment and will provide better transparency to consumers on the state of the market. For instance, the report provides a considerable amount of data to consider future trend lines and the corresponding impact on end users.

As this is the first installment of the report, my expectations were measured in view of the huge task, and I applaud staff for the work they have done in a brief time frame. In future years, I hope that reports won't be as siloed according to technology and regulatory regime. While the report takes account of intermodal competition in certain instances, a comprehensive representation of the communications marketplace would be more helpful if it went further. For example, reports in future years should recognize increasing competition between mobile and fixed broadband providers, given their substitutability, as well as disparate burdens faced by regulated entities due to competing with non-regulated entities in the same Internet ecosystem.

STATEMENT OF
COMMISSIONER BRENDAN CARR

Re: *Communications Marketplace Report*, GN Docket No. 18-231; *The State of Mobile Wireless Competition*, WT Docket No. 18-203; *Status of Competition in the Market for the Delivery of Video Programming*, MB Docket No. 17-214; *Status of Competition in the Marketplace for Delivery of Audio Programming*, MB Docket No. 18-227; *Satellite Communications Services for the Communications Marketplace Report*, IB Docket No. 18-251.

The document we're voting on today is titled the Communications Marketplace Report. But it's really the Commission's first Report on the Race to 5G.

Today's Report comes out of the RAY BAUM'S Act, enacted earlier this year. Congress directed us to consolidate a variety of previously separate reports about previously distinct industries into one document. Doing so underscores how the many platforms we regulate are now locked in competition with each other. This only will increase with 5G.

Consider this:

- Millennials have learned that through their grandparents' "rabbit ears" they can get some of their favorite video content for free over the air. As the Report notes, broadcast viewership has increased for the last two years, with broadcasters competing squarely with programming from multiple platforms, including satellite.
- Satellite in turn is building a new generation of low earth orbit satellites that can provide broadband at speeds and latency that compete with wireless.
- Wireless offers voice, broadband, and content—and increasingly delivers it to the home in competition with cable.
- And cable is competing to build a fixed and mobile platform to offer broadband and video services, which will feature content it owns and even creates. That is, cable competes against broadcast, satellite, wireless, telcos—and even movie studios.

This is not like any competition we've seen before. All of these previously siloed industries are competing to build fast, ubiquitous networks. All of them, from cable to satellite, are converging on 5G and next-gen networks.

And in that race, there's good news to report. After broadband investment fell during the final two years of the last Administration, the key indicators have turned around. Broadband investment is up. Speeds have increased. Infrastructure deployments have accelerated. And prices have declined. All great signs for consumers. So I am glad that today's Report walks through these key indicators in the race to 5G.

One of the most important steps we've taken to stimulate investment and competition is to streamline the rules governing the physical build out of next-gen and 5G networks. Deploying these networks is tough work. It's hard hats and bucket trucks, harnesses and excavators. These 5G jobs are just as critical as coders and programmers.

So we've taken steps to make that work easier. In March, we clarified that environmental and historic reviews designed for large, 200-foot macro towers no longer apply to the backpack-sized small cells needed for 5G. That decision already has accelerated broadband build out. One carrier reported that it's clearing small cells for construction at six times the pace that it did before, and economists predict it will lead to 57,000 new small cells.

In September, we established reasonable fee limits and shot clocks for localities' approval of small cells. We learned from the 20 states that had passed small cell reform bills, and we modeled our

order on their work. Economists project that this decision will save $2 billion in fees, stimulate $2.4 billion in investment, and provide next-gen coverage for 1.8 million more homes and businesses—97% of which are in rural and suburban communities.

While the September order doesn't go into effect until next month, we're already seeing positive results. In the last few weeks alone, Boston and Virginia Beach have concluded agreements with carriers that include shot clocks and fees that mirror those in our order. So by providing clarity, our decision is helping cities and providers quickly reach agreements that further their shared goals.

In short, these decisions will help 2019 be the Year of 5G. For everyday Americans, this plainly is a win. It means more competition for fast, affordable broadband. And it means more choices of content and services riding on top of that platform.

This Race to 5G Report details some of the successful policies that prepared the way for next year and a path forward for improvement. I want to thank all of the bureaus and offices that worked on this Report. It was a team effort, and it has my support.

STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL,
CONCURRING

Re: *Communications Marketplace Report*, GN Docket No. 18-231; *The State of Mobile Wireless Competition*, WT Docket No. 18-203; *Status of Competition in the Market for the Delivery of Video Programming*, MB Docket No. 17-214; *Status of Competition in the Marketplace for Delivery of Audio Programming*, MB Docket No. 18-227; *Satellite Communications Services for the Communications Marketplace Report*, IB Docket No. 18-251.

Over time at the Federal Communications Commission, we have put together a lot of reports that are required by Congress. We gather data about the state of competition in the mobile wireless market, the satellite market, and the video market. We look at the characteristics of each of these different industry segments, the state of deployment of communications capabilities, and barriers to entry. We dig deep into facts about broadband, compiling statistics about availability and speed. In some cases, we take what we learn and benchmark it against what other countries are doing.

Make no mistake—all of this activity is important. The reports that are carefully crafted in our halls become useful evidence for decisions about merger approvals, ongoing regulatory initiatives, and even new legislation. So they not only inform our work, but the work of Congress and other expert agencies like the Department of Justice and the Federal Trade Commission. And for every day consumers, they might be the only source of public data about the state of the industry.

This year we're doing things a little bit differently. That's because Congress has asked us to consolidate much of our reporting activity into a single, comprehensive report. For the first time, we are taking virtually everything we know about the communications marketplace and making it available in one place. I thank our staff at the agency for its effort in response to this Herculean task. It does the job we were assigned to do.

But I think this new reporting model offers a bigger opportunity—and we should seize it. We should be taking steps now to ensure that this first report provides us with a solid going-forward analytical basis for the communications market of tomorrow. One that provides data and facts that can be better absorbed, organized, and used to make smart laws and policy for the future. Because this is the kind of information we need if we want to have a thriving communications sector and a resilient democracy in the 21st century.

I fear, however, that today's report is letting that opportunity pass us by. Let me explain.

First, in each of the sections of this document there is something about the analysis that feels old and stale. The individual reports tell us a bit about where we are but nothing about where we are going. Take the wireless report, for starters. Reading it, you would have no idea that the industry is in the middle of a transformative change to next-generation networks, technologies, and services. Or that there is pending before this agency a request to combine the third and fourth largest wireless service providers. And despite combining this year's wireless report with the reports on fixed broadband, video, and satellite, you will find not a thing about the future of convergence. In other words, we only have a backward-looking story.

The FCC should be using this new format to stop thinking so narrowly—especially about our wireless markets. Going forward wireless is much more than the sum total of the phones in our palms, pockets, and purses. Instead, we will have connectivity coming to cars and homes, powering our smart cities, and informing data analytics in powerful ways that can make us more efficient and effective in so many sectors throughout the economy. I am weary of reports that fail to see this future—because the market is bigger and bolder than what gets reported on in the here and now.

Second, this report doubles down on data we know is flawed, and in some cases just plain wrong. That's because we continue to rely on third parties to provide us with a lot of the information you'll find in this report. I think that—as the expert agency—we should be gathering this data ourselves or at the very least validating or qualifying it before we pass it along to Congress to inform their decision-making. As I've suggested elsewhere, this agency needs to be more creative about gathering data and needs to explore the power of crowdsourcing to inform our work. Why not start with a broad effort to engage the American public in developing a broadband and wireless map, for instance? It's time to embrace the wisdom of the crowd and not just rely on the same-old, same-old industry-supported tools in our toolbox.

Third, today's report fails to build on good progress this agency has made over the course of previous reports. In fact, it reverses course by cutting out important data that we previously made available. Our video reports used to discuss how broadband deployment and provider practices such as data caps and zero rating alter consumer video viewing habits. That is gone. Our wireless reports used to discuss the entire mobile wireless ecosystem, including input markets like towers and backhaul and output markets like mobile applications and content. That, too, is gone. We may have a slightly shorter report, but we miss the bigger picture and the lessons to be gleaned from it.

Finally, this report should not ignore some of the hard facts that are coming to light in other recently available data. Wireless market concentration, as measured by the Herfindahl-Hirshman Index, is at an all-time high. According to new study, American consumers are paying some of the highest prices for mobile data anywhere in the developed world. Almost 20 million Americans still do not have access to broadband and, according to recent reports, more than 160 million Americans are not using it. The rural divide is as pronounced as ever with one in four rural Americans lacking access to high-speed broadband compared with just one-and-a-half percent of urban Americans. Plus, the FCC's official maps—which are supposed to tell us where broadband and wireless service does and does not exist—have major inaccuracies in them.

We have real work to do—not just in updating our reporting for tomorrow's communications marketplace, but in learning from it. For that reason, I concur.

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