

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

In the Matter of )
)
Inquiry Concerning the Deployment of Advanced ) GN Docket No. 16-245
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 )

TWELFTH BROADBAND PROGRESS NOTICE OF INQUIRY

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By the Commission: Commissioners Pai and O’Rielly approving and part, concurring in part and issuing separate statements.

TABLE OF CONTENTS

Table with 2 columns: Section Title and Para. Number. Includes sections like I. INTRODUCTION, II. ANALYZING ADVANCED TELECOMMUNICATIONS CAPABILITY, etc.

## I. INTRODUCTION

1. Section 706 of the Telecommunications Act of 1996, as amended, requires the Commission to determine and report annually on “whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion.”<sup>1</sup> With this Notice of Inquiry (Inquiry), we initiate the next annual assessment of the “availability of advanced telecommunications capability to all Americans,” and solicit comment and information to help guide our analysis.<sup>2</sup>

2. On January 29, 2016, we released the *2016 Broadband Progress Report*, which found that advanced telecommunications capability was not being deployed to all Americans in a reasonable and timely fashion.<sup>3</sup> We based our finding on the determination that, despite some advances in the deployment and availability of advanced telecommunications capability, these advances were not occurring broadly enough, or quickly enough, to satisfy the goals of section 706.<sup>4</sup> In particular, the *2016 Broadband Progress Report* noted that approximately ten percent of the population – nearly 34 million Americans – lacked access to fixed advanced telecommunications capability.<sup>5</sup> Further, the *2016 Broadband Progress Report* found a persistent urban-rural divide in access to broadband services, with Americans in rural areas and on Tribal lands approximately ten times more likely than those Americans in urban areas to lack access to services able to provide advanced telecommunications capability.<sup>6</sup> The *2016 Broadband Progress Report* separately concluded that deployment of advanced telecommunications capability to schools and classrooms continued to lag behind the needs of American students and educators.<sup>7</sup>

3. The *2016 Report* also considered the role of mobile and satellite broadband services in its section 706 analysis.<sup>8</sup> Recognizing the increasing importance of mobile broadband to American consumers, the *2016 Report* found that, today, deployment of advanced telecommunications capability requires access to both fixed and mobile broadband service.<sup>9</sup> In addition, the *2016 Report* found that

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<sup>1</sup> 47 U.S.C. § 1302(b). For simplicity in past inquiries, the Commission has sometimes used the term “broadband” to refer to “advanced telecommunications capability.” However, “advanced telecommunications capability” is a statutory term with a definition that is more expansive than the term “broadband.” See 47 U.S.C. § 1302(d)(1) (“The term ‘advanced telecommunications capability’ is defined, without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology.”). As this definition makes clear, while all services providing advanced telecommunications capability are “broadband,” not all broadband services provide advanced telecommunications capability. Thus, in this Inquiry, we do not equate the term “broadband” with the statutory term “advanced telecommunications capability,” but we do necessarily consider the availability of various broadband services that contribute to advanced telecommunications capability in our analysis under the statute. See *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191, 2016 Broadband Progress Report, 31 FCC Rcd 699, 700 n.1 (2016) (*2016 Broadband Progress Report* or *2016 Report*).

<sup>2</sup> 47 U.S.C. § 1302(b).

<sup>3</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 701, 750-51, paras. 4, 120-24.

<sup>4</sup> *Id.* at 701, para. 4.

<sup>5</sup> *Id.* at 750, para. 120.

<sup>6</sup> *Id.* at 750, para. 121.

<sup>7</sup> See *id.* at 702, 750, paras. 5, 120.

<sup>8</sup> See *id.* at 706-07, paras. 17-18.

<sup>9</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 708-19, paras. 20-44.

fixed satellite broadband service must meet the same speed threshold as other fixed broadband services in order to provide American consumers access to advanced telecommunications capability.<sup>10</sup>

4. In this Inquiry, we seek comment on the current state of advanced telecommunications capability deployment and availability. In particular, we seek comment on the appropriate criteria and benchmarks by which to measure whether fixed and mobile broadband services provide access to advanced telecommunications capability.<sup>11</sup> As part of this inquiry, we seek comment on whether to update our existing 25 Mbps download/3 Mbps upload speed benchmark for fixed advanced telecommunications capability,<sup>12</sup> as well as on whether we should establish a speed benchmark for mobile broadband services and, if so, what that speed benchmark should be.<sup>13</sup> We also seek comment on the relationship of non-speed performance metrics, including service consistency and latency, to advanced telecommunications capability, and on whether and how to adopt benchmarks for these metrics.<sup>14</sup> Next, we seek comment on criteria and benchmarks by which to measure advanced telecommunications capability deployment to schools and classrooms, as well as on additional factors that may affect the deployment and/or availability of advanced telecommunications capability.<sup>15</sup> Finally, we seek comment on the various data sources used by the Commission for the purposes of our annual Broadband Progress Report, and whether additional or alternative sources of data are available to inform our analysis under Section 706(b).<sup>16</sup>

5. We remind commenters responding to this Notice that section 706 defines the term “advanced telecommunications capability . . . without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology.”<sup>17</sup> We encourage commenters to keep this definition in mind in advocating for a particular outcome concerning the findings to be made in the upcoming Report regarding the availability of advanced telecommunications capability in a reasonable and timely basis.

## II. ANALYZING ADVANCED TELECOMMUNICATIONS CAPABILITY

6. In this section, we seek comment on the technical criteria that we should use to inform our analysis as to what services provide advanced telecommunications capability. First, we seek comment generally on the basic criteria we should use in interpreting the definition of advanced telecommunications capability, including speed, latency, and consistency of service. Second, we propose to retain our existing advanced telecommunications capability speed benchmark of 25 Mbps/3 Mbps for fixed broadband services, and seek comment on this proposal and on whether the Commission should adopt an alternative speed benchmark for fixed broadband services. Third, we seek comment on service consistency and on whether we should adopt a benchmark by which to assess this particular service metric for fixed broadband services. Fourth, we propose to adopt a latency benchmark for fixed advanced telecommunications capability and seek comment on this approach and on how best to incorporate latency into our analysis of the deployment and availability of advanced telecommunications capability over fixed broadband networks.

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<sup>10</sup> 2016 Broadband Progress Report, 31 FCC Rcd at 719-21, paras. 45-48.

<sup>11</sup> See *infra* Section II.A.

<sup>12</sup> See *infra* Section II.B.1.a.

<sup>13</sup> See *infra* Section II.B.2.a.

<sup>14</sup> See *infra* Section II.B.1.b-c, II.B.2.b-c.

<sup>15</sup> See *infra* Section III.

<sup>16</sup> See *infra* Section IV.

<sup>17</sup> 47 U.S.C. § 1302(d)(1).

7. In addition to fixed broadband services, we seek additional comment on mobile broadband services. We seek comment on the performance metrics, and their interrelationships, that should be part of any benchmarks to be established to determine American consumers' access to advanced telecommunications capability. More specifically, we seek comment on developments since the last report and on how the Commission might establish a speed benchmark for mobile broadband services. We also seek comment on how to take into account consistency of service and latency in the mobile broadband environment, and their interaction with speed, and seek comment on establishing consistency and latency benchmarks in measuring access to advanced telecommunications capability. In addition, we seek comment on the data sources that should guide the Commission's analysis of these potential benchmarks. Lastly, with regard to the deployment and availability of advanced telecommunications capability to schools and libraries, we propose to retain the Commission's existing short- and long-term speed benchmarks of 100 Mbps per 1,000 students and staff, and 1 Gbps per 1,000 students and staff, respectively. We seek comment on whether these benchmarks should be updated and whether further proceedings are appropriate to revisit the standards for evaluating broadband deployment to American classrooms.

#### A. Criteria for Assessing Consumer Broadband

8. *Background.* In the past, the Commission's Broadband Progress Reports have analyzed deployment and availability of advanced telecommunications capability in terms of download and upload speeds, an approach that we continued in the *2016 Broadband Progress Report*.<sup>18</sup> Previous Broadband Progress Reports have made it clear, however, that additional factors, such as latency, consistency of service, price, data allowances, and security, may provide valuable insight into the capabilities of broadband services,<sup>19</sup> and may be as relevant as speed in determining what does and does not constitute advanced telecommunications capability.<sup>20</sup> In particular, the *2016 Broadband Progress Report* noted that service metrics beyond speed, such as latency and consistency of service, "seem to figure prominently into whether a broadband service is able to provide advanced capabilities," and discussed latency and service consistency as quality of service metrics to supplement the Commission's existing fixed speed benchmark.<sup>21</sup> While we recognized the importance of these metrics in the *2016 Broadband Progress Report*, we chose not to adopt non-speed advanced telecommunications capability performance benchmarks due to the lack of "comprehensive data on factors other than speed."<sup>22</sup> Instead, we pledged to

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<sup>18</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 721, para. 49.

<sup>19</sup> See *id.* at 725, para. 62.

<sup>20</sup> See, e.g., *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, 1392, para. 24 (2015) (*2015 Broadband Progress Report*); *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. 12-228, Ninth Broadband Progress Notice of Inquiry, 27 FCC Rcd 10523, 10528-33, paras. 7-21 (2012); *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, 10348-49, para. 7 (2012) (*2012 Broadband Progress Report*).

<sup>21</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 725, para. 62.

<sup>22</sup> *Id.* at 725-26, para. 63.

continue gathering information about these important features of broadband service with an eye to reevaluating their role in providing advanced telecommunications capability in a future Report.<sup>23</sup>

9. *Discussion.* We propose to continue using speed as one of the criteria by which we analyze advanced telecommunications capability. We also seek comment on whether to include additional criteria, such as latency and consistency of service, within our interpretation of the definition of advanced telecommunications capability for the purposes of the next Report.<sup>24</sup> We seek comment on this approach. Is speed still an appropriate metric by which to measure advanced telecommunications capability? Should latency and service consistency be included as part of the advanced telecommunications capability analysis in the next Report? Why or why not? Are there additional criteria beyond speed, latency, and service consistency that the Commission should consider when assessing what services constitute advanced telecommunications capability? If so, what additional criteria should we consider, and why?

## **B. Benchmarks for Assessing Consumer Broadband**

10. In addition to seeking comment on the general criteria that the Commission should consider in interpreting the definition of advanced telecommunications capability, we seek comment below regarding specific benchmarks for fixed and mobile broadband service, including benchmarks for speed, consistency of service, and latency. More specifically, as discussed below, we propose to retain the current speed benchmark of 25 Mbps/3 Mbps for fixed broadband services, and seek comment on this proposal and on whether the Commission should adopt an alternative speed benchmark for fixed broadband services. We also seek comment on how non-speed metrics such as consistency of service and latency affect access to advanced telecommunications capability, and on whether the Commission should develop benchmarks related to consistency of service and latency for fixed broadband services. We seek additional comment on currently available data for consistency of service and latency, and on any other sources of data that could be used to supplement or enhance currently available data. In addition to fixed broadband services, we seek additional comment on mobile broadband services. We seek comment on the performance metrics, and their interrelationships, that should be part of any benchmarks to be established to determine American consumers' access to advanced telecommunications capability. More specifically, we seek comment on developments since the last report and on how the Commission might establish a speed benchmark for mobile broadband services. We also seek comment on how to take into account consistency of service and latency in the mobile broadband environment, and their interaction with speed, and seek comment on establishing consistency and latency benchmarks in measuring access to advanced telecommunications capability. In addition, we seek comment on the data sources that should guide the Commission's analysis of these potential benchmarks.

### **1. Fixed Broadband Service Benchmarks**

#### **a. Fixed Broadband Speed**

11. In the past, the Commission has recognized the importance of upload and download speeds as a metric for assessing broadband performance.<sup>25</sup> Below, we propose to retain our existing 25

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<sup>23</sup> See *id.* at 726, para. 63.

<sup>24</sup> Note that we discuss and seek comment on additional performance metrics beyond speed, latency, and consistency of service – such as pricing, data allowances, adoption, privacy and security, packet loss, and the availability of competitive alternatives – elsewhere in this Inquiry because we believe that they are better considered in more general terms rather than through a specific benchmark for purposes of this latest Inquiry. See *infra* paras. 51-56 (discussing and seeking comment on pricing, data allowances, adoption, the availability of competitive alternatives, packet loss, issues relating to privacy and security, and recent revisions and proposed amendments to the Commission's outage reporting rules); see also *infra* paras. 73-76 (discussing and seeking comment on pricing and usage data) and paras. 77-80 (discussing and seeking comment on adoption data).

<sup>25</sup> 2016 Broadband Progress Report, 31 FCC Rcd at 725, para. 62.

Mbps/3 Mbps speed benchmark for fixed broadband services. We seek comment on this approach, as well as on several alternative speed benchmarks.

12. *Background.* In the *2015 Broadband Progress Report*, the Commission increased the existing speed benchmark for advanced telecommunications capability from 4 Mbps/1 Mbps of actual download/upload speeds to 25 Mbps/3 Mbps of actual download/upload speeds.<sup>26</sup> In doing so, the Commission acknowledged a variety of shifts that had reshaped the broadband landscape in the preceding years and that warranted the establishment of a higher speed benchmark.<sup>27</sup> In the *2016 Broadband Progress Report*, the Commission chose to retain the 25 Mbps/3 Mbps speed benchmark for fixed terrestrial broadband services, finding that download/upload speeds of 25 Mbps/3 Mbps continued to provide consumers with the capacity necessary to utilize advanced services that enable consumers to originate and receive high-quality voice, data, graphics, and video telecommunications.<sup>28</sup> The Commission also applied the 25 Mbps/3 Mbps speed benchmark, which had previously been applied only to fixed terrestrial services, to fixed satellite broadband service.<sup>29</sup> Given claims by fixed satellite broadband providers that new satellites could offer speeds in excess of 25 Mbps/3 Mbps, and considering that fixed satellite service could also be used as a home broadband solution, the Commission concluded that fixed satellite services must meet the same speed benchmark as other fixed services.<sup>30</sup>

13. *Discussion.* We propose to retain our existing speed benchmark of 25 Mbps/3 Mbps for fixed broadband services. Based on our most recent Report, we lack usage data that would serve to establish a higher benchmark. Our current observations are that download speeds of 25 Mbps allow a household to access a range of bandwidth intensive services, including HD video streaming, simultaneously over multiple devices.<sup>31</sup> In addition, it appeared to us in the *2016 Report* that services that offer 3 Mbps upload speed continue to support advanced broadband services, including HD video calling, virtual private network (VPN) platforms, telemedicine, and distance learning applications.<sup>32</sup> Through this Notice, we ask whether the 2016 conclusion should continue to be adopted by the Commission or whether there is a basis for change.

14. So, for example, in discussing the existing speed benchmark in the *2016 Broadband Progress Report*, the Commission noted that despite the growth in adoption of broadband services at or above 25 Mbps/3 Mbps, household usage patterns for fixed broadband services had not changed so significantly in the preceding year as to warrant an increase in the fixed speed benchmark.<sup>33</sup> We observe that the overall adoption rates seem to have not changed significantly from the findings in the *2016 Report*, and do not appear sufficient to warrant an increase from the existing benchmark of 25 Mbps/3 Mbps. Based upon June 2015 FCC Form 477 data and our 2015 Household data, only 27 percent of all Americans had adopted fixed services at speeds of 50 Mbps/5 Mbps, and only 14 percent had adopted fixed services at speeds of 100 Mbps/10 Mbps, as of June 30, 2015.<sup>34</sup> Given the continued lack of

<sup>26</sup> *2015 Broadband Progress Report*, 30 FCC Rcd at 1393, 1403-08, paras. 45-55.

<sup>27</sup> *See id.* at 1403-04, paras. 46-48 (noting that “[h]ousehold use clearly has changed significantly” since 2010, when the previous speed benchmark of 4 Mbps/1 Mbps was established).

<sup>28</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 722, paras. 51-52.

<sup>29</sup> *Id.* at 719, para. 46.

<sup>30</sup> *Id.*

<sup>31</sup> *Id.* at 722, para. 54.

<sup>32</sup> *Id.*

<sup>33</sup> *Id.*

<sup>34</sup> These adoption percentages were created using staff calculations based on an analysis of our June 2015 FCC Form 477 data, combined with an analysis of our 2015 Household data. These estimates include the U.S. Territories but may overstate or understate adoption, since not all of the incumbent local exchange carriers (ILECs) in the U.S. Territories have submitted FCC Form 477 data. *See infra* para. 77 n.178.

adoption of fixed broadband services at speeds above our current threshold of 25 Mbps/3 Mbps—as well as the ability of consumers to access a range of bandwidth intensive services, such as HD video streaming, using fixed services at speeds of 25 Mbps/3 Mbps—we do not believe that household usage patterns or broadband needs have altered significantly enough to warrant an increase from our current speed benchmark at this time.<sup>35</sup> We seek comment on this analysis and on our proposal to retain the existing speed benchmark of 25 Mbps/3 Mbps for fixed broadband services.

15. Despite current adoption rates of fixed broadband services at speeds above our present benchmark, we note that deployment of fixed services at high speeds continues to progress at a faster pace than does consumer adoption. For example, as of June 30, 2015, only 12 percent of all Americans lacked access to fixed broadband services at speeds of 50 Mbps/5 Mbps, and only 35 percent of all Americans lacked access to fixed broadband at speeds of 100 Mbps/10 Mbps.<sup>36</sup> The increased deployment of these higher speed fixed services are reflected in the promotional materials of broadband service providers, which consistently offer high-speed fixed service plans at speeds greater than the 25 Mbps/3 Mbps threshold that we have established as our current benchmark.<sup>37</sup> We seek comment on whether deployment rates should influence our conclusion that 25 Mbps/3 Mbps is an adequate benchmark by which we may continue to measure the performance of fixed broadband services. Do current deployment rates for fixed services at speeds greater than 25 Mbps/3 Mbps support an increase in this current threshold?

16. Notwithstanding the high overall deployment rate of higher speed fixed broadband services, we note that there is a stark discrepancy between the deployment of such services in urban areas versus rural areas. While 96 percent of Americans living in urban areas have access to fixed broadband services at speeds of 50 Mbps/5 Mbps, only 55 percent of Americans living in rural areas have access to such services. And although fixed services at speeds of 100 Mbps/10 Mbps are available to 74 percent of Americans living in urban areas, only 30 percent of Americans living in rural areas have access to such services.<sup>38</sup> We seek comment on whether, as before, the discrepancy between urban and rural access to advanced telecommunications services provides an independent basis for determining that advanced telecommunications services are “not being deployed to all Americans in a reasonable and timely fashion.”<sup>39</sup> The Commission remains focused, of course, on how to increase the reach of advanced telecommunications to America’s rural populations.

17. We also seek comment on the extent to which the availability of bandwidth intensive services, such as 4k Ultra HD TV, is relevant to our determination of whether to retain the current speed benchmark or increase it to a higher level. Is our current benchmark sufficient to support these bandwidth intensive services? Conversely, are there off-setting trends, such as advanced data compression

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<sup>35</sup> We note that in the *2015 Broadband Progress Report*, which updated the speed benchmark from 4 Mbps/1 Mbps to 25 Mbps/3 Mbps, the Commission noted that this change was due, in part, to the fact that a substantial and fast-growing number of consumers were adopting broadband at speeds of 25 Mbps/3 Mbps. See *2015 Broadband Progress Report*, 30 FCC Rcd at 1401, para. 41.

<sup>36</sup> These deployment percentages were created using staff calculations based on an analysis of our June 2015 FCC Form 477 data, combined with an analysis of our 2015 Household data.

<sup>37</sup> See, e.g., Charter, *Charter’s Spectrum Internet*, <https://www.charter.com/browse/content/internet> (last visited Aug. 2, 2016) (offering Internet packages with download speeds of 60 Mbps); Comcast, *Browse XFINITY Internet Offers*, <http://www.xfinity.com/internet-service.html> (last visited Aug. 2, 2016) (offering Internet packages with download speeds of 75 and 150 Mbps, respectively); Verizon, *Pick Your FiOS Home Internet Plan*, <http://www.verizon.com/home/fios-fastest-internet/> (last visited Aug. 2, 2016) (offering Internet packages with download and upload speeds of 50, 100, 150, 300, and 500 Mbps, respectively).

<sup>38</sup> These deployment rates in rural versus urban areas were created using staff calculations based on an analysis of our June 2015 FCC Form 477 data, combined with an analysis of our 2015 Household data.

<sup>39</sup> 47 U.S.C. § 1302(b).

techniques that may allow greater amounts of information to be transmitted using less bandwidth, which could suggest that our current threshold of 25 Mbps/3 Mbps will continue to remain adequate to allow consumers to access a full range of advanced services?

18. Are there any further considerations that would warrant a change to our current benchmark? If commenters believe that there is a justification to adopt a higher speed than the one we have proposed to retain, what would be a more appropriate benchmark and why? We seek comment on whether other alternative speed benchmarks (between, for example, 50 Mbps/3 Mbps and 100 Mbps/10 Mbps) would be better-suited than our existing benchmark for current household usage of advanced broadband-based services, such as video streaming, online gaming, and HD video calling. Is a higher speed benchmark needed to accommodate current household usage of applications that enable consumers to originate and receive high-quality voice, data, graphics, and video telecommunications, and, if so, what applications are driving that usage? Are such advanced capabilities used widely enough or in such frequency as to warrant an increase from the existing speed benchmark of 25 Mbps/3 Mbps? Does the use of upload-intensive services such as video calling and online gaming, which can require speeds of 1.5 Mbps upload,<sup>40</sup> warrant consideration of changes to our current upload speed benchmark of 3 Mbps?

19. We note that in the context of examining the deployment and availability of advanced telecommunications capability in schools and libraries, the Commission has adopted both a short-term benchmark as well as a higher, long-term benchmark.<sup>41</sup> Given the existence of such evolving benchmarks in the schools and libraries evaluation, we seek comment on whether adopting an additional, long-term speed benchmark for fixed services, in addition to our existing benchmark of 25 Mbps/3 Mbps, might improve the Commission's ability to measure the deployment and availability of advanced telecommunications capability. Should the Commission adopt such a long-term benchmark in addition to our current speed benchmark? What would the potential benefits and drawbacks be of setting a long-term benchmark? If the Commission were to adopt a long-term benchmark, at what level should such a benchmark be set? Would a long-term, aspirational threshold of 50 Mbps or 100 Mbps in download speed paired with an upload speed greater than 3 Mbps serve as a useful supplement to our current benchmark?<sup>42</sup> If so, how? Would gathering and publishing data on any of these additional benchmarks help the Commission to promote the deployment of advanced telecommunications capability?

#### **b. Fixed Broadband Consistency**

20. In this section, we seek comment on the relationship between consistency of service and the provision of advanced telecommunications capability over fixed broadband networks. We seek comment on whether to adopt a consistency of service benchmark for fixed broadband services, and, if so, the appropriate means to develop and implement such a standard.

21. *Background.* The *2016 Broadband Progress Report* noted that inconsistent performance could “significantly impact whether a broadband service delivers advanced telecommunications

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<sup>40</sup> See Skype, *How Much Bandwidth Does Skype Need?*, <https://support.skype.com/en/faq/FA1417/how-much-bandwidth-does-skype-need> (last visited Aug. 2, 2016) (recommending upload speeds of 1.5 Mbps for HD video calling).

<sup>41</sup> *2015 Broadband Progress Report*, 30 FCC Rcd at 1410, para. 62 (describing how the Commission has adopted two speed benchmarks for schools, including a short-term speed benchmark of 100 Mbps per 1,000 students and staff, and a long-term speed benchmark of 1 Gbps per 1,000 students and staff).

<sup>42</sup> We note that in the Connect America Fund (CAF) Phase II Report and Order and Further Notice of Proposed Rulemaking, the Commission established four tiers of bids available for bidding with varying speeds. The baseline performance tier required that bidders commit to provide speeds of at least 25 Mbps/3 Mbps, while the above-baseline tier required that bidders commit to provide speeds of at least 100 Mbps/20 Mbps. See *Connect America Fund; ETC Annual Reports and Certifications; Rural Broadband Experiments*, WC Docket Nos. 10-90, 14-58, 14-259, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-64 at 2-3, para. 2 (released May 26, 2016).

capability, particularly in the mobile environment.”<sup>43</sup> Despite the observation that service consistency is relevant to whether a broadband service delivers advanced telecommunications capability, the *Report* declined to adopt benchmarks for consistency of service, finding that doing so would be premature.<sup>44</sup> Nevertheless, the *Report* indicated that the Commission will “continu[e] to consider methods to incorporate this metric into our annual inquiry in future reports.”<sup>45</sup>

22. *Discussion.* In light of our finding in the *2016 Broadband Progress Report*, we seek comment on how consistency of service impacts access to advanced telecommunications capability over fixed broadband networks. Are certain applications or classes of application uniquely sensitive to inconsistent network performance? The 2015 Measuring Broadband America Fixed Broadband Report found that consistency of speed may be “more important to customers who are heavy users of applications that are both high bandwidth and sensitive to variations in actual speed,” and that “[s]ome video streaming and some cloud-based applications fit into this category.”<sup>46</sup> How does service consistency affect consumer experience with these, or other, types of applications?

23. In addition, we seek information on how service consistency affects whether consumers have high-quality access to interactive applications, such as VoIP, video-conferencing, and online gaming, which the Commission has previously identified as among the kinds of applications that are central to the provision of advanced telecommunications capability.<sup>47</sup> Which aspects of service consistency – including, but not limited to, consistency of speed, latency (i.e. jitter), or packet loss – most affect whether broadband consumers are able to “originate and receive high-quality voice, data, graphics, and video telecommunications”?

24. Would analysis of service consistency improve our ability to measure the deployment and availability of advanced telecommunications capability? If so, which network performance metrics should the Commission consider when analyzing service consistency? Should we adopt a specific benchmark, or benchmarks, for service consistency related to these metrics? If so, how should these standards be formulated and applied? As we noted in the *2015 Broadband Progress Notice of Inquiry*, the MBA program presents data on broadband speed consistency “by tracking the minimum actual speeds experienced by consumers, relative to their advertised speeds, at a given frequency.”<sup>48</sup> Could a similar calculation be used to create consistency of service benchmarks for our annual Broadband Progress Reports?

25. Finally, we seek comment on potential data sources that may be available to the Commission related to fixed broadband network service consistency. Are other data sources available to

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<sup>43</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 727, para. 68.

<sup>44</sup> *Id.* at 728, para. 70.

<sup>45</sup> *Id.*

<sup>46</sup> FCC, 2015 Measuring Broadband America Fixed Broadband Report: A Report on Consumer Fixed Broadband Performance in the United States at 7 (2015), <https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-broadband-america-2015> (2015 Measuring Broadband America Fixed Broadband Report).

<sup>47</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 727, para. 68.

<sup>48</sup> *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191, Eleventh Broadband Progress Notice of Inquiry, 30 FCC Rcd 8823, 8839, para. 43 (2015) (*2015 Broadband Progress NOI*). For example, using an 80/80 rubric (80 percent of customers, 80 percent of the time), the 2015 Measuring Broadband America Fixed Broadband Report found that “[c]ustomers of Cablevision, Comcast, [and] Verizon Fiber (FiOS) experienced actual download speeds that are very consistent; over 80% of their customers experienced actual download speeds at or above advertised download speeds during at least 80% of the peak usage period.” See 2015 Measuring Broadband America Fixed Broadband Report at 16.

the Commission, in addition to the MBA data, which might aid the Commission in establishing such a consistency of service benchmark? If we do adopt a specific consistency benchmark, now or in the future, to what extent are such data sources sufficiently granular to allow us to differentiate areas that meet the benchmark from those that do not? Alternatively, besides the development of specific benchmarks, are there other ways for our annual section 706 inquiry to account for the effect that service consistency has on the use of high-quality interactive applications?

**c. Fixed Broadband Latency**

26. In this section, we propose to adopt a latency benchmark for all fixed advanced telecommunications capability. We seek comment on this approach, and on what an appropriate latency standard should be to ensure that consumers are able to both originate and receive “high-quality voice, data, graphics, and video telecommunications” as is required by section 706.<sup>49</sup> In order to generate a comprehensive record on this issue, we present a variety of questions regarding how best to incorporate latency into our analysis of the deployment and availability of advanced telecommunications capability over fixed broadband networks.

27. *Background.* As we observed in the *2016 Broadband Progress Report*, latency “significantly impacts the performance of interactive, real-time applications, including VoIP, online gaming, videoconferencing, and VPN platforms.”<sup>50</sup> Moreover, because these types of applications “are contemporary examples of the advanced services that Congress directed the Commission to consider in our section 706 inquiry,” the *2016 Broadband Progress Report* found that latency “plainly affects” whether consumers have access to advanced telecommunications capability.<sup>51</sup> The *Report* also observed that the “higher latencies of some services, particularly satellite-based broadband services, may ‘negatively affect the perceived quality of . . . highly interactive applications,’” thereby affecting the ability of these types of services to deliver advanced telecommunications capability.<sup>52</sup> However, because the Commission “lack[ed] sufficiently comprehensive data on latency,” we declined to adopt a latency benchmark in the *2016 Report*.<sup>53</sup> Instead, we stated our intent to continue consideration of latency in future iterations of the section 706 inquiry.<sup>54</sup>

28. Building on the findings of the *2016 Broadband Progress Report*, we seek detailed comment below on the proper means to incorporate latency into our section 706(b) analysis of fixed broadband services. To develop a robust record on this important issue, we present a number of different questions and potential strategies for addressing latency. We seek comment on these approaches, as well as any viable alternatives.

29. We first seek comment on the specific ways that fixed broadband network latency impacts consumers’ ability to “originate and receive high-quality voice, data, graphics, and video telecommunications,” as section 706 requires.<sup>55</sup> As discussed above, we have previously found that latency plays a role in determining service quality for users of many highly-interactive applications,<sup>56</sup> and we note that latency is likely to affect interactive, two-way communications platforms more significantly

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<sup>49</sup> See 47 U.S.C. § 1302(d)(1).

<sup>50</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 726, para. 64.

<sup>51</sup> *Id.* at 726-727, paras. 64-67.

<sup>52</sup> *Id.* at 727, para. 67 (quoting 2015 Measuring Broadband America Fixed Broadband Report at 7).

<sup>53</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 727, para. 66.

<sup>54</sup> See *id.* at 727, para. 67.

<sup>55</sup> See 47 U.S.C. § 1302(d).

<sup>56</sup> See *supra* para. 27.

than one-way applications like streaming video.<sup>57</sup> We seek comment on how latency affects access to “high-quality” telecommunications services, as required by section 706. What is the best approach to differentiate “high-quality” from lesser-quality consumer experiences with telecommunications services? Which applications in particular are affected by higher latencies? Does latency impact “high-quality” access to video and data services, in addition to voice and gaming platforms? At what point does network latency become too great to support a “high-quality” experience for users of these applications? Notwithstanding the impact of latency on the use of highly-interactive applications, are there reasons that we should not seek to include latency in our review of the deployment and availability of fixed advanced telecommunications capability?

30. We next seek comment on how best to account for the effect of network latency on the ability of fixed broadband services to deliver advanced telecommunications capability. As noted above, we propose to adopt a single latency benchmark to evaluate whether a fixed service constitutes advanced telecommunications capability and we seek comment on this proposal. We note that this would not be the first instance in which the Commission adopted a latency benchmark. In 2013, the Wireline Competition Bureau adopted a 100 milliseconds (ms) network latency benchmark that certain price cap carriers must meet in order to receive Connect America Phase II funding.<sup>58</sup> This benchmark refers to the round-trip latency on a last-mile provider’s network,<sup>59</sup> and was calculated based on latency standards developed by the International Telecommunications Union (ITU) for ensuring consumer satisfaction with the quality of VoIP calls.<sup>60</sup> This standard is also being applied by the Commission in the *Emerging Wireline Networks* proceeding.<sup>61</sup> Should we adopt a similar approach to considering latency in the section 706 context, where the statute mandates an inquiry into “advanced telecommunications capability”?<sup>62</sup> If so, what is an appropriate latency benchmark to ensure that consumers have high-quality access to the bundle of telecommunications services—including VoIP, videoconferencing, VPN services, and online gaming applications—that provide advanced telecommunications capability? We recognize that some of the

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<sup>57</sup> See, e.g., 2015 Measuring Broadband America Fixed Broadband Report at 7.

<sup>58</sup> See *Connect America Fund*, WC Docket No. 10-90, Report and Order, 28 FCC Rcd 15060, 15061, 15068-70, paras. 2, 19-20 (Wireline Comp. Bur. 2013) (*CAF Phase II Service Obligations Order*); see also 2015 Broadband Progress NOI, 30 FCC Rcd at 8836, para. 35.

<sup>59</sup> The latency benchmark applicable to price-cap ILECs accepting Phase II Connect America support refers to network latency as measured “during peak period (defined as weeknights between 7:00 pm to 11:00 pm local time) between the customer premises and the closest designated Internet core peering interconnection point.” *CAF Phase II Service Obligations Order*, 28 FCC Rcd at 15069-70, para. 23.

<sup>60</sup> See *id.* at 15068-72, paras. 19-24; see also International Telecommunication Union, Telecommunication Standardization Sector, Series G: Transmission Systems and Media, Digital Systems and Networks, G.114 at 3 (Figure 1—Determination of the effects of absolute delay by the E-model) (May 2003) (ITU Series G.114).

<sup>61</sup> *Technology Transitions; USTelecom Petition for Declaratory Ruling That Incumbent Local Exchange Carriers Are Non-Dominant in the Provision of Switched Access Services; Policies and Rules Governing Retirement Of Copper Loops by Incumbent Local Exchange Carriers*, GN Docket No. 13-5, Declaratory Ruling, Second Report and Order, and Order on Reconsideration, FCC 16-90, para. 95 (rel. July 15, 2016) (*Emerging Wireline Networks Second Report and Order*).

<sup>62</sup> 47 U.S.C. 1302 (d). We note that, for our high-cost Universal Service Fund (USF) program, we developed a benchmark based on an ITU Report that indicated that consumers were “very satisfied” with the quality of VoIP calls with an overall “mouth-to-ear” latency of 200 milliseconds (ms) or less. This 200 ms “mouth-to-ear” transmission delay includes latency caused by the transmission of a data packet from one point to another across the Internet, as well as latency generated by sources outside of the network, including data processing delays generated by communications equipment. See *CAF Phase II Service Obligations Order*, 28 FCC Rcd at 15068-72, paras. 19-24; see also ITU Series G.114 at 3. After factoring in delays caused by communications equipment and transmittal through the Internet backbone, the *CAF Order* found that the roundtrip latency on a given provider’s last-mile network should be no more than 100 ms in order to ensure that consumers achieved the 200 ms mouth-to-ear latency for VoIP calls. See *CAF Phase II Service Obligations Order*, 28 FCC Rcd at 15068-72, paras. 19-24.

latency examples, discussed herein, are developed in the context of wireline services. We seek comment on whether these latency requirements may be appropriate for other fixed services, such as fixed wireless and satellite, in the context of section 706.

31. We note that other standards developed by the ITU for “[r]eal-time, jitter sensitive, high interaction” applications suggest that an overall “mouth-to-ear” latency of 150 ms or less, rather than the 200 ms or less standard used as the baseline in the *CAF Phase II Service Obligations Order*, may be necessary for use of the most latency-sensitive applications.<sup>63</sup> Further, as discussed above, this “mouth-to-ear” figure includes latency generated by sources outside the network. To compensate for these non-network sources of delay, the ITU’s performance objectives indicate that highly-interactive applications may require an average network latency of 100 ms or less to function properly.<sup>64</sup> Additionally, for certain applications, particularly multiplayer online gaming platforms, even lower latencies may be desirable. Xbox Live, a popular online gaming platform, recommends a latency no greater than 150 ms for use of its service.<sup>65</sup> Would a “high-quality” experience on these kinds of applications require a lower latency connection?<sup>66</sup> Is high-quality access to such services a component of advanced telecommunications capability?

32. Based on the preceding discussion, would a round-trip latency benchmark of 100 ms or below be necessary to ensure that consumers have high-quality access to interactive voice, data, graphics, and/or video applications? Would a lower benchmark be appropriate? If so, what should the lower benchmark be and why? Should the Commission consider additional or alternative sources in developing a potential latency benchmark? If the Commission adopts a latency benchmark, would it also need to account for consistency of latency (i.e., jitter)? For example, the *CAF Phase II Service Obligations Order* provided that “price cap carrier[s] accepting model-based support will need to certify that 95 percent or more of all peak period measurements . . . of network round trip latency are at or below 100 ms.”<sup>67</sup> This approach was also adopted by the Commission in the *Emerging Wireline Networks* proceeding.<sup>68</sup> Would a similar requirement be suited to establishing compliance with a latency benchmark in the section 706 context? Why or why not?

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<sup>63</sup> See *supra* note 62; International Telecommunication Union, Telecommunication Standardization Sector, Series G: Transmission Systems and Media, Digital Systems and Networks, G.1010 at 8, Appx. 1 (Nov. 2001) (ITU Series G.1010).

<sup>64</sup> ITU Series Y.1541 at 9 (Table 1 – IP network QoS class definitions and network performance objectives).

<sup>65</sup> Xbox Live, *Support – Slow Performance Solutions*, <http://support.xbox.com/en-US/xbox-360/networking/slow-performance-solution> (last visited Aug. 2, 2016).

<sup>66</sup> For example, the 3<sup>rd</sup> Generation Partnership Project has found that a network latency of 75 ms or less may be preferable for real-time interactive online games. 3GPP TS 22.105 at 15 (Table 1 – End-user Performance Expectations – Conversational / Real-time Services). Additionally, in a white paper submitted to the Commission in response to the *National Broadband Plan Notice of Inquiry*, networking equipment manufacturer ADTRAN synthesized the latency standards developed by various organizations, and argued that a round-trip latency of “35 ms upstream and 15 ms downstream” would be an appropriate standard for broadband providers to ensure proper functionality for the full spectrum of interactive applications on their last-mile access networks. ADTRAN, *Defining Broadband: Network Latency and Application Performance* at 1, <http://apps.fcc.gov/ecfs/document/view;jsessionid=8J2ZJd2LhSfmWq0FpLYn325DKqPyH3hkMLTVrdx812dx2fDZsXj9!134036602!-592336258?id=6520222942>.

<sup>67</sup> *CAF Phase II Service Obligations Order*, 28 FCC Rcd at 15069-70, para. 23. Similarly, in the recently released *CAF Phase II Auction Order*, the Commission required that low-latency bids meet the same standard. See *Connect America Fund, ETC Annual Reports and Certifications, Rural Broadband Experiments*, WC Docket Nos. 10-90, 14-58, 14-259, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-64, paras. 28-34 (May 25, 2016) (*CAF Phase II Auction Order*). It also, however, allowed for the possibility that some providers, likely satellite providers, might choose to offer higher-latency services. See *id.*

<sup>68</sup> See *Emerging Wireline Networks Second Report and Order* at para. 95.

33. Alternatively, should latency be viewed as a discrete attribute of broadband performance that different consumers may value differently? For example, consumers may be willing to trade speed for latency so that a higher speed makes up for greater latency. If so, should we account for these potential differences in conducting our annual section 706 inquiry? How might we identify and analyze advanced telecommunications capability deployment to such consumers?<sup>69</sup> Are there households with user needs where higher speeds are more desirable than low latency? If so, should we develop a system to weigh and balance the importance of various broadband uses in evaluating whether consumers have access to advanced telecommunications capability?

34. Further, we seek comment on how and at what point in the network we should measure latency.<sup>70</sup> In determining the latency measurement, should we consider the performance characteristics of the technology being used to provide a connection to the consumer? We note that services may not always be provided end-to-end using the same technology.<sup>71</sup> Some providers also could opt to offer broadband services that are not latency sensitive through satellite while the voice portion of their service may be provided using a terrestrial connection to reduce latency.<sup>72</sup> We seek comment on whether and how such an approach would achieve the statutory goals of section 706. Are there currently any such networks? If so, how should we account for the use of hybrid satellite/terrestrial networks in our analysis?

35. Finally, as discussed in more detail below,<sup>73</sup> we also seek comment on the data sources available to the Commission for our analysis of latency. In particular, we seek comment on whether there are further sources of information, in addition to the Measuring Broadband America (MBA) data to which we have historically had access, which might aid the Commission in establishing and applying a latency benchmark. What additional sources of data exist, and how might they help the Commission in the establishment and application of a latency benchmark?

## 2. Mobile Broadband Service Benchmarks

36. For mobile broadband services, we seek comment on the performance metrics, and their interrelationships, that should be part of any benchmarks to be established to determine American consumers' access to advanced telecommunications capability. More specifically, we seek comment on developments since the last report and how the Commission might establish a speed benchmark for mobile broadband services. We also seek comment on how to take into account consistency of service and latency in the mobile broadband environment, and their interaction with speed, and seek comment on

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<sup>69</sup> We note that the *CAF Phase II Auction Order* incorporated a requirement that “high latency” carriers bidding for Connect America Fund Phase II funding must “demonstrate a score of four or higher using the Mean Opinion Score (MOS)” – a system of measurement of the perceived quality of voice calls. *See CAF Phase II Auction Order*, FCC 16-64 at para. 2. Could a similar concept be incorporated in the section 706 context?

<sup>70</sup> *See also supra* Section II.B.1.c.

<sup>71</sup> For example, in some remote areas, while the connection to the consumer might be a fixed wired connection, the backhaul connection to the provider might be provided through fixed wireless or satellite infrastructure. *See, e.g., Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees Petition for Rulemaking filed by Fixed Wireless Communications Coalition to Amend Part 101 of the Commission's Rules to Authorize 60 and 80 MHz Channels in Certain Bands for Broadband Communications*, WT Docket No. 10-153, Report and Order, Further Notice of Proposed Rulemaking, and Memorandum Opinion and Order, 26 FCC 11614, 11616, para. 2 (2011).

<sup>72</sup> *See e.g.,* Letter from John P. Janka, Counsel to ViaSat, Inc., to Marlene H. Dortch, Secretary, FCC, WC Docket No. 10-90 et al., at 2 (filed Feb. 2, 2016) (stating that the Commission should “apply the latency requirement only with respect to the very limited amount of latency-sensitive traffic that may exist, thus enabling the use of hybrid networks to deliver the most cost-effective broadband solution to the consumer”).

<sup>73</sup> *See infra* Section IV.D for a discussion of additional sources of broadband performance data.

establishing consistency and latency benchmarks in measuring access to advanced telecommunications capability. In addition, we seek comment on the data sources that should guide the Commission's analysis of these potential benchmarks.

**a. Mobile Broadband Speed**

37. *Background.* In the *2016 Report*, the Commission determined that mobile broadband services are as essential as fixed broadband services and that Americans increasingly rely on mobile devices as indispensable tools of daily life.<sup>74</sup> The Commission also concluded that fixed and mobile broadband are often used in conjunction with one another and, as such, are not functional substitutes; each service offers different capabilities to consumers, the services are marketed differently, and most consumers with the financial means choose to purchase both.<sup>75</sup> The Commission further found that advanced telecommunications capability should be deemed deployed only in geographical areas where consumers have access to both services.<sup>76</sup> However, while the Commission noted that speed is a key determinant of advanced telecommunications capability, the Commission concluded in the *2016 Report* that the record was not sufficient to set a mobile speed benchmark, as it did not provide adequate use cases, engineering models, or empirical evidence that could be used to support a particular benchmark for mobile services.<sup>77</sup>

38. *Discussion.* We reiterate our view that speed is a central factor affecting the user experience of mobile broadband services and is a key determinant of advanced telecommunications capability.<sup>78</sup> In addition, as discussed below, speed is inherently related to service consistency – that is, how often a particular speed is provided – as well as latency in the mobile broadband environment: consumers are increasingly making use of new mobile broadband services, from high definition video calling and interactive gaming to streaming video, that require consistent high-speed low-latency connectivity. We aim to establish a benchmark for mobile broadband that reflects the critical importance of speed as one of the primary factors influencing user experience, in conjunction with consistency and latency, and we seek comment on the extent to which speed is relevant to the statutory definition of advanced telecommunications capability. We seek comment on developments since the *2016 Report*, including updated information about trends in deployment and adoption of mobile broadband services. Our determination of an appropriate benchmark will be informed by assessing the mobile broadband services and speeds that are available to consumers today, as well as evidence regarding what services consumers are choosing today, and what might be available in the near future, and we ask commenters to address these factors in their comments.

39. We seek comment on how differences in fixed broadband and mobile broadband usage patterns relate to the question of setting a speed benchmark for mobile broadband services. As mobile broadband currently addresses different consumer needs and provides different capabilities than fixed

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<sup>74</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 708, para. 20.

<sup>75</sup> *See id.* at 710, para. 24; *see also generally id.* at 710-19, paras. 25-44 (discussing why fixed and mobile broadband are not functional substitutes); *id.* at 714-15, paras. 36-37 (observing that 68 percent of Americans use a smartphone; users spent 34 hours and 17 minutes per month on average using their mobile browser or apps; and U.S. consumers use 1.9 GB of mobile data on average a month versus 57.4 GB of data per month per household for fixed); *id.* at 716, para. 39 (discussing that those consumers with limited financial means tend to subscribe only to a mobile option, and that early trends indicate that the “mobile only” group is growing); *id.* at 724-25, para. 60 (discussing likely growth in tethering and mobile hotspot use).

<sup>76</sup> *See id.* at 710, para. 24.

<sup>77</sup> *See id.* at 724, para. 58. The Commission reported that approximately 2 million Americans (1 percent) did not have access to mobile wireless LTE, and that approximately 171 million Americans (53 percent) did have access to a mobile wireless LTE service with a speed of at least 10 Mbps/1 Mbps. *See id.* at 734-35, para. 83, Table 4.

<sup>78</sup> *See id.* at 723, para. 56.

broadband, we anticipate that an appropriate speed benchmark would be lower than the 25 Mbps/3 Mbps adopted for fixed broadband services. Taking into consideration the interrelated consistency and latency effects, we seek comment on whether a mobile speed benchmark of 10 Mbps/1 Mbps is appropriate to reflect current customer usage patterns for mobile broadband services, and whether a 10 Mbps/1 Mbps edge speed is an accurate measure of advanced telecommunications capability. Would this speed benchmark be likely to reflect increasing consumer use in the near future? If not, what speeds do consumers need to have access to advanced telecommunications capability in the mobile environment? Would a download speed benchmark higher or lower than 10 Mbps be appropriate? Should the Commission's download speed benchmark be paired with an upload speed higher than 1 Mbps, such as 3 Mbps? We ask commenters to address the benefits and costs of potential speed benchmarks of 10 Mbps/3 Mbps or 10 Mbps/1 Mbps for mobile broadband. We also ask commenters to address the data sources that should guide the Commission's analysis of these potential benchmarks. What effects might testing methods, failed speed tests, and other characteristics of a particular speed test have on the appropriateness of a certain speed benchmark? Further, we seek comment on the appropriate methodology to use for setting a speed benchmark for mobile broadband. We invite interested parties to present alternative approaches.

40. In the *2016 Report*, the Commission noted that the characteristics of mobile services appear to make them generally inappropriate for certain data-intensive activities such as telecommuting or the highest-quality multimedia experiences.<sup>79</sup> We seek comment on the current use cases that may require high download speeds or upload speeds which the Commission should take into consideration.<sup>80</sup> Is there an objectively notable difference among download times for different use cases that could help inform an appropriate speed benchmark? The Commission further noted in the *2016 Report* that mobile transmissions are subject to environmental factors that fixed line transmissions do not encounter and, thus, cannot achieve the same kinds of consistent speeds at the current level of technology.<sup>81</sup> In addition, mobile broadband networks lack the capacity or consistency of service to support most bandwidth intensive uses, such as full-screen HD video streaming, online gaming, and video conferencing applications, including telehealth and education platforms.<sup>82</sup> We seek comment on how the interaction between speed and latency as well as consistency of service may affect the implementation of an appropriate speed benchmark.

41. Our determination of an appropriate speed benchmark must also be forward-looking and take into account mobile advanced telecommunications services that are anticipated for the future. Accordingly, we also ask commenters to include information in their comments about projected future trends in consumer demand for mobile broadband services and device functionality that will be required to meet those demands. As consumers' use of data continues to grow,<sup>83</sup> we seek comment on how this increasing demand for smartphones, tablets, and other connected devices is likely to affect the appropriate speed benchmark to adopt. What speeds will be necessary to allow the growing use of data intensive

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<sup>79</sup> See *id.* at 712-13, para. 29.

<sup>80</sup> For instance, a 5 MB picture – a common smartphone photo size – takes four seconds to download at 10 Mbps and eight seconds to download at 5 Mbps. We note that in the context of web page load times, the first four seconds tend to lead to the steepest abandonment rates by users. See KissMetrics, *How Loading Time Affects Your Bottom Line*, <https://blog.kissmetrics.com/wp-content/uploads/2011/04/loading-time.pdf> (last visited Aug. 2, 2016); Nathan Eddy, eWeek, *Slow Load Times Lead to Mobile Transaction Abandonment* (Aug. 18, 2015) <http://www.eweek.com/small-business/slow-load-times-lead-to-mobile-transaction-abandonment.html>.

<sup>81</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 712, para. 29.

<sup>82</sup> See *id.* at 717-18, para. 41.

<sup>83</sup> See *id.* at 708, para. 20. Consumers' use of data on the go has been growing substantially and, while the average monthly data usage per subscriber was 122 MB in 2010, it is predicted that the monthly average will be 25 GB by 2021. See *id.*

mobile broadband services? Specifically, we seek additional information about developing use cases for mobile broadband. For instance, in the *2016 Report*, we noted that automobile-based mobile services, which allow multiple users on one mobile connection, were just entering the marketplace, and that tethering and hot spot use for these and other systems was likely to grow.<sup>84</sup> We also noted that some consumers were using their mobile broadband service with larger, more data intensive tablets.<sup>85</sup> Consumers are increasingly consuming media, including high-definition video, on tablets, handsets, in vehicles, and virtual reality headsets, wherever they happen to be.<sup>86</sup> While most video applications require greater downstream usage, some applications, such as interactive video and gaming, may have greater requirements for upload speeds. We seek comment on these developments and the evolution of these services. How should the Commission account for these types of services in determining an appropriate mobile speed benchmark?

42. In addition, we seek comment on what new mobile services, applications, and products may develop or evolve in the near future, and the speeds they might require. For example, the U.S. Department of Transportation anticipates that over the next decade, autonomous and semi-autonomous vehicles will be in widespread use and will be highly dependent on reliable communications to interact with vehicle management systems, with nearby vehicles, and to read sensors.<sup>87</sup> We seek comment on speed and latency requirements for such vehicles and systems. Further, the number of devices and connected sensors comprising what is commonly referred to as the “Internet of Things” (IoT) is expected to grow by orders of magnitude in the coming years.<sup>88</sup> Applications include shipment tracking, immersive augmented reality, monitoring, smart home/office management, etc. What impact is the IoT expected to have on mobile networks and what speeds will likely be required for anticipated IoT applications? We seek comment on the speeds that are likely to be necessary to support the functionalities enabled by these services and others that are being developed with next generation 5G technologies.

43. In the *2016 Report*, we noted that mobile broadband encounters degrading effects from factors such as congestion, interference, and challenges presented by the physical velocity of a mobile antenna.<sup>89</sup> We noted that, even though it might be possible to provide certain advanced telecommunications capabilities, such as video conferencing, at lower data rates in certain circumstances, future mobile broadband speeds may not be sufficient to account for potential signal degradation as well

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<sup>84</sup> See *id.* at 724-25, para. 60. For example, to ensure a secure connection “on the go,” consumers may use a mobile USB modem for their laptops. See, e.g., Verizon Wireless, *MiFi 4G LTE Global USB Modem U620L*, <http://www.verizonwireless.com/internet-devices/verizon-mifi-4g-lte-global-usb-modem-u620l/> (last visited Aug. 2, 2016) (“[J]ust plug the USB into your laptop and connect to fast 4G LTE in the US . . .”). Consumers also use their mobile broadband service with equipment such as MiFi devices.

<sup>85</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 725, para. 60. See, e.g., Verizon Wireless, *Jet Pack MiFi 6620L*, <http://www.verizonwireless.com/internet-devices/jetpack-mifi-6620l/> (last visited Aug. 2, 2016) (“Got Wi-Fi-enabled devices such as tablets and laptops that you want to connect to the Internet? The Verizon Jetpack MiFi 6620L provides that link – even when outside the country. Connect up to 15 Wi-Fi-enabled devices to 4G LTE and 3G.”).

<sup>86</sup> See Cisco, Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, White Paper 2015-2020 (2016), <http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html>.

<sup>87</sup> See Press Release, U.S. Department of Transportation, Secretary Foxx Unveils President Obama’s FY17 Budget Proposal of Nearly \$4 Billion for Automated Vehicles and Announces DOT Initiatives to Accelerate Vehicle Safety Innovations (Jan. 14, 2016), <https://www.transportation.gov/briefing-room/secretary-foxx-unveils-president-obama%E2%80%99s-fy17-budget-proposal-nearly-4-billion>.

<sup>88</sup> See Press Release, Gartner, Gartner Says 6.4 Billion Connected “Things” Will Be in Use in 2016, Up 30 Percent From 2015 (Nov. 10, 2015), <http://www.gartner.com/newsroom/id/3165317>.

<sup>89</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 725, para. 61.

as the advent of new technologies and increasing consumer demand.<sup>90</sup> We ask commenters to address how the Commission should factor in the unique technical characteristics of mobile wireless communications in establishing a speed benchmark. In addition, we seek comment on how to establish a mobile speed benchmark that accounts for such technical characteristics. Given the effect of factors such as congestion or interference, as well as certain physical factors, should we set the mobile speed benchmark in excess of what speed may be necessary to support advanced telecommunications capabilities in ideal conditions? How should the Commission determine what speed is necessary to account for the presence of commonly encountered degrading conditions that affect mobile networks? For example, should the Commission set a median speed benchmark, and if so, what level of consistency should be associated with that benchmark? Should that speed be achieved 80 percent or 90 percent of the time, or should we set some other measure of reliability?

**b. Mobile Broadband Consistency**

44. While speed is a key determinant of advanced telecommunications capability, the user experience for mobile broadband is also dependent on how consistently the service delivers the speeds it can provide. As noted above, in the *2016 Report*, the Commission found that, particularly in a mobile environment, consistency has the potential to have a significant effect on whether a mobile broadband service delivers advanced telecommunications capability.<sup>91</sup> We continue to view consistency of service as an important indicator of access to advanced telecommunications capability and seek comment on how the Commission should evaluate consistency in the mobile broadband environment. Should the Commission establish a consistency of service benchmark for mobile broadband and, if so, what should the standard be? As noted in the *2016 Report*, different service consistency benchmarks may be appropriate for fixed broadband services as compared to mobile broadband services because mobile broadband services are inherently less consistent.<sup>92</sup> Would a consistency of service benchmark effectively measure the quality of mobile broadband services?

45. Further, we seek comment on how the Commission might set standards for consistency of service for mobile broadband services. Should a mobile consistency benchmark focus on the median user, or is it important to measure consistency along the entire range of the consumer experience? Should a mobile consistency benchmark be analogous to the one presented in the *2015 Measuring Broadband America Fixed Broadband Report*?<sup>93</sup> We seek comment on whether an appropriate benchmark for consistency is that a user should experience a certain speed 80 percent of the time in the relevant geographic area in order to conclude that access is being provided to advanced telecommunications capability. Or is it more appropriate for the speed benchmark to be met 90 percent of the time? What effect might factors such as packet loss have on the quality of the mobile broadband user experience, and how might we best measure that? Is there an alternative consistency benchmark that would be more appropriate for mobile broadband services? How might the Commission develop a benchmark that takes into account the importance of consistency while recognizing the many factors that affect consistency? What are the potential data sources that may be available for the Commission to be able to rigorously measure mobile broadband network service consistency? And what methodology should the Commission use?

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<sup>90</sup> See *id.* at 725, para. 61.

<sup>91</sup> See *id.* at 727-28, para. 68.

<sup>92</sup> See *id.* at 728, para. 70; see also *2015 Broadband Progress NOI*, 30 FCC Rcd at 8846, para. 66 (“The performance of mobile broadband services can be affected by a number of factors, including the mobile wireless technology deployed in a particular area, the backhaul technology used, as well as the end user’s signal strength, the level of network congestion, and interference.”).

<sup>93</sup> *2015 Measuring Broadband America Fixed Broadband Report* at 7 (“In this Report, we continue to present statistics on the minimum actual speed that was experienced by at least 80% of panelists during at least 80% of the peak usage period.”).

**c. Mobile Broadband Latency**

46. Similarly to fixed broadband services, consumers may use their mobile devices for many real time applications and services such as voice calls over the Internet, high-definition video streaming, or video conferencing. As such, latency is an important determinant of measuring access to advanced telecommunications capability, and we should also take into account its interrelatedness with consistency of service. We seek comment on precisely how latency affects access to advanced telecommunications capability, and whether we should develop a latency benchmark for mobile broadband services. Is a latency benchmark an appropriate tool to ensure that mobile customers are able to use advanced telecommunications services over their mobile broadband connection?

47. We also seek comment on the specific latency standard, if any, that the Commission should adopt for mobile broadband services. Would a peak period round-trip latency benchmark of 100 ms be necessary to ensure that consumers have high-quality access to interactive voice, data, graphics, and/or video applications on their mobile devices? And would that benchmark be necessary in all cases or would a lower percentage such as 90 or 95 percent of cases be appropriate? Would a higher or lower ms peak period round-trip latency benchmark or some other figure be more appropriate? Why or why not? How might the effect of latency on the consumer experience using mobile LTE services be different from the effect of latency on fixed broadband services? Are there factors that would argue in favor of a different latency standard for mobile broadband services than for fixed broadband services given the differences between the two services? What are the interactions between latency and consistency of service, and how might that affect a potential latency benchmark?

48. We seek comment about the available data sources for analyzing latency in the mobile broadband services context. We seek comment on the use of the mobile Measuring Broadband America (Mobile MBA) program dataset for measuring latency. Should the Commission rely on the findings from data sets such as the Mobile MBA program, Ookla, or Rootmetrics to assess mobile broadband latency? Are there other datasets that the Commission could use in assessing mobile broadband latency?

**C. Criteria and Standards for School and Library Broadband Access**

49. *Background.* Section 706 requires the Commission to focus on the deployment and availability of advanced telecommunications capability to “elementary and secondary schools and classrooms.”<sup>94</sup> In the *2015 Broadband Progress Report*, the Commission found that “the broadband needs of schools are likely to be significantly greater than the needs of most households,” a finding that warranted use of higher speeds when determining whether advanced telecommunications capability is being deployed to elementary and secondary schools in a reasonable and timely fashion.<sup>95</sup> We also concluded that it would be appropriate to adopt both a short-term and a long-term benchmark for measuring reasonable and timely deployment.<sup>96</sup> Relying on standards it established in the prior year’s *E-rate Modernization Order*,<sup>97</sup> the Commission thus adopted two speed benchmarks for schools: (1) a short-term speed benchmark of 100 Mbps per 1,000 students and staff, and (2) a long-term speed benchmark of 1 Gbps per 1,000 students and staff.<sup>98</sup> As of the publication of the *2016 Broadband Progress Report*, while the majority of schools had reached the short-term speed benchmark, a significant percentage of schools still had not.<sup>99</sup> Furthermore, we found in the *2016 Broadband Progress Report* that

<sup>94</sup> 47 U.S.C. § 1302(b).

<sup>95</sup> *2015 Broadband Progress Report*, 30 FCC Rcd at 1410, para. 61.

<sup>96</sup> *See id.* at 1410, para. 62.

<sup>97</sup> *See Modernizing the E-rate Program for Schools and Libraries*, WC Docket No. 13-184, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 8870, 8885, para. 34 (2014) (*E-rate Modernization Order*).

<sup>98</sup> *See 2015 Broadband Progress Report*, 30 FCC Rcd at 1410, para. 62.

<sup>99</sup> *See 2016 Broadband Progress Report*, 31 FCC Rcd at 741, para. 92 (“59% of schools . . . have met the Commission’s [short-term] goal”).

the vast majority of elementary and secondary schools were not purchasing broadband services that satisfy the Commission's long-term benchmark. In the *2016 Broadband Progress Report*, the Commission estimated that 41 percent of schools do not purchase broadband services at the Commission's short-term goal of 100 Mbps per 1,000 users, and 91 percent of schools do not purchase broadband services at the Commission's long-term goal of 1 Gbps per 1,000 users.<sup>100</sup>

50. *Discussion.* As of the publication of the *2016 Broadband Progress Report*, a large percentage of schools still lacked services at either the short-term benchmark or long-term benchmark established in the *E-rate Modernization Order* and embraced in the *2015 Broadband Progress Report*. We propose to retain those benchmarks and seek comment on such an approach. We also seek comment, however, on whether those standards ought to be updated and whether further proceedings are appropriate to revisit the standards for evaluating broadband deployment to American classrooms.

### III. OTHER FACTORS AFFECTING DEPLOYMENT AND AVAILABILITY

51. *Background.* In the *2016 Broadband Progress Report*, the Commission affirmed its prior findings that, for the purposes of our analysis under section 706(b), the terms broadband "deployment" and "availability" are broader than the mere physical presence of broadband networks.<sup>101</sup> The Commission also found that it should examine a variety of factors that affect access to broadband services—including price, service quality, and adoption by consumers—when making its determination of whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion.<sup>102</sup> The Commission went on to discuss each of these factors as they pertained to the deployment and availability of advanced telecommunications capability.<sup>103</sup>

52. *Discussion.* We continue to believe that the Commission should examine factors that affect access to broadband services beyond mere physical network deployment when making our determination of whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely manner.<sup>104</sup> In addition to service quality and latency,<sup>105</sup> we seek comment on whether non-speed service characteristics such as data allowances, adoption, and the availability of competitive alternatives should be additional factors in our inquiry. Are any of the factors not pertinent to our ultimate determination of whether advanced telecommunications capabilities are being deployed to all Americans in a reasonable and timely manner? If so, which factors and why, and how can we measure them? Are there any additional factors not previously mentioned that the Commission should consider

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<sup>100</sup> See *id.* at 741, paras. 92-94.

<sup>101</sup> See *id.* at 741, para. 95.

<sup>102</sup> See *id.* at 742, para. 96.

<sup>103</sup> See *id.* at 741-48, paras. 95-113.

<sup>104</sup> See, e.g., *2016 Broadband Progress Report*, 31 FCC Rcd at 745-47, paras. 103-109 (stating that, for purposes of evaluating the availability of advanced telecommunications capability, the Commission examines not only physical deployment and adoption, but also price and quality metrics, including actual speeds, consistency of service, latency, and packet loss); *2015 Broadband Progress Report*, 30 FCC Rcd at 1410-11, paras. 64-65 (stating that the Commission should evaluate a variety of factors affecting access to broadband, including service quality and adoption by consumers, as well as physical network deployment, when determining whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion); *id.* at 1435-39, paras. 100-106 (stating that, for purposes of evaluating the availability of advanced telecommunications capability, the Commission examines not only physical deployment and adoption, but also price and quality metrics, including actual speeds, latency, consistency of speeds, and applications such as web browsing, VoIP, and streaming video); *2012 Broadband Progress Report*, 27 FCC Rcd at 10363, para. 27 (holding that Congress intended the annual section 706(b) inquiry to be broader than a narrow examination of physical network deployment, and that the Commission's inquiry thus includes an assessment of a variety of factors indicative of availability, including cost, quality, and adoption by consumers).

<sup>105</sup> See *supra* Sections II.B.1.b-c, II.B.2.b-c.

when making this determination in the future? In what ways should non-speed metrics such as those we have listed affect our conclusions about the deployment and availability of advanced telecommunications capability? We note that the Commission recently found as part of its review of the recent Charter Communications, Inc., Time Warner Cable, Inc., and Advance/Newhouse Partnership transactions, that data allowances in use by wired broadband Internet access service (BIAS) providers currently significantly and chiefly affect online streaming video traffic.<sup>106</sup> By affecting consumers' data consumption, and in particular consumption of online streaming video traffic, such data allowances may inhibit consumers from accessing the full range of services that might otherwise be available to them, including such bandwidth intensive services as HD video streaming and high-quality video telecommunications. Are there other ways in which data allowances or other non-speed metrics, such as those we have listed above, may affect the availability of advanced telecommunications capability?

53. We also seek comment on the pricing and affordability of services, and whether the Commission should consider the impact of these factors as part of our annual inquiry under section 706(b). In its 2015 report on the state of residential broadband in America, the Pew Research Center noted that for those Americans without broadband service in their homes, financial concerns—including, most prominently, the monthly cost of a broadband subscription—loomed large as barriers to non-adoption.<sup>107</sup> Even among individuals who can sometimes afford mobile service, many have had to shut off or cancel their mobile service for a period of time due to financial hardship.<sup>108</sup> Given the influence that cost may exert in determining consumers' likelihood to purchase advanced services, we seek comment on whether we should consider pricing and affordability as part of our inquiry into the availability of advanced telecommunications capability and our determination of whether it is being deployed to all Americans in a reasonable and timely fashion. If commenters believe we should consider these factors as part of our annual inquiry, how might the Commission consider the impact of such factors on the availability and deployment of advanced telecommunications services? What effect do considerations of pricing and affordability have on consumer adoption of advanced telecommunications services? Are the effects different for subscribers of only fixed, only mobile, or subscribers to both fixed and mobile?

54. In addition to those non-speed service metrics already mentioned, we seek comment on packet loss and whether it should be considered as part of our determination of whether advanced telecommunications capability is being made available to all consumers in a reasonable and timely

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<sup>106</sup> See *Applications of Charter Communications, Inc., Time Warner Cable Inc., and Advance/Newhouse Partnership For Consent to Assign or Transfer Control of Licenses and Authorizations*, MB Docket No. 15-149, Memorandum Opinion and Order, FCC 16-59 at 43, para. 85 (May 10, 2016). The Media Bureau also reiterated in its most recent Video Competition Report the observation of some commenters that online video distribution usage is the primary reason that consumers exceed Internet service data allowances. See *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, MB Docket No. 15-158, Seventeenth Report, DA 16-510 at 71, para. 167 (MB May 6, 2016). The Media Bureau also noted that, given the increasing volume of online video usage by consumers, usage-based pricing, which is based on data allowances, may have an increasingly significant effect on online video distribution. See *id.* at 70-71, para. 167.

<sup>107</sup> See Pew Research Center, *Home Broadband 2015: The share of Americans with broadband at home has plateaued, and more rely only on their smartphones for online access at 15* (Dec. 21, 2015), <http://www.pewinternet.org/2015/12/21/home-broadband-2015/> (Pew Home Broadband 2015). The Pew report noted that cost, whether of the service itself or of a computer, was the chief reason that non-adopters cite when permitted to identify more than one reason they do not have a home high-speed subscription. See *id.* When asked to identify the most important reason they do not have a home broadband subscription, non-adopters were most likely to cite the monthly cost of broadband service than any other reason. See *id.*

<sup>108</sup> Pew Research Center, *U.S. Smartphone Use in 2015* at 4 (2015), [http://www.pewinternet.org/files/2015/03/PI\\_Smartphones\\_0401151.pdf](http://www.pewinternet.org/files/2015/03/PI_Smartphones_0401151.pdf) (“48 percent of smart-phone dependent Americans have had to cancel or shut off their cell phone service . . . because the cost of maintaining that service was a financial hardship.”).

fashion. Packet loss occurs when packets of information are discarded or lost, and is typically the result of network congestion or buffer overflows on end systems.<sup>109</sup> Packet loss may directly affect the perceived quality of applications that do not request retransmission of lost packets, such as phone calls over the Internet, video chat, some online multiplayer games, and some video streaming.<sup>110</sup> Is such packet loss relevant to our determination of whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely manner? Why or why not? If commenters believe that the Commission should consider packet loss as part of our inquiry under section 706(b), should we also consider adopting a benchmark that would set a uniform threshold by which to measure such information loss? For instance, the 2015 Measuring Broadband America Fixed Broadband Report asserts that packet losses over a few tenths of a percent are sufficiently small that they are unlikely to significantly affect the perceived quality of phone calls, Internet video chat, and some online multiplayer games and video streaming, whereas packet losses closer to one percent may affect the perceived quality of some such applications.<sup>111</sup> We seek comment on these assertions. Would a threshold of a few tenths of a percent, such as 0.2, 0.3, or 0.4 percent, or some other percentage, serve as an appropriate benchmark by which to assess packet loss? Why or why not? Is a certain amount of packet loss not reasonably avoidable, even under the best network conditions, such that any provider will inevitably experience such information loss at one point or another? If so, are these proposed benchmarks sufficiently high to allow for the amount of packet loss that is not reasonably avoidable while still ensuring that consumers have access to advanced capabilities that enable them to originate and receive high-quality voice, data, graphics, and video telecommunications without a perceived loss in quality? If the Commission does choose to adopt a benchmark that would set a uniform threshold by which to measure packet loss, what data sources would allow us to determine which areas do or do not have sufficiently low levels of packet loss often enough to be considered as providing advanced telecommunications capability?

55. In the *2015 Broadband Progress Report*, we recognized that privacy and security are “among the factors that can affect the quality and reliability of broadband services.”<sup>112</sup> In the *2016 Broadband Progress Report*, we found that “if consumers have concerns about the privacy of their personal information, such concerns may restrain them from making full use of broadband services, thereby lowering the likelihood of broadband adoption and decreasing consumer demand.”<sup>113</sup> At the same time, “protection of customers’ personal information may spur consumer demand for those services” thus encouraging investment in and deployment of broadband services.<sup>114</sup> As technologies transition, it is important that we reassess and update methods for ensuring that communications remain secure and reliable, and that transitions to new technologies do not diminish privacy and network security protections consumers are accustomed to in traditional circuit-switched networks.<sup>115</sup> We therefore seek comment on

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<sup>109</sup> See The Linux Information Project, *Packet Loss Definition* (Nov. 1, 2005), [http://www.linfo.org/packet\\_loss.html](http://www.linfo.org/packet_loss.html).

<sup>110</sup> See 2015 Measuring Broadband America Fixed Broadband Report at 19.

<sup>111</sup> See *id.*

<sup>112</sup> *2015 Broadband Progress Report*, 30 FCC Rcd at 1438, para. 105; *2014 Broadband Progress Notice of Inquiry*, 29 FCC Rcd at 9768-69, paras. 45-47.

<sup>113</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 751-52, para. 126; see also National Telecommunications and Information Administration (NTIA), *Lack of Trust in Internet Privacy and Security May Deter Economic and Other Online Activities* (May 13, 2016), <https://www.ntia.doc.gov/blog/2016/lack-trust-internet-privacy-and-security-may-deter-economic-and-other-online-activities> (noting that in an NTIA survey of 41,000 households with at least one Internet user, 45 percent of respondents reported that privacy and security concerns “stopped them from conducting financial transactions, buying goods or services, or posting on social networks, or expressing opinions on controversial or political issues via the Internet.”).

<sup>114</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 751-52, para. 126.

<sup>115</sup> *2015 Broadband Progress Report*, 30 FCC Rcd at 1438-39, para. 105-106.

whether and, if so, how privacy and security concerns should be factored into our inquiry into the availability of advanced telecommunications capability and our determination as to whether it is being deployed to all Americans in a reasonable and timely fashion. Since our last *Broadband Progress Report*, have issues related to consumer security and privacy concerns affected the reasonable and timely deployment and adoption of advanced telecommunications capability? More generally, to what extent have providers responded to these concerns in the last year? What, if any, security risk management practices have providers employed to address these concerns? Has there been an increase in the perceived security threats over the last year that affects the reasonable and timely deployment and adoption of advanced telecommunications capability?<sup>116</sup>

56. We note that as part of the Commission's efforts to modernize its rules in of light technological transitions, the Commission recently took steps to revise and enhance our rules regarding disruptions to communication networks and the Commission's web-based Network Outage Reporting System (NORS), through which communications providers can submit reports to the Commission detailing network outages.<sup>117</sup> In the *Further Notice* in the NORS proceeding, the Commission proposed that BIAS providers and dedicated service providers be subject to the Commission's outage reporting rules.<sup>118</sup> The Commission also sought comment on issues specific to broadband outage reporting, including the appropriate measurement of performance characteristics.<sup>119</sup> We seek comment on the potential value of such broadband outage reporting to our annual inquiry under section 706(b), and on whether and how such outage reporting should be considered as part of this inquiry. For instance, would broadband outage reporting help the Commission to fulfill its statutorily-mandated goal of accelerating the deployment of advanced telecommunications capability by helping us to better identify areas where infrastructure investment and effective competition may be lacking? Would broadband outage reporting provide information regarding broadband infrastructure and service vulnerabilities, risks, and disruptions that may dampen consumer adoption and thus dis-incentivize broadband investment and deployment within certain areas? Those commenters supporting the use of outage reports in our annual inquiry under section 706(b) should address how such reports could be used while complying with the requirement under our rules that outage reports submitted to the Commission be presumed to be confidential.<sup>120</sup>

#### IV. DATA SOURCES AND ANALYSIS

57. In determining whether advanced telecommunications capability is being made available to all Americans on a reasonable and timely basis, the Commission first considers the physical presence of broadband networks meeting our speed benchmarks.<sup>121</sup> In addition, the Commission historically also

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<sup>116</sup> We recognize that some of these issues have been touched on by commenters on the Notice of Proposed Rulemaking in our pending proceeding on Protecting the Privacy of Customers of Broadband and other Telecommunications Services proceeding. See *Protecting the Privacy of Customers of Broadband and other Telecommunications Services*, WC Docket No. 16-106, Notice of Proposed Rulemaking, 31 FCC Rcd 2500 (2016).

<sup>117</sup> See *Amendments to Part 4 of the Commission's Rules Concerning Disruptions to Communications; New Part 4 of the Commission's Rules Concerning Disruptions to Communications; The Proposed Extension of Part 4 of the Commission's Rules Regarding Outage Reporting to Interconnected Voice Over Internet Protocol Service Providers and Broadband Internet Service Providers*, PS Docket Nos. 15-80, 11-82, ET Docket No. 04-35, Report and Order, Further Notice of Proposed Rulemaking, and Order on Reconsideration, FCC 16-63, 2-3, paras. 1-3 (PSHSB May 26, 2016) (*2016 NORS Report & Order and Further Notice*). These rules currently require reports for "hard down" and "significant degradation" events. 47 C.F.R. § 4.5.

<sup>118</sup> See *2016 NORS Report & Order and Further Notice* at 49-50, paras. 111-113.

<sup>119</sup> *2016 NORS Report & Order and Further Notice* at 57-59, paras. 133-144.

<sup>120</sup> See 47 C.F.R. § 4.2.

<sup>121</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 731-34, paras. 79-81 (reporting deployment results for the U.S., including breakdowns of deployment in rural and urban areas, U.S. Territories, and within Tribal lands); *id.* at (continued....)

has considered other factors, including consumer adoption of fixed broadband services, service performance, and price data.<sup>122</sup> In this section, we seek comment on the data sources underlying our analysis, how best to assess the availability of broadband using these data sources, whether other data sources are available, and what additional studies and/or reports should be included in our analysis.

#### A. Deployment Data for Fixed Services

58. *Background.* In the *2016 Broadband Progress Report*, our deployment analysis of advanced telecommunications services was based, for the first time, upon our revised Form 477 deployment data for fixed broadband services, including both terrestrial and satellite services.<sup>123</sup> This analysis begins with the determination of whether there is at least one provider of residential fixed services<sup>124</sup> in each census block with the capability to provide services meeting our 25 Mbps/3 Mbps speed benchmark. For purposes of the Broadband Progress Reports, our calculation of the number of Americans (and households) without access to fixed advanced telecommunications capability adds together the population of the census blocks without a single provider of these services. Similarly, the calculation for the number of Americans (and households) with access to fixed advanced telecommunications capability adds together the population of the census blocks with at least one provider of these services.<sup>125</sup>

59. *Discussion.* In the *2016 Broadband Progress Report* we found that the new FCC Form 477 deployment data were the most reliable data to determine whether Americans had access to fixed broadband services meeting our 25 Mbps/3 Mbps speed threshold.<sup>126</sup> While we see no need to reconsider these findings, we seek comment on the use of FCC Form 477 deployment data for fixed services and whether there are additional or alternative sources of deployment data for residential fixed services that we should consider. The *2016 Broadband Progress Report* presented an analysis of Americans without access to fixed advanced telecommunications capability for the United States as a whole, each state and county, the U.S. Territories, Tribal lands, urban areas and rural areas.<sup>127</sup> Based upon our FCC Form 477 Data, as of June 30, 2015, and our population estimates for 2015,<sup>128</sup> approximately 35 million (11 percent)

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734-35, paras. 82-84 (reporting deployment figures for mobile broadband services, as well as the number of Americans without access to fixed and mobile broadband services).

<sup>122</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 745, para. 103 (“For purposes of evaluating availability of advanced telecommunications capability, we examine not only physical deployment and adoption, as presented above, but also quality and price.”).

<sup>123</sup> See *2016 Broadband Progress Report*, 31 FCC at 729, para. 73.

<sup>124</sup> These estimates are based upon deployment data for providers of consumer services using: Asymmetric xDSL, ADSL2, VDSL, Symmetric xDSL, Other Copper Wireline, Cable Modem, Cable Modem - DOCSIS 1, 1.1, and 3.0, Optical Carrier/Fiber to the End User, Satellite, Terrestrial Fixed Wireless, Electric Power Line, and a catchall category, “All Other.” Our estimates of the population (and households) with and without access to 25 Mbps/3 Mbps broadband services is dependent upon the source of the population data.

<sup>125</sup> In past Broadband Progress Reports, we have followed the same procedure for mobile wireless services. See e.g., *2016 Broadband Progress Report*, 31 FCC Rcd at 735, para. 84; *2015 Broadband Progress Report*, 30 FCC Rcd at 1414, para. 73. This year we seek comment on methods to evaluate mobile broadband coverage. See *infra* paras. 61-62.

<sup>126</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 729-30, paras. 73-75 (discussing the benefits of the new FCC Form 477 deployment data, and finding that the new FCC Form 477 data is the most accurate data for determining whether Americans have access to fixed advanced telecommunications capability).

<sup>127</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 731-34, paras. 77-81, Appendices D, E, and G.

<sup>128</sup> These estimates are based upon applying the Commission’s estimates of population count data for 2015 to the Form 477 deployment data. These data are based upon 2010 U.S. Census Data that the Commission has updated to account for population growth and economic development.

of all Americans, approximately 25 million (41 percent) Americans residing in rural areas, and approximately 10 million (4 percent) Americans residing in urban areas did not have access to fixed services meeting the 25 Mbps/3 Mbps speed benchmark.<sup>129</sup> We seek comment on the availability of additional analyses and data sources to inform our fixed services deployment analysis.

60. We also seek comment on how to evaluate satellite deployment data given that satellite providers, while having a collective nationwide footprint in theory, cannot provide services to all consumers simultaneously as a practical matter due to satellite space station capacity constraints. How are providers offering satellite services at or above the 25/3 Mbps speed benchmark providing coverage to the continental United States? What is the most appropriate way to calculate satellite coverage taking into account capacity of nationwide satellites? To what extent would it be feasible to determine the near-term total and available satellite capacity on a more granular geographic level? Are there other data sources we can use to supplement our 477 satellite deployment and subscription data to ensure the reasonableness of our analysis in this broadband progress report?

## **B. Deployment Data for Mobile Broadband Services**

61. *Background.* The Commission found in the *2016 Broadband Progress Report* that Americans need access to both fixed and mobile broadband services, although there was insufficient information at that time to establish a speed benchmark for mobile broadband services.<sup>130</sup> However, similar to fixed broadband services, the Commission did provide estimates of the number of Americans without access to mobile broadband services,<sup>131</sup> based on the same methodology applied for fixed broadband services on the Form 477 mobile deployment data.<sup>132</sup>

62. *Discussion.* While we based our analysis of the availability and deployment of mobile broadband services in the *2016 Report* on the FCC Form 477 mobile deployment data, we seek comment on alternative data sources and methods for this year's Broadband Progress Report. We seek comment on the Commission's use of the Form 477 data for measuring mobile broadband deployment. Are there alternative data sources that we could use in our analysis? We seek comment on the methodology that the Commission should use to determine coverage. Is the centroid methodology an appropriate way to measure mobile broadband coverage or are there alternative methods that would be more appropriate?<sup>133</sup>

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<sup>129</sup> The designation of a census block as rural or urban is based upon the 2010 U.S. Census. See *2016 Broadband Progress Report*, 31 FCC Rcd at 762-63, Appx. C, paras. 11, 14. These estimates include the U.S. Territories. Because some of the ILECs in the U.S. Territories have not yet submitted the relevant FCC Form 477 data, these estimates may understate deployment in the U.S.

<sup>130</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 716-19, paras. 40-44 (finding that consumers require access to both mobile and fixed broadband services); *id.* at 724, para. 58 (finding that the record at that time was not sufficient to set a mobile speed benchmark).

<sup>131</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 734-35, paras. 82-83, Table 4.

<sup>132</sup> The Form 477 data replaced the State Broadband Initiative (SBI) data that the Commission had relied on in previous reports, and which were submitted by service providers to the Commission. Unlike the SBI data, which collected data based on the maximum advertised speed, the Form 477 mobile broadband data are based on the minimum advertised speed. See *2016 Broadband Progress Report*, 31 FCC Rcd at 734, para. 82.

<sup>133</sup> The centroid method overlays the geographic polygons showing wireless coverage onto a map of census blocks. The centroid method codes a census block as covered if the calculated center point (the "centroid") of the census block is within the coverage polygon. If a centroid is covered, then all of the population and land area in the corresponding census block is also coded as covered. If the calculated center point lies outside of the boundaries of a census block, then the centroid will be identified as the point inside the census block nearest to the calculated center point. *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 15-125, Eighteenth Report, 30 FCC Rcd 14515, 14537-38, para. 34 & n.69 (WTB 2015).

### C. Deployment Data for Elementary and Secondary Schools and Classrooms

63. *Background.* To evaluate developments in the deployment of advanced telecommunications capability to America's elementary and secondary public schools in the *2016 Broadband Progress Report*,<sup>134</sup> we relied upon the FCC Form 471 data for E-rate funding year 2015,<sup>135</sup> EducationSuperHighway's Connecting America's Students: Opportunities for Action report,<sup>136</sup> and the CoSN 2014 Annual E-Rate and Infrastructure Survey.<sup>137</sup> Based upon the above sources, the *2016 Broadband Progress Report* found that 41 percent of schools, representing 47 percent of students, had not met our short-term goal, and that only 9 percent of schools had met our long-term goal of 1 Gbps per 1,000 students.<sup>138</sup>

64. *Discussion.* We seek comment on our continued use of FCC Form 471 and the analyses we relied upon in the *2016 Broadband Progress Report*, and seek comment regarding any additional data sources that we should consider to evaluate deployment of services in elementary and secondary schools. We also invite interested parties to submit their analyses of FCC Form 471 data to help inform our deployment analysis.

### D. Broadband Performance Data

#### 1. Fixed Broadband Performance

65. In this section, we briefly describe the Commission's fixed Measuring Broadband America (MBA) survey. We then seek comment on our use of this annual report to assess whether Americans have access to fixed advanced telecommunications services.

66. *Background.* Since the *2012 Broadband Progress Report*, the Commission has cited its fixed MBA Reports to show that consumers in the United States generally receive high-quality services.<sup>139</sup> The Commission's fixed MBA survey is based upon a hardware approach whereby a

<sup>134</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 740-41, paras. 92-94.

<sup>135</sup> FCC Form 471 includes information about the applicant's connectivity, including the speed of service sought, the price of the services for which the applicant is seeking E-rate funding, and identifies whether schools are located in rural or urban areas. Schools located in areas that are not urban areas, as defined by the most recent decennial Census, are considered rural for the purposes of the E-rate program. See *E-rate Modernization Order*, 29 FCC Rcd at 8957, paras. 222-24.

<sup>136</sup> See EducationSuperHighway, Connecting America's Students: Opportunities for Action at 12 (April 2014), <http://www.educationsuperhighway.org/wp-content/uploads/2014/11/Connecting-Americas-Students-K12-E-rate-Spending-Report-April-2014.pdf>. EducationSuperHighway (ESH) tracks public schools' progress toward the Commission's goals for K-12 connectivity using the Commission's FCC Form 471 data and its outreach efforts to FCC E-Rate applicants for clarifications on their Form 471 applications. ESH reports on the number of schools and school districts with broadband access of 100 kbps or more of service per student, which approximates our short term goal of 100 Mbps per user. See *id.* at 3-8.

<sup>137</sup> See Consortium for School Networking (CoSN), CoSN's 2<sup>nd</sup> Annual E-rate and Infrastructure Survey in Partnership with AASA (the School Superintendents Association) and MDR at 5 (2014), [http://cosn.org/sites/default/files/pdf/CoSN%202nd%20Annual%20E-rate%20and%20Infrastructure%20Report,%202010-15-2014\\_2.pdf](http://cosn.org/sites/default/files/pdf/CoSN%202nd%20Annual%20E-rate%20and%20Infrastructure%20Report,%202010-15-2014_2.pdf) (CoSN Survey). CoSN's report summarizes the results of its survey of public school district leaders regarding the current state of broadband and technology infrastructure in U.S. school systems. See *id.* at 3.

<sup>138</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 740-41, paras. 92-94.

<sup>139</sup> See, e.g., *2012 Broadband Progress Report*, 27 FCC Rcd at 10396-99, paras. 123-30. Both the *2015 Broadband Progress Report* and the *2016 Broadband Progress Report* found that consumers of broadband services using cable, fiber, or satellite technologies receive services that are close to or exceed advertised speeds, while consumers receiving broadband services from certain DSL-based ISPs experience actual speeds that are on average below the advertised "up-to" speed. See *2016 Broadband Progress Report*, 31 FCC Rcd at 746, paras. 104-105; *2015 Broadband Progress Report*, 30 FCC Rcd at 1436-38, para. 103.

“whitebox” is placed inside the consumer’s home, the device is physically connected to the consumer’s Internet connection, and the device periodically runs tests to remote targets on the Internet.<sup>140</sup> The goals of the fixed MBA survey are to measure ISP performance in order to provide statistics at the national level<sup>141</sup> and to generate a representative sample of residential consumers to support statistically valid inferences<sup>142</sup> about the major ISPs,<sup>143</sup> the service technology type, these providers’ most popular speed tiers,<sup>144</sup> and Census region.<sup>145</sup> The fixed MBA survey sampling methodology has been reviewed and agreed to by statistical experts from the Commission and the participating ISPs.<sup>146</sup>

67. We note that the fixed MBA survey is designed to provide statistics at a national level<sup>147</sup> and for the most popular service tiers among the participating ISP’s offerings.<sup>148</sup> Thus, the fixed MBA survey sampling methodology is not designed to assess the quality of broadband services provided at a local level, nor was it designed to measure all providers of broadband services.<sup>149</sup> Approximately 34.6 million Americans with access (12 percent) to 25 Mbps/3 Mbps services receive service in areas without a

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<sup>140</sup> See 2015 Measuring Broadband America Fixed Broadband Report, Technical Appx. at 6. The benefit of the hardware approach is that the device continually collects data regardless of whether or not the whitebox is switched on. *Id.* The primary disadvantages of a hardware approach are that this approach is more expensive than a software approach and requires the installation of the hardware by the consumer or a third party. In contrast, a software approach allows a very large sample to be reached relatively easily. However, software approaches implemented on a consumer’s computer, smart phone, or other Internet access device have the following disadvantages: (1) the software may affect broadband performance; (2) the software typically does not account for multiple devices on the same network; (3) the software may be affected by the quality and build of a consumer’s device; (4) potential bottlenecks (such as wireless equipment, misconfigured networks, and older devices) are generally not accounted for and result in unreliable data; (5) the consumer may move their device to a different location which can affect performance; (6) the tests may only run when the device is on, limiting the ability to provide a 24-hour profile; and (7) for manually-performed software tests, the consumer may introduce a bias by choose when to run the tests (e.g., consumers may only run tests when encountering service problems). *Id.*

<sup>141</sup> See 2015 Measuring Broadband America Fixed Broadband Report at 66.

<sup>142</sup> See 2015 Measuring Broadband America Fixed Broadband Report, Technical Appx. at 5-6.

<sup>143</sup> The ratio of measured consumers to participating ISPs was developed based upon their market share, as of June 2010 FCC Form 477 Subscriber Data. See *id.* at 7. Data is collected from customers of AT&T, Cablevision Systems Corporation, CenturyLink, Charter Communications, Comcast, Cox Communications, Frontier Communications Company, Hughes Network Systems, Mediacom Communications Corporation, Time Warner Cable, Verizon, ViaSat, and Windstream Communications. See *id.* at Tbl. 1. Collectively, these carriers’ customers account for 80 percent of total ISP customers.

<sup>144</sup> The original speed tiers chosen were based upon the original FCC Form 477 categories. See *id.* at 7 n.6. The survey collects information on the most popular speed tiers offered by each participating provider. See *id.* at 8.

<sup>145</sup> See *id.* at 11. The technologies include DSL, cable, fiber-to-the-home, fixed terrestrial wireless, and satellite services. See *id.* at 6. The four Census Regions are the Northeast, Midwest, South, and West. The focus of the study is to measure performance, based upon real-world usage, within the ISP’s network from the consumer’s Internet access point to the closest major Internet gateway point. See *id.* at 5.

<sup>146</sup> See *id.* at 7.

<sup>147</sup> See 2015 Measuring Broadband America Fixed Broadband Report at 66 (also noting that, “[w]hile the sampling plan was not designed to provide first order inferences by region or state geography, in some cases the subscriber counts and data do support some aggregated statistics by technology and regions, and statistics by state”).

<sup>148</sup> See *id.* at 6 (“Generally, only the most popular service tiers among an ISP’s offerings were tested, even though some service providers may offer other tiers not represented by volunteers contributing data to the program. We note that a particular ISP may offer faster speed tiers either throughout their territory or in specific portions of their territory that are not as popular as the speed tiers we tested.”).

<sup>149</sup> See *supra* note 143 (explaining that the report is based upon data from the subscribers of 13 ISPs).

survey-participating provider.<sup>150</sup> The 2015 Measuring Broadband America Fixed Broadband Report was able to report some granular statistics for 37 states for which there was sufficient data,<sup>151</sup> and some granular statistics for the four Census Regions.<sup>152</sup> In addition, while the goal of the fixed MBA survey sample is to cover the major ISPs providing DSL, cable, fiber-to-the-home, fixed terrestrial wireless and satellite services, the 2015 Measuring Broadband America Fixed Broadband Report did not include results for some satellite providers or for fixed terrestrial wireless technologies due to a low count of panelists subscribing to these technologies.<sup>153</sup>

68. *Discussion.* As noted above, the Commission has relied on the fixed MBA surveys to draw general conclusions about the quality of services provided to Americans. By using the 2015 Measuring Broadband America Fixed Broadband Report, the Commission concluded in the *2016 Broadband Progress Report* that: (1) consumers of broadband services using cable, fiber, or satellite technologies receive services that are close to or exceed advertised speeds; (2) consumers receiving broadband services from certain DSL-based ISPs experience actual speeds that are on average below the advertised “up-to” speed; and (3) average latency results for all terrestrial technologies ranged from 14 ms to 52 ms and that average latency for satellite-based broadband services range from 603 ms to 659 ms.<sup>154</sup> We seek comment on how to use the fixed MBA survey data going forward. In addition, because the Commission considers whether deployment differs between urban and rural areas, we seek comment on whether, to the extent possible,<sup>155</sup> we should examine the fixed MBA survey data to determine whether performance in urban areas is statistically different from performance in rural areas. If the Commission sets a latency benchmark for fixed services, as discussed above, we seek comment on how can we evaluate performance of fixed wireless technologies given the lack of fixed wireless data in the 2015 Measuring Broadband America Fixed Broadband Report. Is there an alternative source of information that we could use to evaluate the performance of fixed wireless services?

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<sup>150</sup> These calculations are based upon a comparison of FCC Form 477 June 30, 2015 deployment data and the 13 participating providers listed in the 2015 Measuring Broadband America Fixed Broadband Report. *See supra* note 143 (listing the 13 participating providers). Approximately 11.1 million of the 34.6 million Americans reside in rural areas, and account for 30 percent of the rural Americans with access to 25 Mbps/3 Mbps services. Approximately 23.5 million of the 34.6 million Americans reside in urban areas, and account for 9 percent of urban Americans with access to 25 Mbps/3 Mbps service. *See* FCC, Broadband Deployment Data from FCC Form 477 (2015), <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; *supra* note 143 (listing the 13 participating providers who provide FCC Form 477 data).

<sup>151</sup> In general, the program’s methodology was not designed to provide an analysis at the state level; however, the 2015 Measuring Broadband America Fixed Broadband Report provides statistics for the states with statistically significant data. *See* 2015 Measuring Broadband America Fixed Broadband Report at 23 n.22, 66-68, Tbl. 5 (listing states with sufficient data), Tbl. 6 (listing the states with insufficient data).

<sup>152</sup> *See id.* at 42. Chart 19 reports advertised download speed and actual download speed by region and by technology. *Id.* at 42 n.28 (“This chart represents an unweighted average of advertised and actual speeds across all panelists in each region. As such, it should not be used to compare the performance of broadband providers. Results for technologies in some regions are excluded when there were not enough panelists to ensure statistically valid metrics.”).

<sup>153</sup> *See* 2015 Measuring Broadband America Fixed Broadband Report, Technical Appx. at 6. The results for these subscribers’ data excluded from the report are released to the public in the Raw Bulk Data Set. *Id.*

<sup>154</sup> *See* 2016 Broadband Progress Report, 31 FCC Rcd at 746-47, paras. 105, 108.

<sup>155</sup> The fixed MBA data permits one to identify the census block group where the panelist resides. Depending upon the percentage of census block group’s population located in a rural census block, the census block group could be designated as rural according to a pre-determined cut-off rule. For example, if at least 25 percent, 50 percent, or 60 percent of the population of the census block group is located in a rural area, then the census block group could be designated as rural.

## 2. Mobile Broadband Performance

69. *Background.* Mobile broadband service performance can be affected by a number of factors, and it therefore is important for the Commission to analyze various data sources in order to understand the level of mobile broadband service performance that Americans are receiving. In the *2016 Broadband Progress Report*, the Commission did not have sufficient evidence to set a particular mobile speed benchmark,<sup>156</sup> or a sufficiently robust empirical dataset to set latency and consistency benchmarks.<sup>157</sup>

70. *Discussion.* We seek comment on the data sources that can potentially be used to assess mobile broadband performance, such as the Ookla Speedtest mobile app or mobile broadband performance as measured by the Commission's mobile MBA data.<sup>158</sup> These potential data sources may vary widely with respect to geographic reach, sample size, and sampling methodology: For example, the CalSPEED drive-test data are collected by the California Public Utility Commission and only reflects speeds within the state of California,<sup>159</sup> and DataCardinal is an app which only captures speeds across the Commonwealth of Virginia. What are the advantages and disadvantages of each data source that could be used? We seek comment about other data sources that may be available for the Commission to better understand mobile broadband performance at a geographically granular level.

## 3. Other Sources of Performance Data

71. *Background.* In addition to the MBA data to which we have historically had access, the Commission's Open Internet enhanced transparency rules require broadband Internet access service providers to disclose certain information including information on service speed and reliability.<sup>160</sup> The Commission recently announced new "broadband labels" that will serve as a "safe harbor" to meet these

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<sup>156</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 723-24, para. 58 ("The record does not provide adequate use cases, engineering models, or empirical evidence for mobile that could be used to support a particular benchmark.").

<sup>157</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 727-28, paras. 66, 70.

<sup>158</sup> The Commission released a speed test app for Android phones in November of 2013 and a speed test app for iPhones in early 2014. The Commission's speed apps use smartphone-based technology to collect anonymized broadband performance data from volunteers participating in a crowdsourcing initiative. The app for Android phones can be set up to run manually or to run periodically in the background. In contrast, the app for iPhones can only execute the speed test manually because iPhone devices do not have automated testing capability. The total amount of data used by the application is configured by default not to exceed 100 MB per month. The tests are engineered not to interfere with a user's broadband Internet use and the application can be configured to not perform any automated background testing. However, manual testing can lead to biased results when performed only at specific times or places, and may provide a less accurate picture of overall broadband performance. Automatic background tests contribute more valuable, high-quality data that help inform our reports and provide the most accurate data about mobile broadband performance. FCC, *Measuring Broadband America Mobile Broadband Services* (Sept. 29, 2014), <https://www.fcc.gov/measuring-broadband-america/mobile>.

<sup>159</sup> As part of a grant from NTIA, the California Public Service Commission created and implemented CalSPEED, a program to measure mobile broadband speeds and service quality using an Android mobile crowdsourcing application. The program also performs semi-annual field testing of mobile broadband service quality throughout California. The California PUC argues that the CalSPEED is more accurate representation of quality of service, in part, because it does not filter out any of its results, i.e., if the webpage fails to load, the result is a valid representation of the user's experience. Comments of the California Public Utilities Commission, GN Docket No. 14-126, at 5-6 (filed Sept. 4, 2014). One component of the CalSPEED program is that, at each location, tests were done using the latest Android phone and USB network device on a Windows based netbook for each of the four major carriers. *See id.* at 3, 6-7, 25-26, 30-31.

<sup>160</sup> *Protecting and Promoting the Open Internet*, GN Docket No. 14-28, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5601, 5673-75, para. 165-166 (2015), *aff'd sub nom* USTA v. FCC, No. 15-1063 (D.C. Cir. June 14, 2016) (*2015 Open Internet Order*).

requirements,<sup>161</sup> and “[p]articipation in the [MBA] program continues to be a safe harbor for fixed broadband providers in meeting the requirement to disclose actual network performance.”<sup>162</sup> The Public Notice recently released by the Commission’s Chief Technologist, Office of General Counsel, and Enforcement Bureau provides guidance on compliance with the enhanced disclosure requirements of the Open Internet Order’s transparency rule, and offers guidance regarding acceptable methodologies for disclosure of, among other information, the typical latency experienced by consumers using their service.<sup>163</sup>

72. *Discussion.* We seek comment on whether we should consider transparency rule disclosures and/or broadband labels in conjunction with the MBA survey data and the other performance data discussed above as a means to evaluate the performance of providers for which there is insufficient (or no) data. We also seek comment on new and alternative sources of publicly or commercially available broadband performance data, including passively generated network data.<sup>164</sup> Could the Commission rely on performance data in the MBA program alone, or in combination with other publicly available information, to approximate the typical speeds and levels of latency and service consistency experienced by consumers of various broadband services based on the technology of the underlying network? For example, could the Commission use speed and reliability data from a cable broadband provider with a system participating in the MBA survey to approximate the performance of a smaller cable broadband provider’s system or systems for which the MBA program does not collect data? Why or why not? How significantly do factors such as speed and reliability vary among providers using the same underlying technology to provide service?

#### **E. Pricing and Usage Data**

73. In the *2016 Broadband Progress Report*, we reported that we could not provide a rigorous analysis of prices because “we lack reliable data as to the actual prices consumers pay for these services and information” and the extent to which usage allowances affect consumers’ data usage or willingness to subscribe to such plans.<sup>165</sup> Nonetheless, data are available to evaluate some consumer pricing. For instance, in the Commission’s Urban Rate survey the Wireline Competition Bureau collects from providers prices for standalone fixed terrestrial broadband service offered in urban areas; the survey

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<sup>161</sup> See Press Release, FCC, FCC Unveils Consumer Broadband Labels to Provide Greater Transparency to Consumers, (April 4, 2016), <https://www.fcc.gov/document/fcc-unveils-consumer-broadband-labels>; <https://www.fcc.gov/consumers/guides/consumer-labels-broadband-services> (showing sample consumer broadband labels).

<sup>162</sup> *2015 Open Internet Order*, 30 FCC Rcd at 5674, para 166 n.411.

<sup>163</sup> See *Guidance on Open Internet Transparency Rule Requirements*, GN Docket No. 14-28, Public Notice, DA 16-569 (OGC May 19, 2016). The Public Notice also explained that mobile BIAS providers may disclose their results from the mobile MBA program as a sufficient disclosure of actual download and upload speeds, actual latency, and actual packet loss of a service. That option is available if the results satisfy sample size criteria and if the MBA program has provided CMA-specific network performance metrics of the service in CMAs with an aggregate population of at least one half of the aggregate population of the CMAs in which the service is offered. *Id.* at 6. The Commission has advised consumers to file complaints with the Commission if consumers believe the content of a provider’s broadband label is misleading or inaccurate. *2015 Open Internet Order*, 30 FCC Rcd at 5674, para 166 n.411. We note that consumers have the ability to monitor their provider’s speed and latency performance by using Ookla’s speedtest.net and pingtest.net. Ookla, *Speed Test*, <https://www.ookla.com> (last visited Aug. 2, 2016). Speedtest.net tests the speed of the connection. Pingtest.net measures packet loss (the percentage of packets sent to a server that never arrive), Ping (the time it takes for a packet to travel from your computer to a server and back) and jitter (the variance in ping measurements where zero means all were the same).

<sup>164</sup> We note that in seeking comment on passively generated network data we are looking toward commercially or publicly available sources and are not seeking comment on broadband providers or edge providers submitting their own data for our use in our analysis.

<sup>165</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 746, para. 103.

enables the Bureau to determine the local voice rate floor and reasonable comparability benchmarks for fixed voice and broadband rates for universal service purposes.<sup>166</sup> Based upon data collected by Google,<sup>167</sup> the *Fifth International Broadband Data Report* reported that the average monthly all-inclusive price of standalone fixed broadband services with advertised download speeds greater than 15 Mbps and less than or equal to 25 Mbps was \$59.51 and that average monthly all-inclusive price of standalone fixed broadband services with an advertised download speed greater than 25 Mbps and less than or equal to 50 Mbps was \$62.17.<sup>168</sup> The average monthly standalone price for fixed broadband plans with usage limits and a download speed of at least 25 Mbps was \$81.53.<sup>169</sup>

74. In the case of mobile broadband, the Commission reported in the *2016 Broadband Progress Report* that for a standard single line plan with an equipment installment payment plan, “the price per GB of data (as defined by the flat fee divided by the data allowance), for AT&T, Sprint and T-Mobile was \$13, and \$20 for Verizon.”<sup>170</sup> For a comparable 4-line plan, the effective price per GB was \$10 for AT&T and Verizon and \$8 for Sprint and T-Mobile.<sup>171</sup>

75. *Discussion.* We seek comment on the usefulness of these price and usage-allowance surveys for purposes of our analysis of the availability of advanced telecommunications capability. We note that these sources for pricing data may not reflect actual prices paid by consumers, including the impact of promotions and bundle discounts. In addition, prices offered at any given time may not reflect the average price paid by consumers because consumers are likely to pay different prices depending upon when they began their service. For instance, consumers may subscribe to legacy plans with prices that may be higher or lower than currently offered plans. Further we recognize that the price will be affected by the number of lines included in any given plan. Finally, we recognize that these surveys do not necessarily reflect the plans most commonly chosen by consumers.

76. We seek comment on whether there are other data sources or approaches to capturing information on the prices consumers actually pay in the United States, including the applicability of usage allowances. As discussed above, service pricing and affordability may affect the adoption of broadband services.<sup>172</sup> As in the past, we are seeking comment on broadband pricing and data allowances only as related to our Broadband Progress Report analysis.<sup>173</sup>

## F. Adoption Data

77. *Background.* In the *2016 Broadband Progress Report*, we concluded that our determination of whether advanced telecommunications capability is “being deployed to all Americans in a reasonable and timely fashion” must include an assessment of factors indicative of broadband availability, including adoption of services by consumers.<sup>174</sup> There we reported an estimate for adoption

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<sup>166</sup> *Wireline Competition Bureau Announces Results of 2016 Urban Rate Survey For Fixed Voice and Broadband Services and Posting of Survey Data and Explanatory Notes*, WC Docket No. 10-90, Public Notice, 31 FCC Rcd 3393 (Wireline Comp. Bur. 2016).

<sup>167</sup> *International Comparison Requirements Pursuant to the Broadband Data Improvement Act, International Broadband Data Report*, GN Docket No. 15-191, Fifth Report, 31 FCC Rcd 2667, 2676-80, paras. 32-42 (2016) (*Fifth International Broadband Data Report*).

<sup>168</sup> *Id.* at 2691-92, Tbls. 2c, 2d.

<sup>169</sup> *Id.* at 2694, 2698, Tbls. 4a, 4f.

<sup>170</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 713, para. 34.

<sup>171</sup> *See id.*

<sup>172</sup> *See supra* para. 53.

<sup>173</sup> *See infra* Section V (discussing the usefulness of price data reported in the International Broadband Data Reports).

<sup>174</sup> *Id.* at 743, paras. 98-99.

rates based upon our FCC Form 477 data for the United States, non-urban areas, urban areas, as well as individual states and Tribal lands.<sup>175</sup> The adoption rate reported represents the number of residential connections to fixed broadband at or above the specified level of speed divided by the total number of households in the area with access to fixed broadband services advertised at or above the specified level of speed.<sup>176</sup> We have not historically reported adoption rates for mobile services based upon the FCC Form 477 because these subscription data are only available at the state-level and we have insufficient information to account for non-residential subscribers or for households and/or individuals that may or may not have multiple handsets.<sup>177</sup> Based upon the June 30, 2015 FCC Form 477 data and our 2015 Household data, we find the overall adoption rate for 25 Mbps/3 Mbps is 42 percent.<sup>178</sup>

78. Other publically available data include the CPS supplement for Computer and Internet Usage, the American Community Survey (ACS) and that from the Pew Research Center.<sup>179</sup> While these data sources do not have a speed component, they are a source of information for adoption of mobile Internet access and household and/or individual adoption of both fixed and mobile Internet access. As shown in Table 1 below, a comparison of our results from FCC Form 477 data with this publically available data show there is a range in adoption estimates depending on the data source and that these surveys and FCC Form 477 data diverge in terms of their estimates for total fixed-broadband adoption.

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<sup>175</sup> *Id.* at 744, para. 100, 772, Appx. H.

<sup>176</sup> *Id.* at 743, para. 98.

<sup>177</sup> *See e.g.*, FCC Form 477 Instructions at 47.

<sup>178</sup> Put another way, the 42 percent of all households that subscribe to a fixed broadband service of at least 25 Mbps/3 Mbps account for just over 50 percent of all households that subscribe to a service that is at least 200 kbps/200 kbps (the slowest speed service collected in FCC Form 477). This estimate includes the U.S. Territories, but may overstate or understate adoption because not all of the ILECs in the U.S. Territories have submitted FCC Form 477 data.

<sup>179</sup> Every two years, NTIA sponsors a data collection on American's Internet use and the devices they use to go online. This data collection is done as a supplement to the Census Bureau's annual Current Population Survey (CPS). NTIA analyzes the data and reports the findings. *See* NTIA, *Data Central*, <https://www.ntia.doc.gov/category/data-central> (last visited Aug. 2, 2016). Each year, as part of the American Community Survey (ACS), the Census Bureau collects data about household subscription to Internet services in the U.S. and Puerto Rico. *See* U.S. Census Bureau, *American Community Survey (ACS): Internet Data Collection*, <http://www.census.gov/programs-surveys/acs/library/publications-and-working-papers/internet-data-collection.All.html> (last visited Aug. 2, 2016). The Pew Research Center periodically releases survey results for Americans in the U.S. (excluding all U.S. Territories). *See generally, e.g.*, Pew Home Broadband 2015; Pew Research Center, *Three Technology Revolutions*, <http://www.pewinternet.org/three-technology-revolutions> (last visited Aug. 2, 2016).

Table 1 – Estimates of Adoption Rates for Households and Adults

	FCC Form 477 Data (June 2015) Households <sup>180</sup>	NTIA CPS Annual Supplement (2015) Households <sup>181</sup>	American Community Survey (2014) Households <sup>182</sup>	Pew Research Center (2015) Adults <sup>183</sup>
Internet Service (Any Type)	N/A	74%	80%	80%
Fixed Internet	75%	59%	69%	67%
Both Fixed & Mobile Internet	N/A	30%	30%	N/A
Only Mobile Internet	N/A	15%	10%	13%

79. Furthermore, a straightforward comparison of adoption rates in rural and urban areas can only be done with the American Community Survey. Our FCC Form 477 subscriber data is submitted at the census tract level, and census tracts are often comprised of urban and rural areas. Thus, the best rural/urban adoption rates estimate from FCC Form 477 data derives from a comparison of adoption rates for urban core areas to adoption rates in non-urban core areas.<sup>184</sup> The best rural/urban adoption rate estimate from NTIA's CPS Computer and Internet supplement data could be derived from an analysis of metropolitan areas compared to non-metropolitan areas.

80. *Discussion.* We seek comment on these data sources and what factors we should take into consideration in determining which data source(s) we should rely upon for the Commission's determination concerning the availability of both fixed and mobile Internet services and the Commission's consideration of disparities between rural and urban areas. We note that these data sources are released with different frequency: the FCC Form 477 data is released approximately every 6 months; the one year ACS estimates are typically released every September, the CPS Computer and Internet Survey data are released every 2 years; and the results of the Pew Surveys are released periodically, but

<sup>180</sup> In order to be comparable to other estimates for adoption of broadband services, the figures are for the states and District of Columbia. The FCC Form 477 adoption rate is residential subscribers for broadband services with a speed of at least 200 kbps/200 kbps divided by the number of *all* households in the states and District of Columbia.

<sup>181</sup> All percentages are rounded to the nearest percentage. Because the statistics available on the NTIA website are, generally, in terms of the population aged 3 and older, FCC staff analyzed the underlying data in order to report percentages in term of households. The reported percentages are based upon household respondents answering the type of Internet services used at home and includes group quarters, e.g., households with unrelated people or households with a combination of related and unrelated people. NTIA reports statistics for mobile Internet services, three types of fixed services (Wired Internet services, Satellite Internet services and dialup Internet service), and Other, a catchall category. Based upon households with Internet services at home, NTIA reports 61 percent of households have mobile Internet services, 76 percent have wired Internet services, 3 percent have satellite Internet services and 0.7 percent have dial-up Internet services. See NTIA, *Digital Nation Data Explorer* (March 21, 2016), <https://www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer>. As a check of the data, we note FCC staff analysis of the NTIA data indicate that 82 percent of households have a mobile phone, while CDC estimates that between 86 percent and 90 percent of households have mobile service. CDC, *Wireless Substitution: Early Release of Estimates from the National Health Interview Survey at 2* (January–June 2015), <http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201512.pdf>.

<sup>182</sup> These estimates are based upon the American Community Survey 2014 One Year Estimates. Percentages do not add up due to rounding. The American Community Survey 2015 One Year Estimates will be released in September, 2016.

<sup>183</sup> Pew Home Broadband 2015 at 2. Pew reports 13 percent of adults have smart phone and no home broadband. See *id.*

<sup>184</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 761, Appx. C, paras. 9, 15.

not necessarily every year. Finally, while the FCC Form 477 data is based upon a data collection that does not change often, the question template for the other data sources have been modified over time.<sup>185</sup> Thus, the Commission may need to rely upon multiple data sources that may yield differences in their estimates.<sup>186</sup> We seek comment on this discussion, including how the Commission should use these data sources and whether there are other data sources that we could rely upon for our adoption analysis.

## V. INTERNATIONAL COMPARISONS

81. Section 706 requires the Commission to include an international comparison of broadband service capability and prices in its annual broadband progress report.<sup>187</sup> The *2016 Broadband Progress Report* incorporated by reference the International Bureau's *Fifth International Broadband Data Report*,<sup>188</sup> which noted that "[t]he available international broadband data, though not fully comparable to data on the United States, continue to suggest that although the United States may be among the leaders for developed countries with regard to some broadband metrics, it lags in some other metrics."<sup>189</sup> The Commission added that broadband deployment is more likely to be reasonable and timely if deployment in U.S. communities compares favorably to that in other countries, and less likely to be reasonable and timely if U.S. communities compare unfavorably.<sup>190</sup>

82. We seek comment on how best the International Broadband Data Report can compare U.S. broadband deployment, capabilities, and prices with those in other developed nations and how these comparisons should affect our statutory finding.<sup>191</sup> We propose comparing at least 25 countries that are the most similar to the United States in terms of population, income, and size.<sup>192</sup> We seek comment on how to improve the selection of the countries for comparison. In the *Fifth International Broadband Data Report*, the International Bureau analyzed 39 countries.<sup>193</sup> Would eliminating some of the countries from the comparison, *i.e.*, those that are the least similar to the United States, increase the quality of the various international comparisons? We also invite commenters to provide any relevant qualitative and

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<sup>185</sup> See Department of Commerce, U.S. Census Bureau, American Community Survey, OMB Control Number: 0607-0810, Form Number(s): ACS-1, ACS-1(SP), ACS-1(PR), ACS-1(PR)SP, ACS-1(GQ), ACS-1(PR)(GQ), GQFQ, ACS CATI(HU), ACS CAPI (HU), ACS RI (HU), and AGQ QI, AGQ RI, 80 Fed. Reg. 30655 (May 29, 2015) at 30658 (explaining change in the questions to assess Consumers' adoption of Internet services for the 2016 survey); Department of Commerce, National Telecommunications and Information Administration, Proposed Information Collection, 80 Fed. Reg. 6058 (Feb. 4, 2015) (explaining NTIA's modification to the CPS Computer an Internet Supplement between the 2013 and 2015 data collection); Pew Home Broadband 2015 at 22 n.3 (explaining change in wording for question on whether respondent has Internet at home).

<sup>186</sup> We note that while the FCC Form 477 data do not suggest that adoption of fixed broadband services has plateaued or is declining, the Pew survey suggests that the adoption of fixed broadband services has plateaued and that fixed broadband adoption fell from 70 percent in 2014 to 67 percent in 2015, and the CPS Computer Supplement data suggest that home Internet use decreased from 74 percent to 73 percent in 2015. See Pew Home Broadband 2015 at 2; NTIA, *First Look: Internet Use in 2015* (Mar. 21, 2016), <https://www.ntia.doc.gov/blog/2016/first-look-internet-use-2015>.

<sup>187</sup> 47 U.S.C. § 1303(b). Specifically, 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 to reflect different speed tiers." *Id.*

<sup>188</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 748, para. 114.

<sup>189</sup> *Fifth International Broadband Data Report*, 31 FCC Rcd at 2667, para. 1.

<sup>190</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 742, para. 97.

<sup>191</sup> *Id.*

<sup>192</sup> 47 U.S.C. § 1303(b)(1).

<sup>193</sup> See *Fifth International Broadband Data Report*, 31 FCC Rcd at 2684, Appx. A.

quantitative data for the relevant countries that would improve the next International Broadband Data Report and the international comparison.

83. In the *Fifth International Broadband Data Report*, the International Bureau presented data on both advertised and actual broadband speeds in different countries, by using the publicly available raw speed test data (for fixed broadband in 2014) provided by Ookla, proprietor of speedtest.net, on their Net Index site.<sup>194</sup> As noted in the *Fifth International Broadband Data Report*, this dataset is no longer available as Ookla has discontinued the Net Index.<sup>195</sup> What other broadband speed data should the Commission consider? We also seek input on the sources of pricing data. In the last report, we relied on a combination of Google's broadband price data (for fixed and mobile service offerings) and data gathered through Commission staff research (namely smartphone broadband plans).<sup>196</sup> We note that given the complexity in the pricing of broadband services, it is difficult to compare empirically various pricing data across countries.<sup>197</sup> We seek comment on how useful the pricing data analyses in the previous reports were and how they can be improved. Are there other sources of international broadband pricing data that might result in a more appropriate and useful pricing comparison?

## VI. IS ADVANCED TELECOMMUNICATIONS CAPABILITY BEING DEPLOYED TO ALL AMERICANS IN A REASONABLE AND TIMELY FASHION?

84. *Background.* In the *2016 Broadband Progress Report*, we found that “advanced telecommunications capability is not being deployed to all Americans in a reasonable and timely fashion.”<sup>198</sup> Although our finding was based solely on fixed broadband deployment, because we determined that “the availability of advanced telecommunications capability requires access to both fixed and mobile services,”<sup>199</sup> we reported data for both types of services. With respect to fixed services, the Commission found that roughly 34 million Americans (or 10 percent of the population) “lack access to fixed 25 Mbps/3 Mbps advanced telecommunications capability.”<sup>200</sup> With respect to mobile services, we found that 1.7 million Americans (or 1 percent of the population) lack “access to a mobile provider using LTE technology” and 171.5 million Americans (or 53 percent of the population) lack “access to [a] mobile service provider with an LTE technology service [offering] a minimum advertised speed of 10 Mbps/1 Mbps.”<sup>201</sup> Further analysis also revealed “a stark contrast in service between urban and rural America.”<sup>202</sup> We found that roughly 24 million Americans (or 39 percent of Americans residing in rural areas) lacked access to fixed 25 Mbps/3 Mbps advanced telecommunications capability.<sup>203</sup> On Tribal lands in rural areas, we found that roughly 1 million Americans (or 69 percent of American's residing in these areas) lacked access to such speeds.<sup>204</sup> In addition, we estimated that 41 percent of schools did not receive broadband services meeting the our short-term speed benchmark of 100 Mbps per 1,000 students and staff and 91 percent of schools did not receive broadband services meeting the Commission's long-

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<sup>194</sup> *Id.* at 2670, para. 8.

<sup>195</sup> *Id.* at 2675, para. 27 n.56.

<sup>196</sup> *Id.* at 2670, 2676-77, paras. 10, 33.

<sup>197</sup> *Id.* at 2676, para. 32.

<sup>198</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 700, para. 1.

<sup>199</sup> *Id.* at 701, para. 2.

<sup>200</sup> *Id.* at 731, para. 79, Tbl. 1.

<sup>201</sup> *Id.* at 734-35, para. 83-84, Tbl. 4.

<sup>202</sup> *Id.* at 731-32, para. 79, Tbl. 1.

<sup>203</sup> *Id.*

<sup>204</sup> *2016 Broadband Progress Report*, 31 FCC Rcd at 732-33, para. 80, Tbl. 2.

term speed benchmark of 1 Gbps per 1,000 students and staff.<sup>205</sup> Given Congress’s emphasis on deployment of advanced telecommunications capability in schools and classrooms, we determined that “these data alone would preclude a positive finding” that such capabilities were being deployed to schools in a reasonable and timely fashion.<sup>206</sup>

85. *Discussion.* We invite comment on whether advanced telecommunications capability is being deployed to all Americans on a reasonable and timely basis in light of the data and analysis in this proceeding. We invite interested parties to address each of the factors that led to the Commission’s negative finding in the *2016 Broadband Progress Report* based on any new information or changes to our analytical framework. In particular, we seek comment on the Commission’s finding in the *2016 Report* concerning the stark and continuing disparity between the availability of advanced telecommunications capability in urban areas, and the availability of such services in rural areas and Tribal lands. We invite interested parties to address whether there have been any changes in this disparity, and seek comment on how the Commission should account for any such changes in making its determinations under section 706(b). We also seek comment on whether, independent of such rural and urban considerations, there exist income-based disparities in the availability of advanced telecommunications capability to all Americans.<sup>207</sup> Are areas with lower income levels more or less likely than higher income areas to have access to advanced services? To what extent are there divides—within urban areas, within rural areas, and across the country—with respect to the availability of advanced telecommunications among lower and higher income consumers? Should the income levels of various population areas be taken into account when analyzing the availability of advanced telecommunications capability? And, if so, how should the Commission take these considerations into account when making its determination of advanced telecommunications capability availability under section 706(b)? Additionally, we seek comment on whether any new considerations or other information warrant discussion when analyzing the availability of advanced telecommunications capability and how the Commission should account for such changes in making its determination under section 706(b).

## VII. PROCEDURAL MATTERS

### A. Ex Parte Rules

86. This proceeding shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission’s *ex parte* rules.<sup>208</sup> Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must: (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted, in whole or in part, of data or arguments already reflected in the presenter’s written comments, memoranda, or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings instead of summarizing them in the memorandum. If the presenter provides citations to his or her prior comments, memoranda, or other filings, the presenter must specify the relevant page and/or paragraph numbers where such data or arguments can be found. Documents shown or given to Commission staff during *ex parte* meetings are

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<sup>205</sup> See *id.* at 751, para. 123 (“41 percent of schools . . . have not met our short-term goal” and “[w]ith regard to our long-term goal[,] . . . only 9 percent of schools have connectivity”).

<sup>206</sup> *Id.*

<sup>207</sup> See *2016 Broadband Progress Report*, 31 FCC Rcd at 738-39, para. 90, Tbl. 8 (reporting the average per capita income, average median household income, and average percentage of households living in poverty for areas with and without access to advanced telecommunications capability).

<sup>208</sup> 47 CFR § 1.1200 *et seq.*

deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

## B. Comment Filing Procedures

87. Pursuant to sections 1.415, 1.419, and 1.430 of the Commission's rules,<sup>209</sup> interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS).<sup>210</sup>

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs>.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
  - All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12<sup>th</sup> Street, SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes and boxes must be disposed of *before* entering the building.
  - Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.
  - U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12<sup>th</sup> Street, SW, Washington, DC 20554.

## C. Accessible Formats

88. To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an email to [fcc504@fcc.gov](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at (202) 418-0530 (voice) or (202) 418-0432 (tty).

## VIII. ORDERING CLAUSE

89. Accordingly, IT IS ORDERED that, pursuant to section 706 of the Telecommunications Act of 1996, as amended, 47 U.S.C. § 1302, and section 103(b) of the Broadband Data Improvement Act, 47 U.S.C. § 1303(b), this Notice of Inquiry IS ADOPTED.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

<sup>209</sup> 47 CFR §§ 1.415, 1.419, 1.430.

<sup>210</sup> See *Electronic Filing of Documents in Rulemaking Proceedings*, 63 Fed. Reg. 24121 (1998).

**STATEMENT OF  
COMMISSIONER AJIT PAI  
APPROVING IN PART AND CONCURRING IN PART**

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 16-245.

Today, we start the clock on our annual inquiry “concerning the availability of advanced telecommunications capability to all Americans.”<sup>1</sup> I approve this *Notice* to the extent that it meets the requirements of section 706 of the Telecommunications Act.

But, as in previous years, this proceeding promises to play out like a 1970s television show: a predictable script that meets a preordained goal. There will, of course, be some drama. Will the Commission adopt a definitive benchmark for mobile broadband? Will the Commission add latency, jitter, or packet loss to the definition of broadband? Will the Commission acknowledge that the Universal Service Fund is spending billions of dollars to build out services that don’t qualify as broadband? But everyone knows the denouement: Early next year, the FCC will find that broadband is not being deployed “in a reasonable and timely fashion.”<sup>2</sup>

This sham is a shame. We should treat this proceeding as an annual status report on our efforts to promote digital infrastructure. The statute requires us—the government—to “encourage [broadband] deployment on a reasonable and timely basis . . . to all Americans” using a variety of regulatory tools.<sup>3</sup> And so we should be asking, what has the FCC done to encourage broadband deployment? What barriers to infrastructure investment have we removed? How have we reformed price cap regulation? How have we exercised regulatory forbearance? What measures have we taken to promote competition in the local telecommunications market? What have state commissions done that we can learn from? And focusing on the future, what should the FCC be doing? What barriers to investment can be eliminated? What regulatory obstacles stand in the way of investment, innovation, and entrepreneurship and how can we get rid of them?

We don’t need more lip service to the “stark discrepancy” between broadband in rural and urban America—we’ve said that all before.<sup>4</sup> Instead, we need concerted action to make good on the promise of universal service once and for all. And given how long rural Americans have waited already, we need it soon.

For all these reasons, I approve in part and concur in part.

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<sup>1</sup> Telecommunications Act § 706(b).

<sup>2</sup> *Id.*

<sup>3</sup> Telecommunications Act § 706(a).

<sup>4</sup> *Notice* at para. 16; see also *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15–191, Eleventh Annual Broadband Progress Notice of Inquiry, 31 FCC Rcd 8823, 8824, para. 2 (2015) (discussing the 2015 Report’s finding of a “digital divide” between rural and urban deployment).

**STATEMENT OF  
COMMISSIONER MICHAEL O'RIELLY  
APPROVING IN PART AND CONCURRING IN PART**

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 16-245.

Like last year, I approve issuing this Notice of Inquiry pursuant to Section 706 of the Telecommunications Act of 1996. Having better data and soliciting the views of interested parties on the state of broadband deployment and the deregulatory ways to improve it – if done in a neutral way – could be helpful to our overall obligations at the Commission. In a number of instances, however, the text of this item strays from that role and, therefore, I can only concur with those portions.

Take for instance the notion of an “aspirational threshold” of broadband speed. Such a concept is contained nowhere in the law. How would “adopting an additional, long-term speed benchmark for fixed services, in addition to our existing benchmark ... help the Commission to promote the deployment of advanced telecommunications capability” today? In fact, the Commission rejected the idea of setting an additional “forward-looking” benchmark in the past two reports, so I’m not sure why this is even on the table again this year. Setting an aspirational benchmark is particularly questionable when a majority of the Commission claims that we haven’t made progress in meeting the current benchmark, which was set two reports ago. In my view, 25/3 Mbps continues to be aspirational enough already.

Moreover, even if this year’s inquiry resulted in a finding that 100 percent of consumers had broadband at 25/3 Mbps speeds, which it won’t be able to do, what would it matter if we were only on a partial trajectory to some arbitrary aspirational goal to be achieved at a future date? Would the Commission still produce a negative finding under its Section 706 “authority”? Of course not. Setting aspirational speed thresholds for an exercise that requires a snapshot in time is beyond dubious and borders on the ridiculous.

Further, this item reiterates the falsehood, contained in last year’s report, that wired and wireless services are not functional substitutes. And yet the American people – as evidenced by their perceptions and personal behavior – find them so. Despite this information, the Commission appears prepared to declare that consumers must have access to both or a perpetual threat of a negative Section 706 finding looms in the balance. Moreover, the item’s inquiry highlights that the Commission seems to be no closer to defining the magical measurements of ubiquitous wireless service components that would be necessary to avoid such a finding.

I also continue to object to including non-deployment factors, including privacy, security, adoption, and pricing, into the determination of whether “advanced telecommunications capability is being *deployed* to all Americans in a reasonable and timely fashion.” For example, the item suggests, as many of us anticipated at the time, that the Charter Communications-Time Warner-Advance/Newhouse “findings” will now be used as precedent for other actions. In this case, data allowances are examined – without the presentation of any counter arguments – as a means to “affect the availability of advanced telecommunications capability.” While data caps/allowances may or may not affect consumer take rates, that is a far different issue than whether Internet access is being deployed to all Americans.

In the end, the NOI is not completely objectionable on its face. But make no mistake, everyone is already in on the larger joke to be played with this inquiry process. We all know the eventual outcome of the final report pursuant to section 706 that will be coming in the future. This seemingly benign NOI does not hide the reality that awaits.