

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

In the Matter of )  
 )  
Inquiry Concerning Deployment of Advanced ) WC Docket No. 18-238  
Telecommunications Capability to All  
Americans in a Reasonable and Timely  
Fashion

**REPLY COMMENTS OF DR. TIMOTHY J. TARDIFF**

**Introduction and Summary**

The Federal Communications Commission’s (FCC) Notice of Inquiry (NOI) in this proceeding seeks, among other things, data on deployment fixed broadband services for the period 2013-2017.<sup>1</sup> In previous proceedings evaluating the extent of broadband availability and competitive intensity, the FCC has not always used consistent measurement of the change in broadband provision. For example, as I described in my Reply Comments in last year’s proceeding,<sup>2</sup> the FCC deemed competition to be insufficient in its 2010 Internet Order<sup>3</sup> and that progress in broadband deployment was insufficient in its 2016 Broadband Progress Report,<sup>4</sup> based on very different measures of broadband availability.<sup>5</sup> Inconsistent measurement, as in any scientifically valid research, cannot produce valid conclusions on the *growth* in broadband availability. These Reply Comments provide an analysis of the change in broadband services using a consistent set

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<sup>1</sup> Federal Communications Commission, *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 17-199, Fourteenth Broadband Deployment Report and Notice of Inquiry, August 9, 2018 , ¶ 7, available at <https://www.fcc.gov/edocs/search-results?t=quick&dockets=18-238>.

<sup>2</sup> Reply Comments of Dr. Timothy J. Tardiff, *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, WC Docket No. 17-199, October 7, 2017, available at <https://ecfsapi.fcc.gov/file/10061571715086/Tardiff%20reply%20comments%202017%2010%2006.pdf>.

<sup>3</sup> Federal Communications Commission, *Preserving the Open Internet*, GN Docket No. 09-191, *Broadband Industry Practices*, GN Docket No. 09-191, Report and Order, December 23, 2010, ¶ 32, available at [https://apps.fcc.gov/edocs\\_public/attachmatch/FCC-10-201A1\\_Rcd.pdf](https://apps.fcc.gov/edocs_public/attachmatch/FCC-10-201A1_Rcd.pdf).

<sup>4</sup> Federal Communications Commission, *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, January 29, 2016 , ¶ 4, available at [https://apps.fcc.gov/edocs\\_public/attachmatch/FCC-16-6A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf)

<sup>5</sup> In 2010, the FCC evaluated the adequacy of broadband availability by measuring the percentage of households living in census *tracts* in which 0, 1, 2, or three or more providers offered service at the 3 Mbps downstream/0.768 Mbps upstream speed level. In contrast, in 2016, the FCC evaluated broadband progress based on the percentage of the population living in census *blocks* (a much more granular scale) in which 0, 1, or 2 or more providers offered service at the 25 Mbps downstream/3 Mbps upstream speed level.

of measures over time, based on availability measures that Advanced Analytical Consulting Group (AACG) has developed from the FCC's Form 477 data.<sup>6</sup> To the extent that stakeholders, believe that the most appropriate measure of broadband is evolving overtime the consistent set of measures allow parties to see that evolution across time and geography. The consistent measures for broadband availability since 2013 reveal substantial growth in broadband availability at the 25 Mbps downstream/3 Mbps upstream speed level. Further, comparing the growth trends for the 25 Mbps downstream/3 Mbps upstream speed level with the trend for the 10 Mbps downstream/1 Mbps upstream speed level suggests that the strong growth in availability at the higher speed level was the combination of a modest increase in the number of providers and an upgrade in the offerings of existing providers from lower speed levels.

The Free State Foundation's Comments provided an initial look at deployment figures from the FCC's most recent (June 2017) fixed broadband deployment data, which was released on September 10, 2017.<sup>7</sup> Free State's Comments observed that as of June 2017, 72.57 percent of the population was served by three or more fixed broadband providers at speeds of at least 25 Mbps/3 Mbps and 93.86 percent were served by three or more providers at speeds of at least 10 Mbps/1Mbps.<sup>8</sup> These Reply Comments (1) provide additional detail about the FCC's most recent Form 477 data, (2) provide comparable results biannually for earlier years, and (3), consistent with the FCC's *Internet Freedom* Order,<sup>9</sup> provide results for all fixed broadband Internet Service Providers (ISPs), including fixed wireless and satellite, and wireline ISPs, e.g., cable television and telephone companies. In the tables below, data for the periods from December 2014 through June 2017 were calculated by Advanced Analytical Consulting Group, based on the FCC's biannual releases of Form 477 data<sup>10</sup> and the data for December 2013 was presented in former Chairman Tom Wheeler's 2014 speech.<sup>11</sup>

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<sup>6</sup> A description of these consistent measures and reports updating the measures after the FCC releases new Form 477 data can be found at <http://aacg.com/litigation/telecommunications/net-neutrality/>.

<sup>7</sup> "FCC Releases Form 477 Data of Broadband Deployment as of June 30, 2017, *Public Notice*, WC Docket No. 11-10, September 10, 2018, available at <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>.

<sup>8</sup> Comments of the Free State Foundation, September 17, 2018, p. 5, available at <https://ecfsapi.fcc.gov/file/1091727996605/FSF%20Comments%20-%20Deployment%20of%20Advanced%20Telecommunications%20Capability%20to%20All%20Americans%20in%20a%20Reasonable%20and%20Timely%20Fashion%20091718.pdf>.

<sup>9</sup> Federal Communications Commission, *Restoring Internet Freedom*, WC Docket No. 17-108, Declaratory Ruling, Report and Order, and Order, January 4, 2018, ¶¶ 124-125, ("2018 Order"), available at [https://docs.fcc.gov/public/attachments/FCC-17-166A1\\_Rcd.pdf](https://docs.fcc.gov/public/attachments/FCC-17-166A1_Rcd.pdf).

<sup>10</sup> Since the FCC changed how it measures broadband availability in its Internet Service Access Reports (available at <https://www.fcc.gov/internet-access-services-reports>), Advanced Analytical Consulting Group produces a series of consistent availability measures, including a series consistent with the FCC's December 2009 through December 2013 measures. A description of this analysis can be found at <http://aacg.com/litigation/telecommunications/net-neutrality/>.

<sup>11</sup> "Prepared Remarks of Chairman Tom Wheeler: The Facts and Future of Broadband Competition," September 4, 2014, p. 2, available at [https://apps.fcc.gov/edocs\\_public/attachmatch/DOC-329161A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DOC-329161A1.pdf).

## 25 Mbps Upstream/3 Mbps Downstream

Table 1 presents broadband availability for the period from December 2014 through June 2017 when wireline, fixed wireless, and satellite ISPs are included.<sup>12</sup>

**Table 1: Percentage of US households in census blocks in which wireline, fixed wireless, or satellite broadband ISPs reported deployment at speeds of at least 25 Mbps down/3 Mbps up**

| 25 Mbps downstream/3 Mbps upstream |        |        |        |        |        |        |        |
|------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Alternatives                       | Dec-13 | Dec-14 | Jun-15 | Dec-15 | Jun-16 | Dec-16 | Jun-17 |
| 3 or more                          | NA     | 6.5%   | 6.0%   | 7.1%   | 21.9%  | 42.5%  | 71.7%  |
| 2                                  | NA     | 30.4%  | 29.9%  | 30.8%  | 40.3%  | 33.4%  | 22.5%  |
| 1                                  | NA     | 51.9%  | 52.8%  | 51.2%  | 30.4%  | 19.6%  | 5.8%   |
| 0                                  | NA     | 11.1%  | 11.2%  | 10.8%  | 7.4%   | 4.5%   | 0.0%   |

Sources: December 2013: "Prepared Remarks of Chairman Tom Wheeler: The Facts and Future of Broadband Competition," September 4, 2014, [https://apps.fcc.gov/edocs\\_public/attachmatch/DOC-329161A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DOC-329161A1.pdf). December 2014, June 2015, December 2015, June 2016, December 2016, and June 2017: calculated from data available at <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>.

The data show a large increase in competitive alternatives. For example, as of December 2014, 36.9 percent (6.5 percent + 30.4 percent) lived in census blocks with two or more alternatives, while 11.1 percent lived in census blocks with no broadband providers at this speed. By June 2016 (the period for which data were available for last year's broadband progress report proceeding), the percent of households in census blocks with two or more suppliers reached 62.2 percent (21.9 percent + 40.3 percent) while the percent of households in census blocks with no broadband providers at this speed had declined to 7.4 percent. Indeed, in the sixth month period from December 2015 to June 2016, the percentage of households in census blocks with two or more alternatives had increased from 37.9 percent (7.1 percent + 30.8 percent) to 62.2 percent, primarily due to an increase in satellite and fixed wireless providers offering service at this speed.<sup>13</sup> By the end of the period (June 2017), 94.2 percent (71.7 percent + 22.5 percent) of households lived in census blocks with two or more alternatives, with at least one ISP offering service at this speed available everywhere.

<sup>12</sup> The corresponding availability for December 2016 from the *Internet Freedom Order* are 43.9 percent, 32.6 percent, 19.1 percent, and 4.4 percent for 3 or more, 2, 1, and no alternative providers, respectively. 2018 Order, ¶ 124. The small differences between the FCC's percentages and the corresponding percentages in Table 1 are due to small differences in households (Table 1) versus population (FCC) in each census block. Since the average number of persons per household varies across census blocks, such small differences are not surprising.

<sup>13</sup> In Table 2 below (where fixed wireless and satellite ISPs are not included), the trend from December 2014 through December 2015 is similar to the trend in Table 1, albeit at a somewhat higher level of availability. Subsequently, the respective trends diverge, suggesting that satellite and fixed wireless alternatives are generating much of the large increases in post-2015 availability shown in Table 1.

Table 2 displays the results for wireline ISPs only for the period from December 2013 through June 2017.<sup>14</sup>

**Table 2: Percentage of US households in census blocks in which wireline broadband ISPs reported deployment at speeds of at least 25 Mbps down/3 Mbps up**

| 25 Mbps downstream/3 Mbps upstream |        |        |        |        |        |        |        |
|------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Alternatives                       | Dec-13 | Dec-14 | Jun-15 | Dec-15 | Jun-16 | Dec-16 | Jun-17 |
| 3 or more                          | 2.4%   | 2.2%   | 2.5%   | 2.5%   | 5.3%   | 6.0%   | 7.1%   |
| 2                                  | 22.9%  | 28.6%  | 28.5%  | 28.6%  | 42.6%  | 43.8%  | 47.7%  |
| 1                                  | 55.3%  | 57.3%  | 57.0%  | 57.0%  | 41.4%  | 40.6%  | 36.2%  |
| 0                                  | 19.4%  | 11.9%  | 12.0%  | 11.8%  | 10.7%  | 9.6%   | 8.9%   |

Sources: December 2013: "Prepared Remarks of Chairman Tom Wheeler: The Facts and Future of Broadband Competition," September 4, 2014, [https://apps.fcc.gov/edocs\\_public/attachmatch/DOC-329161A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DOC-329161A1.pdf). December 2014, June 2015, December 2015, June 2016, December 2016, and June 2017: calculated from data available at <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>.

Table 2 shows a steady increase in competitive wireline alternatives. For example, as of December 2103, 25.3 percent (2.4 percent + 22.9 percent) lived in census blocks with two or more wireline alternatives, while 19.4 percent lived in census blocks with no wireline broadband providers at this speed. By June 2016 (the period for which data were available for last year’s broadband progress report proceeding), the percent of households in census blocks with two or more wireline suppliers reached 47.9 percent (5.3 percent + 42.6 percent), while the percent in census blocks with no wireline broadband providers at this speed had declined to 10.7 percent. By the end of the period (June 2017), 54.8 percent (7.1 percent + 47.7 percent) of households lived in census blocks with two or more wireline alternatives, while the percent in census blocks with no wireline broadband providers at this speed had declined to 8.9 percent.

### 10 Mbps Upstream/1 Mbps Downstream

Table 3 presents broadband availability for the period from December 2014 through June 2017 when wireline, fixed wireless, and satellite ISPs are included.<sup>15</sup>

<sup>14</sup> Former Chairman Wheeler’s 2014 speech reported wireline ISP availability only, which provides an additional observation for this table. The corresponding availability for December 2016 from the *Internet Freedom Order* are 5.9 percent, 45.2 percent, 39.6 percent, and 9.2 percent for 3 or more, 2, 1, and no alternative providers, respectively. 2018 Order, ¶ 125.

<sup>15</sup> The corresponding availability for December 2016 from the *Internet Freedom Order* are 93.6 percent, 5.7 percent, 0.6 percent, and 0.1 percent for 3 or more, 2, 1, and no alternative providers, respectively. 2018 Order, ¶ 124.

**Table 3: Percentage of US households in census blocks in which wireline, fixed wireless, and satellite broadband ISPs reported deployment at speeds of at least 10 Mbps down/1 Mbps up**

| 10 Mbps downstream/1 Mbps upstream |        |        |        |        |        |        |        |
|------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Alternatives                       | Dec-13 | Dec-14 | Jun-15 | Dec-15 | Jun-16 | Dec-16 | Jun-17 |
| 3 or more                          | NA     | 79.4%  | 81.9%  | 83.9%  | 92.7%  | 93.9%  | 93.9%  |
| 2                                  | NA     | 17.1%  | 14.7%  | 13.3%  | 6.7%   | 5.7%   | 5.6%   |
| 1                                  | NA     | 3.4%   | 3.3%   | 2.9%   | 0.5%   | 0.4%   | 0.5%   |
| 0                                  | NA     | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   |

Sources: December 2013: "Prepared Remarks of Chairman Tom Wheeler: The Facts and Future of Broadband Competition," September 4, 2014, [https://apps.fcc.gov/edocs\\_public/attachmatch/DOC-329161A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DOC-329161A1.pdf). December 2014, June 2015, December 2015, June 2016, December 2016, and June 2017: calculated from data available at <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>.

Primarily because fixed wireless and satellite ISPs offering service at this speed were widely available throughout the period,<sup>16</sup> Table 3 shows a modest increase in competitive alternatives. For example, as of December 2104, 79.4 percent lived in census blocks with three or more alternatives, while only 3.4 percent lived in census blocks with only one broadband provider at this speed. By June 2016 (the period for which data were available for last year’s broadband progress report proceeding), the percent of households in census blocks with three or more suppliers reached 92.7 percent, while the percent in census blocks with only one broadband provider at this speed had declined to 0.5 percent. By the end of the period (June 2017), 93.9 percent of households lived in census blocks with three or more alternatives, while the percent in census blocks with only one broadband provider at this speed fell to 0.5 percent. The percent of households in census block with no provides at least 10 Mbps down/1 Mbps up has remained at 0 percent since December 2014.

Table 4 displays the results for wireline ISPs only for the period from December 2013 through June 2017.<sup>17</sup>

<sup>16</sup> The FCC reported that as of December 2014, satellite broadband service at speeds of at least 10 Mbps downstream and 1 Mbps upstream was available in 99.4 percent of developed census blocks. Federal Communications Commission, “Internet Access Services: Status as of December 31, 2014,” Industry Analysis and Technology Division, Wireline Competition Bureau, March 2016, Figure 5, available at <https://www.fcc.gov/internet-access-services-reports>.

<sup>17</sup> The corresponding availability for December 2016 from the *Internet Freedom Order* are 9.0 percent, 58.5 percent, 26.3 percent, and 6.2 percent for 3 or more, 2, 1, and no alternative providers, respectively. 2018 Order, ¶ 125.

**Table 4: Percentage of US households in census blocks in which wireline broadband ISPs reported deployment at speeds of at least 10 Mbps down/1 Mbps up**

| 10 Mbps downstream/1 Mbps upstream |        |        |        |        |        |        |        |
|------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Alternatives                       | Dec-13 | Dec-14 | Jun-15 | Dec-15 | Jun-16 | Dec-16 | Jun-17 |
| 3 or more                          | 9.8%   | 7.5%   | 8.9%   | 9.3%   | 8.5%   | 9.3%   | 10.7%  |
| 2                                  | 51.5%  | 55.4%  | 58.2%  | 59.0%  | 56.5%  | 57.2%  | 59.5%  |
| 1                                  | 30.3%  | 28.8%  | 24.9%  | 24.6%  | 27.9%  | 27.2%  | 24.0%  |
| 0                                  | 8.4%   | 8.2%   | 8.0%   | 7.2%   | 7.1%   | 6.3%   | 5.8%   |

Sources: December 2013: "Prepared Remarks of Chairman Tom Wheeler: The Facts and Future of Broadband Competition," September 4, 2014, [https://apps.fcc.gov/edocs\\_public/attachmatch/DOC-329161A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DOC-329161A1.pdf). December 2014, June 2015, December 2015, June 2016, December 2016, and June 2017: calculated from data available at <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>.

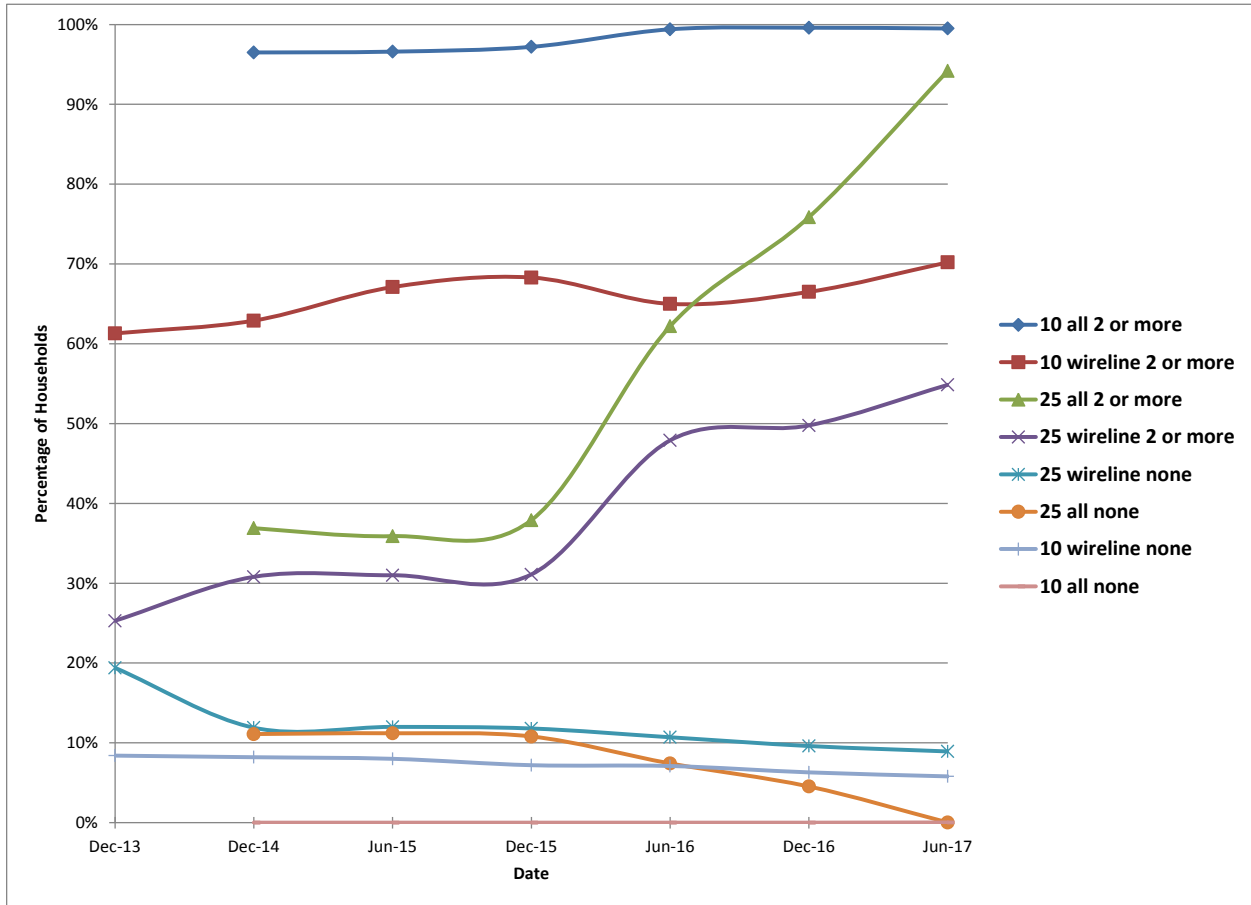
Similar to Table 3, Table 4 shows a modest increase in competitive wireline alternatives. For example, as of December 2103, 61.3 percent (9.8 percent + 51.5 percent) lived in census blocks with two or more alternatives, while 8.4 percent lived in census blocks with no wireline broadband providers at this speed.<sup>18</sup> By June 2016 (the period for which data were available for last year’s broadband progress report proceeding), the percent of households in census blocks with two or more suppliers reached 65.0 percent (8.5 percent + 56.5 percent), while the percent in census blocks with no wireline broadband providers at this speed had declined to 7.1 percent. By the end of the period (June 2017), 70.2 percent (10.7 percent + 59.5 percent) of households lived in census blocks with two or more alternatives, while the percent in census blocks with no broadband providers at this speed had declined to 5.8 percent.

<sup>18</sup> Former Chairman Wheeler’s speech reported availability at 10 Mbps downstream and 0.768 upstream, a somewhat slower speed level with concomitant somewhat higher availability levels.

## Summary

As shown on Figure 1, comparing the growth trends for the 25 Mbps downstream/3 Mbps upstream speed level with the trend for the 10 Mbps downstream/1 Mbps upstream speed level suggests that the strong growth in availability at the higher speeds was the combination of a modest increase in the number of providers and an upgrade in the offerings of existing providers from lower speed levels. In particular, Figure 1 shows that the percentage of households with two or more wireline, fixed wireless, and satellite suppliers at the 10 Mbps downstream/1 Mbps upstream speed level (10 all 2 or more) has been consistently above 90 percent. The corresponding growth in wireline suppliers at this speed level (10 wireline 2 or more) saw the percentage of households living in census blocks with two or more alternatives change from about 60 percent to about 70 percent. For the 25 Mbps downstream/3 Mbps upstream speed level, wireline-only broadband progress (25 wireline 2 or more) tracked the corresponding progress when all broadband suppliers are included (10 all 2 or more) through December 2015. Subsequently, the convergence in the percentage of households living in census blocks with two or more wireline providers at the 25 Mbps downstream/3 Mbps upstream speed level towards the corresponding percentage at the 10 downstream/1 Mbps upstream speed level suggests that wireline suppliers have been upgrading their offerings (and/or customers are opting for the higher level). Similarly, the convergence in the percentage of households living in census blocks with two or more wireline, fixed wireless, and satellite providers at the 25 Mbps downstream/3 Mbps upstream speed level towards the corresponding percentage at the 10 downstream/1 Mbps upstream speed level additionally reflects the effect of satellite broadband becoming ubiquitously available by the end of the period. Finally, the four lower curves (25 wireline none, 25 all none, 10 wireline none, 10 all none) show that the percentage of households in census blocks without wireline providers has dropped to less than 10 percent, even at the 25 Mbps downstream/3 Mbps upstream speed level, while at the same time when satellite and fixed wireless providers are added to the mix, broadband service has been ubiquitously available at 10 Mbps downstream/1 Mbps upstream throughout the period and at the higher speed level by the end of the period.

**Figure 1: Broadband progress through June 2017: 25 Mbps downstream/3 Mbps upstream and 10 Mbps downstream/1 Mbps upstream**



Timothy J. Tardiff  
October 1, 2018



## **Timothy J. Tardiff, Ph.D.**

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### **Professional Summary**

Dr. Timothy J. Tardiff has more than 30 years of academic and consulting experience. He has participated in numerous legal and regulatory proceedings regarding telecommunications, economics, intellectual property antitrust, and regulation issues. His research consulting, and expert witness experience in telecommunications has addressed pricing and costing issues involving increasingly competitive services, such as wireless and traditional wireline services. This experience has also included extensive examination and economic evaluation of all facets of the costing methodologies used to establish prices in rate-regulated industries—including expert reports and testimonies in a U.S. Department of Transportation proceeding on the reasonableness from an economic perspective of the rates international carriers at Los Angeles International Airport pay for use of terminal space. His work has included the telecommunications, software, transportation, energy, and public utility industries, and he has published extensively in economics, telecommunications, and transportation journals.

Dr. Tardiff is an economic consultant with clients in the telecommunications and regulated utilities industries. From 2006 to 2009, he was a Managing Director at Huron Consulting Group. Prior to joining Huron, Dr. Tardiff served as a vice president in the telecommunication practice at NERA Economic Consulting. During his career, he has served as the director of Marketing Research and senior member of the transportation practice at Charles River Associates, Inc. and assistant professor in the Department of Civil Engineering and Division of Environmental Studies at the University of California, Davis.

Dr. Tardiff's research has addressed the demand, cost, and competitive aspects of converging technologies, including wireless and broadband. He has evaluated pricing policies for increasingly competitive telecommunications markets, including appropriate mechanisms for pricing access services to competitors and studied actual and potential competition for services provided by incumbent telephone operating companies. Most recently, he has analyzed the effects of convergence and growing intermodal competition on whether incumbent firms should be considered dominant in the provision of certain services and the regulatory and antitrust implication of such determinations.

Since the passage of the United States Telecommunications Act, Dr. Tardiff has participated in interconnection arbitrations, unbundled element proceedings, universal service investigation, applications by incumbent local exchange carriers for authorization to provide interLATA long-distance, and implementation of the Triennial Review Order rules for unbundling network elements in over 25 states and before the United States Federal Communications Commission. His international research and consulting experience includes studies and expert reports on telecommunication competition issues in Canada, Japan, New Zealand, Peru, Australia, and Trinidad and Tobago, where he was an economic expert in an interconnection arbitration between two wireless carriers.

## Education

- Ph.D., Social Sciences, University of California, Irvine, CA
- B.S., Mathematics, California Institute of Technology, Pasadena, CA

## Testimony experience

- Deposition Testimony, Susan Mojica and Thomas Mojica, Individually and on behalf of others similarly situated v. Securus Technologies, Inc., Civil Action No. 5:14-cv-5258-TLB, U.S. District Court for the Western District of Arkansas, May 31, 2017.
- Expert Report, Susan Mojica and Thomas Mojica, Individually and on behalf of others similarly situated v. Securus Technologies, Inc., Civil Action No. 5:14-cv-5258-TLB, U.S. District Court for the Western District of Arkansas, April 26, 2017 (Supplemental Report May 16, 2017).
- Deposition Testimony, Virginia Electric and Power Company d/b/a Dominion Virginia Power v. Verizon Virginia LLC and Verizon South Inc., Case No. CL15-3029-00, Virginia: In the Circuit Court of the County of Henrico, March 10, 2017.
- Expert Report, Walter Chruby, et al. v. Global Tel\*Link Corporation, Civil Action No. 5:15-cv-05136-TLB, U.S. District Court for the Western District of Arkansas, February 16, 2016.
- Expert Rebuttal Report, Global Tel\*Link Corporation ICS Litigation, Civil Action No. 5:14-cv-5275-TLB, U.S. District Court for the Western District of Arkansas, October 20, 2016.
- Expert Rebuttal Report, Susan Mojica, Individually and on behalf of others similarly situated v. Securus Technologies, Inc., Civil Action No. 5:14-cv-5258-TLB, U.S. District Court for the Western District of Arkansas, October 7, 2016.
- Deposition Testimony, Global Tel\*Link Corporation ICS Litigation, Civil Action No. 5:14-cv-5275-TLB, U.S. District Court for the Western District of Arkansas, August 9, 2016.
- Deposition Testimony, Susan Mojica, Individually and on behalf of others similarly situated v. Securus Technologies, Inc., Civil Action No. 5:14-cv-5258-TLB, U.S. District Court for the Western District of Arkansas, July 12, 2016 and August 30, 2016.

- Expert Report, Susan Mojica, Individually and on behalf of others similarly situated v. Securus Technologies, Inc., Civil Action No. 5:14-cv-5258-TLB, U.S. District Court for the Western District of Arkansas, June 10, 2016.
- Expert Report, Global Tel\*Link Corporation ICS Litigation, Civil Action No. 5:14-cv-5275-TLB, U.S. District Court for the Western District of Arkansas, June 9, 2016.
- Reply Affidavit of Timothy J. Tardiff on the economic evaluation of the monetary value of possible joint use agreement advantages, prepared for filing with the Federal Communications Commission on behalf of Verizon Virginia and Verizon South, Verizon Virginia LLC and Verizon South, Inc., Complainant v. Virginia Electric and Power and Light Company dba Virginia Dominion Power, Respondent, Docket No. 15-190, File No. EB-15-MD-006, February 9, 2016.
- Reply Affidavit of Timothy J. Tardiff on the economic evaluation of the monetary value of possible joint use agreement advantages, prepared for filing with the Federal Communications Commission on behalf of Verizon Florida, Verizon Florida LLC, Complainant v. Florida Power and Light Company, Respondent, Docket No. 15-73, File No. EB-15-MD-002, November 24, 2015.
- Affidavit of Timothy J. Tardiff on the economic evaluation of the monetary value of possible joint use agreement advantages, prepared for filing with the Federal Communications Commission on behalf of Verizon Virginia and Verizon South, Verizon Virginia LLC and Verizon South, Inc., Complainant v. Virginia Electric and Power and Light Company dba Virginia Dominion Power, Respondent, Docket No. 15-190, File No. EB-15-MD-006, August 3, 2015.
- Affidavit of Timothy J. Tardiff on the economic evaluation of the monetary value of possible joint use agreement advantages, prepared for filing with the Federal Communications Commission on behalf of Verizon Florida, Verizon Florida LLC, Complainant v. Florida Power and Light Company, Respondent, Docket No. 15-73, File No. EB-15-MD-002, March 13, 2015.
- Reply Affidavit of Timothy J. Tardiff on presumptive just and reasonable rates for pole attachments, prepared for filing with the Federal Communications Commission on behalf of Frontier Communications, Commonwealth Telephone Company d/b/a Frontier Communications Commonwealth Telephone Company and CTSI, LLC d/b/a Frontier Communications CTSI Company, LLC, Complainants v. UGI Utilities – Electric Division, Respondent, File No. EB-14-MD-007, September 15, 2014.
- Reply Affidavit of Timothy J. Tardiff on presumptive just and reasonable rates for pole attachments, prepared for filing with the Federal Communications Commission on behalf of Frontier Communications, Commonwealth Telephone Company LLC d/b/a Frontier Communications Commonwealth Telephone Company, Frontier Communications of Breezewood, LLC, Citizens Telecommunications Company of West Virginia d/b/a Frontier Communications Company of West Virginia, and Frontier West Virginia Inc., Complainants, v. Metropolitan Edison Company, Pennsylvania Electric Company, West Penn Power

Company d/b/a Allegheny Power , Monongahela Power Company, and the Potomac Edison Company, Respondents, File No. EB-14-MD-008, July 31, 2014.

- Supplemental Expert Report, Duke Energy Carolinas, LLC, Plaintiff v. Frontier Communications of the Carolinas LLC, Defendant, 2:13-cv-00040-MR-DLH, U.S. District Court for the Western District of North Carolina, June 27, 2014.
- Deposition Testimony, Florida Power & Light Company, Plaintiff v. Verizon Florida LLC, Defendant, Case No. 13-014808-CA-01, Circuit Court of the Eleventh Judicial District in and for Miami-Dade County, Florida, June 24, 2014.
- Affidavit of Timothy J. Tardiff on presumptive just and reasonable rates for pole attachments, prepared for filing with the Federal Communications Commission on behalf of Frontier Communications, Commonwealth Telephone Company LLC d/b/a Frontier Communications Commonwealth Telephone Company, Frontier Communications of Breezewood, LLC, Citizens Telecommunications Company of West Virginia d/b/a Frontier Communications Company of West Virginia, and Frontier West Virginia Inc., Complainants, v. Metropolitan Edison Company, Pennsylvania Electric Company, West Penn Power Company d/b/a Allegheny Power , Monongahela Power Company, and the Potomac Edison Company, Respondents, File No. EB-14-MD-008, June 11, 2014.
- Expert Report, Florida Power & Light Company, Plaintiff v. Verizon Florida LLC, Defendant, Case No. 13-014808-CA-01, Circuit Court of the Eleventh Judicial District in and for Miami-Dade County, Florida, May 15, 2014.
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- Testimony before the State Corporation Commission of the State of Kansas in the matter of Southwestern Bell Telephone Company – Kansas’ Compliance With Section 271 of the Federal Telecommunications Act of 1996, Docket No. 97-SWBT- 411-GIT (with Alfred E. Kahn), February 17, 1998.
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- Affidavit of Timothy J. Tardiff on proxy rates for unbundled local switching, prepared for filing with the Federal Communications Commission on behalf of GTE Corporation, petition for a stay of the First Report and Order in the Matter of Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, August 28, 1996.
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- “Economic Evaluation of Selected Issues from the Fourth Further Notice of Proposed Rulemaking in the LEC Price Cap Performance Review: Reply Comments,” Prepared for filing

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- Participant, California Public Utilities Commission, Full Panel Hearing on Universal Telephone Service, September 29, 1995.
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- “Economic Evaluation of OIR/OII on Open Access and Network Architecture Development,” prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, February 8, 1994 (with Richard D. Emmerson).
- “Access to Intelligent Networks: Economic Issues,” prepared for filing with the Federal Communications Commission, on behalf of Pacific Bell, December 1, 1993.
- “The Effect of SFAS 106 on Economy-Wide Wage Rates,” prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, October 1, 1993
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- Review of Selected Studies and Comments in Response to the Department of Labor's Conflict of Interest 2015 Proposed Rule and Exemptions, With Karthik Padmanabhan and Constantijn Panis, Prepared for the United States Department of Labor, March 4, 2016.
- Summary of Proposed Revenue Sharing Arrangements: 2013 Update, (Confidential), Prepared for the Los Angeles County Metropolitan Transportation Authority, February 8, 2013.
- Antitrust and Community Impact Report on the Conversion of Blue Cross and Blue Shield of Montana and Alliance with Health Care Service Corporation, With Daniel S. Levy, Audrius Girnius, and Karthik Padmanabhan, Prepared for the Montana Office of the Commissioner of Securities and Insurance, January 29, 2013.
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- Principles of Competition and Regulation for the Design of Telecommunications Policy, With Dennis L. Weisman, Prepared for Qwest Corporation, October 21, 2009.
- Report on the TSTT Cost Model, With Agustin J. Ros, Nigel Attenborough, and Trung Lu (Confidential), Prepared for Telecommunications Services of Trinidad and Tobago Limited, September 14, 2005.
- Interconnection Costing Methodology: Theory and Practice, With William E. Taylor, Nigel Attenborough, Agustin J. Ros, and Yogesh Sharma, Prepared for the Chinese Academy of Social Sciences, April 15, 2003.
- Imputation Tests for Bundled Services, With Greg Houston, Carol Osborne, and Jennifer Fish, Prepared for the Australian Competition and Consumer Commission, January 2003.
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- Enhancing Competition for Broadband Services: The Case for Removing the Prohibition against High-Speed InterLata Transmission by Regional Bell Operating Companies, With Alfred E. Kahn, Prepared for the United States Telecom Commission, May 22, 2000 (released April 2001).
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- Tardiff, T.J., “Net Neutrality: Economic Evaluation of Market Developments,” *Journal of Competition Law & Economics*, Vol. 11, No. 3, 2015, pp. 701-725. Also presented at Rutgers University, Center for Research in Regulated Industries, Advanced Workshop in Regulation and Competition, 33rd Annual Eastern Conference, Shawnee on Delaware, Pennsylvania, May 13, 2015.
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### **Professional associations**

- Member, American Economic Association
- Associate Member, American Bar Association
- Member, Federal Communications Bar Association

### **Fellowships, grants and awards**

- First Place, Dissertation Contest of the Transportation Science Section of the Operations Research Society of America.
- National Science Foundation (NSF) Research Initiation Grant (Engineering Division), 1976-1978.
- NSF Grant for Improving Doctoral Dissertation Research in the Social Sciences, 1973-1974.
- NSF Predoctoral Fellowship, 1972-1974.
- Public Health Service Traineeship, 1971-1972.