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

In the Matter of	**)**	
	)	
International Comparison Requirements Pursuant	**)**	GN Docket No. 15-191
to the Broadband Data Improvement Act	**)**	
	)	
International Broadband Data Report	**)**	

FIFTH REPORT

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

By the Chief, International Bureau:

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I. INTRODUCTION

    1. This is the International Bureau's fifth International Broadband Data Report (IBDR or Report). Required under Section 103(b) of the Broadband Data Improvement Act (BDIA), the IBDR provides comparative international information on broadband services.[1] Through the presentation of this data, we have the opportunity to compare the state of broadband deployment in the United States and the country's broadband speeds and prices to the international community. The 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. In this Report and its appendices, we present a number

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[1] *See* 47 U.S.C. § 1303(b).

of data points, including fixed broadband deployment data in the United States and the European Union (EU) with a focus on rural areas, advertised and actual fixed broadband speeds in 40 countries around the world, including the United States, and broadband prices (both fixed and mobile plans) across the same 40 countries.[2] As with previous Reports, we also have gathered demographic and regulatory/market data (to the extent available) for the countries included in this Report. The majority of this information is presented in the appendices to this Report.

II.   BACKGROUND

2.   The BDIA requires the Commission to include in its annual broadband progress report "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 for each of the data rate benchmarks for broadband service utilized by the Commission to reflect different speed tiers."[3] The BDIA directs the Commission to assess broadband capability in international communities comparable to the communities in the United States with respect to population size, population density, topography, and demographic profile.[4] The Commission is also directed to include "a geographically diverse selection of countries" and "communities including the capital cities of such countries."[5] The Commission must "identify relevant similarities and differences in each community, including their market structures, the number of competitors, the number of facilities-based providers, the types of technologies deployed by such providers, the applications and services those technologies enable, the regulatory model under which broadband service capability is provided, the types of applications and services used, business and residential use of such services, and other media available to consumers."[6] We comply with the BDIA's requirements, and include the highlights of our findings in this Report and present the detailed data and additional discussion in the relevant appendices.

3.   In this Report, we focus our efforts on analysis of broadband deployment, speed, and price research. Following past practice and the BDIA's goal of developing a geographically diverse and detailed set of data on international broadband, we use two criteria to guide the selection of countries and communities for our research. The first is *inclusivity*: we attempt to capture as full an international profile as possible, embracing communities from all parts of the world, while also focusing on those

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[2] The countries we have selected for this Report are largely the same as those we included in the *Fourth IBDR* (*International Comparison Requirements Pursuant to the Broadband Data Improvement Act, International Broadband Data Report*, GN Docket No. 14-26, Fourth Report, DA 15-132 (2015) (*Fourth IBDR*). As discussed more fully below, we used pricing data collected by Google (Google's data) in this Report. Google's data, though it includes more than 100 countries, did not include fixed and mobile data for all 40 countries that we chose to examine. Specifically, Google's fixed broadband data does not include Estonia, Iceland, Ireland, Lithuania, Luxembourg, New Zealand, or Norway. Google's mobile data does not include Estonia, Iceland, Ireland, Lithuania, Luxembourg, New Zealand, Norway, or Slovenia. *See* http://policybythenumbers.blogspot.com/2015/02/global-broadband-pricing-study-updated.html.

[3] 47 U.S.C. § 1303(b)(1). Several terms that we use in this Report, such as "broadband," "advanced telecommunications capability," and "availability" may have specialized meanings in other contexts, and nothing in this Report should be read to suggest that our use of terminology here is intended to affect the meanings of other specialized terms in the context of the *2016 Broadband Progress Report* or in other proceedings. *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 Nos. 15-191, Broadband Progress Report, FCC 16-6 (rel. January 29, 2016) (*2016 Broadband Progress Report*). The *2016 Broadband Progress Report* incorporates by reference this IBDR to fulfill the obligation imposed by Section 103(b) of the BDIA.

[4] *Id.* § 1303(b)(2).

[5] *Id.*

[6] *Id.* § 1303(b)(3).

countries that have more developed broadband markets. The second is *data availability*: we include only communities for which a substantial set of relevant information is available. These two criteria result in a dataset that exceeds the statutory minimum requirements of 25 countries and 75 communities comparable to U.S. communities, and includes communities from almost all nations with the highest broadband deployment.[7]

4. The criteria we have used for choosing communities enable us to make reasonable international comparisons. The BDIA requires the Commission to choose communities that are similar to U.S. communities, which suggests communities with higher income and education levels, and better broadband service, than communities in poorer, less developed countries. To that end, we have focused our research on 40 countries, including the United States and all Organization for Economic Co-operation and Development (OECD) countries.[8]

5. ***Comments and Data Sources***. The *2015 Broadband Progress Notice of Inquiry* sought comment on how we could make improvements to the IBDR.[9] We received no comments regarding potential improvements to the IBDR. We also sought comment on potential data sources and also invited commenters to provide any relevant qualitative and quantitative data enabling international comparisons under the Act. We received no direct comment on this, though some commenters cited mobile broadband data and rankings in their submissions.[10]

6. As noted above, the BDIA requires that the Commission gather information concerning "the extent of broadband service capability (including data transmission speeds and price for broadband service capability)" in foreign communities.[11] As in previous years, we understand the responsibility of gathering information on "the extent of broadband service capability" to require an inquiry into the deployment and availability of broadband service, which in turn includes factors such as price, quality, and adoption.[12] In preparing this IBDR, we have reviewed a number of data sources and analyzed various rankings that compare broadband deployment and service capability in the United States and other countries.[13]

7. With respect to broadband subscription, the best currently available data comparing the United States to other countries is from the OECD, which collects data on broadband deployment, subscription, and usage and publishes rankings of its respective member countries. The European Commission (EC) also publishes data on fixed broadband coverage. We compare the broadband

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[7] There are some differences in the countries included for each dataset contained in this Report. Those differences are primarily due to data availability. *See* Appendix A.

[8] *See* Appendix A for a complete country list.

[9] *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, paras. 84-86 (2015) (*Eleventh Broadband Progress Notice of Inquiry*).

[10] *See*, *e.g*., Comments of Verizon at 5 (noting that LTE deployment in the United States surpasses that in Europe); comments of Mobile Future at 3 (noting that with LTE subscriber penetration of nearly 50 percent, the United States leads Western Europe (21 percent) and the Asia Pacific region (14 percent)); comments of CTIA—The Wireless Association at 6 (observing that the United States leads the world in mobile broadband investment, deployment, and adoption); reply comments of Public Knowledge at 4 (citing a study by OpenSignal that shows 54 nations have average LTE download speeds that are greater than the U.S. average).

[11] 47 U.S.C. § 1303(b)(1).

[12] *Cf. 2016 Broadband Progress Report* at para. 96.

[13] Differences between which countries are included for each dataset in this Report are primarily due to data availability. *See* Appendix A *infra*.

coverage data for the countries in the EC study with coverage data for the United States, including coverage by households and by rural and non-rural areas in Appendix G.

8.   To comply with the BDIA's requirement to present information on "data transmission speeds" for broadband services, we use publicly available speed data sources and present our findings in Appendix F. To present data on both advertised and actual broadband speeds in different countries, we use the publicly available raw speed test data (for fixed broadband in 2014) provided by Ookla, proprietor of speedtest.net, on its Net Index site.[14]

9.   In the *Fourth IBDR* and in the *2015 Broadband Progress Notice of Inquiry,* we stated that Google publishes open source international broadband pricing data (which includes both fixed and mobile pricing plans in over 100 countries).[15] Google's international broadband pricing dataset is gathered through provider website research, the same way that we have gathered data on pricing plans in prior IBDRs.[16] The Commission sought comment in the *Eleventh Broadband Progress Notice of Inquiry* on a proposal to use Google's international broadband pricing dataset supplemented by mobile (smartphone plans) broadband data collected via online research.[17] We received no comment on this proposal.

10.   In this Report, we use the data for 33 countries included in Google's 2014 international broadband pricing dataset ("Google's pricing dataset")[18] as the basis for our international broadband pricing plan comparison. Google's pricing dataset differs in several ways from our data gathered in the past, and as such we have supplemented it with our own research when appropriate.[19] Most notably, Google's pricing dataset for mobile broadband pricing plans focuses on mobile data-only plans (such as stick modem plans) and includes smartphone plans only when a data-only plan was not available.[20] Our data on smartphone plans for 40 countries directly gathered from providers' websites supplement Google's pricing dataset used in this Report.[21]

11.   The previous IBDRs have compared broadband prices using exchange rates and purchasing power parity (PPP).[22] In this Report, we continue to use exchange rate and PPP as the bases for our price comparison.[23] With respect to pricing plans, we present data and discussion for broadband

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[14] *See* Appendix F for our discussion of the speed data.

[15] *See Fourth IBDR* at para. 9, n.18 and *Eleventh Broadband Progress Notice of Inquiry* at 8851.

[16] We also noted that we may use Google's pricing dataset as our primary source in future reports. *See Eleventh Broadband Progress Notice of Inquiry* at 8851 and *Fourth IBDR* at para. 9, n.18, citing Google, Policy by the Numbers, http://policybythenumbers.blogspot.com/2014/03/international-broadband-pricing-study.html.

[17] *Eleventh Broadband Progress Notice of Inquiry* at 8851.

[18] *See supra* n. 2.

[19] *See* Appendix B.

[20] Communications Chambers, Broadband Pricing Database – Explanatory Notes (Fourth Edition), December 2014, https://docs.google.com/document/d/18SGpg63RCZEchQ29HZ8ro5D5D1Kjx0DcYN0PLk7 -fPA/edit?pli=1.

[21] Our raw price data is available in Appendix B and on our website at https://www.fcc.gov/reports-research/reports/international-broadband-data-reports/international-broadband-data-report-3. Appendix C contains our analysis of the price data in the form of data tables.

[22] *Fourth IBDR*, at para. 9.

[23] For further discussion of PPP, *see infra* n. 74.

plans offered in 2014 and in some cases 2015, in Appendix C, for major fixed and mobile broadband providers (typically at least three of each) in each of our group of 40 countries, when possible.[24]

       12.   Further, we present updated demographic data for the 39 surveyed foreign countries on a sub-national basis, including the latest figures for such indicators as population size, population density, gross domestic product (GDP), and educational attainment in Appendix D of this Report.[25] Finally, we provide a detailed update of regulatory and market developments since our last Report for the surveyed countries in Appendix E.

III.   DISCUSSION

       13.   In this section, we present highlights of our findings. Our full presentation and discussion of the data, including tables, is in the relevant appendices.

A.   Fixed Broadband Coverage Comparison with Europe

       14.   In Appendix G, we compare fixed broadband deployment in the United States and Europe[26] and find that high-speed broadband, as defined below, is more widely deployed in the United States. According to data from both 2013 and 2014, the broadband coverage gap between rural and non-rural areas remains large across Europe and the United States.[27]

       15.   Like the United States, the European Union (EU) is tracking its progress in extending broadband coverage to all of its citizens. One of the EU's Digital Agenda objectives is to provide "Next Generation Access" (referred to herein as "high-speed broadband"), meaning broadband speeds of at least 30 Mbps, by 2020.[28] In the United States, different statistics are collected, but general comparisons can still be made.[29] For purposes of the comparison of high-speed fixed broadband coverage, we use the data

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[24] We gathered information on prices and features from the providers' websites (*e.g.*, monthly fees, activation charges, speeds, usage limits, promotional discounts, equipment charges) for stand-alone and bundled broadband packages. As noted above, Google's fixed broadband dataset does not include Estonia, Iceland, Ireland, Lithuania, Luxembourg, New Zealand, or Norway. Google's mobile dataset does not include Estonia, Iceland, Ireland, Lithuania, Luxembourg, New Zealand, Norway, or Slovenia. *See* http://policybythenumbers.blogspot.com/2015/02/global-broadband-pricing-study-updated.html.

[25] Using this sub-national data, one can draw comparisons across both international and domestic cities, states, and regions. As is the case in the United States, intra-country variations are greater than the inter-country differences. In particular, differences in population density, dispersion, and income may create significant variations. For example, the lower population density and greater size of the United States present unique challenges. We did not have sub-national demographic data for Brazil, Hong Kong, India, and Singapore. *See* Appendix A.

[26] As described in more detail in Appendix G, the European Commission's broadband deployment report ("EC study") included Switzerland, Norway, and Iceland, plus the 28 EU member countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom (collectively, the European countries in the EC study).

[27] In this Report, we compare 2013 and 2014 data on fixed broadband coverage in the United States and in the European countries in the EC study. The most recent coverage data in the United States can be found in the *2016 Broadband Progress Report.* Since the EC studies did not include broadband service provided by satellite, we excluded satellite service from the United States data to maintain comparability with the EC studies.

[28] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions A Digital Agenda for Europe, 2010, available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF. Another Digital Agenda objective is to provide all EU citizens with basic broadband coverage (at least 144 kbps download speed) by the end of 2013. Appendix G contains our discussion of the basic broadband coverage (including differences between the U.S. and European definitions of "basic broadband."

[29] Because the data in the EC study was from December 2013 and 2014, we also use U.S. data from December 2013 and 2014 for comparison. The U.S. data for 2013 comes from NTIA' State Broadband Initiative (SBI), while the

for 25 Mbps for 2013, which most closely matches the 30 Mbps threshold in the EC study.[30] Despite this difference, we think the comparison remains apt. For our comparison of high-speed broadband deployment in 2014, we use 30 Mbps as the EC study does.[31]

16.   Since 2014, the EC released two reports detailing broadband coverage in Europe in 2013 and 2014.[32] The 2013 and 2014 EC studies provide measures of progress towards Europe's broadband coverage objectives in the study countries. As did its earlier studies, the 2013 and 2014 EC studies include data at a sub-national level in Europe – corresponding to counties, departments, or provinces.[33] These sub-national data are helpful to determine broadband capability in those international communities that are comparable to U.S. communities with respect to population size, population density, topography, and demographic profile.[34] The data are also broken down into rural and non-rural areas.

17.   The 2013 EC study shows that by the end of 2013 high-speed broadband reached 62 percent of households. According to the 2014 EC study, by the end of 2014 the percentage of households with access to high speed broadband had increased to 68 percent.

18.   In the United States, different statistics are collected, but general comparisons can still be made.[35] In 2013, 84 percent of total U.S. households had high-speed broadband coverage. In 2014, high-speed broadband coverage expanded to 89 percent of households in the United States.

19.   *Rural Coverage*. Between December 2013 and December 2014, Europe's high-speed broadband coverage increased from 70 to 75 percent for non-rural households and from 18 to 25 percent for rural households. The gap between non-rural and rural thus decreased from 52 percentage points in 2013 to 50 percentage points in 2014. Between December 2013 and December 2014, high-speed broadband coverage in the United States increased from 93 to 96 percent for non-rural households and from 45 to 58 percent for rural households. The high-speed broadband gap between non-rural and rural decreased from 48 percentage points to 38 percentage points. Thus, the gap between rural and non-rural

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U.S. data for 2014 comes from FCC Form 477. Though the use of different datasets does add complications, neither dataset has sufficient data for both 2013 and 2014 on its own.

[30] We note that in the *2015 Broadband Progress Report* for purposes of its section 1302(b) obligation, the Commission considered "advanced telecommunications capability" as 25 Mbps download and 3 Mbps upload. *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, 1377, para. 3 (2015) (*2015 Broadband Progress Report*); 47 U.S.C. § 1302(b).

[31] For 2014, we had Form 477 data available which allows us to make the comparison at 30 Mbps for both the United States and Europe. For 2013, we only had SBI data available, which did not include data at the 30 Mbps speed tier for the United States, but did include data at the 25 Mbps speed tier.

[32] *See* Broadband Coverage in Europe in 2014: Mapping Progress Towards the Coverage Objectives of the Digital Agenda, available at https://ec.europa.eu/digital-agenda/en/news/study-broadband-coverage-europe-2013 "2013 EC study") and Broadband Coverage in Europe in 2014: Mapping Progress Towards the Coverage Objectives of the Digital Agenda, Research Report prepared for the European Commission DG Communications Networks, Content & Technology, European Union, 2015, available at http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=11195 ("2014 EC study").

[33] The population of these sub-national areas (called NUTS-3 level units) range from 150,000 to 800,000.

[34] 47 U.S.C. § 1303(b)(2).

[35] Because the EC study data was from 2013 and 2014, we also use U.S. data from 2013 and 2014 for comparison. For an appropriate comparison, we use fixed broadband coverage data at 25 Mbps for the United States based on the 2013 SBI Data, which most closely matches the 30 Mbps threshold in the EC study, but for 2014, using the new Form 477 data, we are able to compare the U.S and European coverage data at the same speed level (*i.e*., 30 Mbps).

high-speed fixed broadband coverage is smaller in the United States than it is in Europe and the absolute level of coverage of high-speed broadband is higher in the United States in both rural and non-rural areas. The data also show that the United States has been making faster progress in closing the urban-rural gap for high-speed broadband.

20.   *Coverage Ranking by Country*. In 2013, with an overall 84 percent high-speed broadband coverage, the United States ranks higher than 23 of the 31 European countries in the EC study. In 2014, with an overall 89 percent high-speed broadband coverage, the United States ranks higher than 21 of the 31 European countries in the EC study.

21.   The EC study also includes data for 2013 and 2014 on the status of rural high-speed broadband coverage by country. Eight European countries (Malta, Netherlands, Luxembourg, Switzerland, Belgium, Estonia, Lithuania, and Slovenia) had higher rural high-speed broadband coverage than the United States in 2013, and eight European countries (Malta, Netherlands, Luxembourg, Switzerland, Belgium, Iceland, Lithuania, and Slovenia) had higher rural high-speed broadband coverage than the United States in 2014. Appendix G discusses the status of rural high-speed broadband coverage across the European countries in the EC study and the United States.

B.   Broadband Subscription (OECD Countries)

22.   The OECD's subscription metrics define transmission speeds of at least 256 kbps in one direction to be "broadband service" for both fixed and mobile Internet access.[36] This is considerably slower than the 25 Mbps download/3 Mbps upload speeds which the Commission considers as "advanced telecommunications capability" or "broadband" for purposes of the *2016 Broadband Progress Report*.[37] In this section of the Report, we use the OECD's broadband definition to present subscription statistics from OECD countries.

23.   As the most populous member of the OECD, the United States ranked first in 2014 in the sheer number of fixed broadband subscriptions with 100,192,000 subscribers (93,618,000 subscriptions in 2013).[38] Again, by comparison, Japan ranked second with 36,261,653 fixed subscriptions (and 35,785,203 fixed subscriptions in 2013).[39] With respect to subscription in terms of the percentage of population, the United States ranks 16th out of 34 countries for percentage of population with overall fixed broadband subscriptions, with 31.4 broadband subscriptions per 100 inhabitants (also 16th out of 34 countries in 2013 with 30.35 broadband subscriptions per 100 inhabitants).[40] Breaking the fixed subscription numbers down by technology, the U.S. ranking in these surveys ranges from 25th out of 34

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[36] *See* OECD Broadband Portal, Broadband Methodology, http://www.oecd.org/sti/broadband/broadband-methodology.htm. OECD's definition of "fixed" broadband includes DSL, Cable, Fiber, Satellite, Terrestrial fixed wireless, and other wired technologies such as broadband over powerline. OECD's definition of "mobile" broadband includes terrestrial mobile wireless.

[37] *See 2016 Broadband Progress Report* at paras. 3, 19, 51.

[38] OECD Broadband Portal, Total fixed and wireless broadband subscriptions by country, Table 1.1.1 (Dec. 2014), available at http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm. The 2013 data (OECD Broadband Portal, Table 1(d)(1) (Dec. 2013)) is no longer available on the OECD Broadband Portal.

[39] *Id.*

[40] OECD Broadband Portal, Table 1.2.1 (December 2014). Since release of the *Fourth IBDR*, the OECD changed its definitions of fixed and mobile broadband by moving the categories Satellite and Fixed Wireless from mobile to fixed broadband. Consequently, the OECD recalculated the penetration figures for fixed and mobile broadband for years prior to 2014 and made the time series available on the Broadband Portal in charts 1.5.1 and 1.5.2, OECD Historical Fixed and Mobile Broadband Penetration Rates.

in DSL subscription[41] to fifth out of 34 in cable modem subscription,[42] to 17th out of 34 in fiber-to-the-home (FTTH) subscriptions.[43]

24.   In terms of sheer number of mobile broadband subscribers, the United States ranked first out of OECD's 34 countries with 331,373,000 subscriptions with data plans as of December 2014 (compared to 316,440,000 subscriptions as of December 2013 for the first place rank).[44] By comparison, Japan ranked second with 157,812,151 wireless broadband subscriptions in 2014 (142,595,498 in 2013).[45] The OECD's 2014 subscription data also rank countries according the number of subscriptions per 100 inhabitants.[46] By this metric, the United States ranks eighth overall out of the 34 OECD countries in percentage of population with mobile broadband subscriptions, with 104.0 mobile broadband subscriptions per 100 inhabitants[47] (by comparison, Finland ranks first in 2014 with 138.0 mobile broadband subscriptions per 100 inhabitants).[48] In 2013, the United States ranked seventh out of 34 countries with 94.2 mobile broadband subscriptions per 100 inhabitants.[49]

25.   As the OECD notes, subscription is measured using different indicators and different reference dates across various countries.[50] Further, where a particular country falls in these rankings may be influenced by population density and dispersion, income, and other factors. The United States has about one-quarter the population density of Europe, one-tenth that of Japan, and one-fifteenth that of South Korea.[51] We recognize the need for better data on these issues and have initiated efforts to improve available data, both domestically and internationally. In the last section of this Report, we provide an update on international efforts to improve data on broadband.[52]

C.   Fixed Broadband Speeds

26.   The BDIA requires the Commission to gather information on "data transmission speeds" for broadband services.[53] *Speed* is a quantitative description of the information transfer rate of a broadband Internet access service and can be defined as "data signaling rate," as expressed in bits per

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[41] *Id*. The U.S. ranking in this category remains unchanged from last year.

[42] *Id*. The U.S. ranking in this category dropped one from last year, when the United States ranked fourth in cable modem subscribers.

[43] *Id*. Last year the United States ranked 16th in FTTH.

[44] OECD Broadband Portal, Total fixed and mobile broadband subscriptions by country, Table 1.1.2 (Dec. 2014), available at http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm. The 2013 data (OECD Broadband Portal, Table 1(d)(2) (Dec. 2013)) is no longer available on the OECD Broadband Portal.

[45] *Id.*

[46] We reproduce the OECD's most recent broadband subscription rankings in Appendix E.

[47] OECD Broadband Portal, Table 1(d)(2) (December 2013). In the *2015 Broadband Progress Report*, the Commission did not include mobile or satellite in its broadband deployment determination under section 1302(b) and considered fixed wireless to be a fixed service, much like cable or DSL. *See 2015 Broadband Progress Report* at 1379-1380, para. 9 and 1413-1414, para 71.

[48] OECD Broadband Portal, Table 1.2.2 (December 2014).

[49] OECD Broadband Portal, Table 1.5.2, OECD Historical Mobile Broadband Penetration Rates.

[50] *See* OECD Broadband Portal, notes for Tables 1(d)(1) and (2). To elaborate, comparisons between countries may not be precise when data is collected at different times or when countries use different methods of determining what constitutes a broadband subscription.

[51] *See Third IBDR*, 27 FCC Rcd at 9892-93.

[52] *See* Section III.E., para. 54, *infra*.

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

second.[54] Speed is an important indicator of the nature of broadband service. In the *2016 Broadband Progress Report*, the Commission finds that the standard of 25 Mbps/3 Mbps continues to represent an appropriate benchmark for fixed broadband service.[55]

27.   As with our previous IBDRs, we have gathered data on advertised speed from broadband providers' websites for this Report. We gathered advertised speeds from the publicly accessible websites of fixed broadband providers in 33 countries, and performed an analysis of actual speed data based on the publicly available data provided by Ookla, proprietor of speedtest.net, on its Net Index site.[56] In this Report, we used Ookla data for 2014. The data include 6.3 million observations for 17,917 cities in 40 countries from January 1 to December 15, 2014.

28.   Appendix F contains our discussion of the actual fixed broadband speed data, which examines the data on both a country and city basis. We present fixed broadband speeds in 40 countries using Ookla data on actual speeds, as well as Ookla customer surveys of advertised speeds.[57] Using the aggregated data, we ranked 40 countries based on a weighted average of the city mean speeds, with weights determined by the number of tests per city, and using a stratified sample technique to offset changes in average speeds based on differences in city participation across countries.[58] In addition, we compared the Commission's most recent Measuring Broadband America data for fixed broadband to the European Commission's actual broadband speed measurement data for Europe, as we did in the *Fourth IBDR*.

29.   Based on the Ookla data, the United States ranked 26th of 40 countries in 2014 in terms of actual download speeds (26.68 Mbps) when weighted by sample size. Though this is the same ranking as in 2013, the average speed increased 8.01 Mbps over what it was a year prior (18.76 Mbps in 2013). Using the stratified sampling technique,[59] the United States ranked 26th (27.47 Mbps) in average weighted actual download speed in 2014. Though the rank is a drop of one compared to 2013, the speed measurement itself increased by 7.92 Mbps (the 2013 rank was 25th with average speed of 19.55 Mbps). We also compared the United States at the state level with the other IBDR countries in 2014. Nine states appeared in the top quartile in 2014, an increase of one from 2013. The number of states in the bottom quartile was 12 in 2014, a decrease of one.

30.   The Ookla shortfall index, or the percent difference between advertised and actual speeds, changed slightly in the United States, down to 6.2 from 7.15 in 2013.[60] A decrease in a country's shortfall index number means that the country improved in delivering promised speed. Half of the countries surveyed improved in delivering promised speed. The United States moved up one spot in the shortfall index ranking for 2014, to 14th. Though this metric (which is based on self-reported data from

[54] *See Consumer and Governmental Affairs Bureau Seeks Comment on "Need for Speed" Information for Consumers of Broadband Services*, Public Notice, DA 11-661, n.1 (April 11, 2011).

[55] *2016 Broadband Progress Report*, paras. 3, 19, 51.

[56] Since January 2008, Ookla has collected data on over 8 billion speed tests. *See* https://www.ookla.com/. Ookla has discontinued its Net Index, formerly available at http://www.netindex.com.

[57] The Ookla data in our study consists of only fixed broadband connections. Mobile data is not included in the dataset we obtained from Ookla.

[58] We use sample weights (*i.e.*, the number of tests taken) instead of population weights (population in a city). The advantage of using sample weights is that it puts greater weight on speed numbers when they are generated by more tests rather than fewer tests. Using population weights would not achieve this.

[59] A stratified sampling approach divides the sample of cities into different non-overlapping bins according to their population level, and then draws a sample from each bin. If large cities have inherently different broadband characteristics from smaller and sparsely populated cities, then a stratified sample will achieve greater precision than an aggregate ranking.

[60] *See* Appendix F at 143.

consumers) suggests that actual speeds may not meet or exceed advertised speeds in the United States (though to a lesser extent than most of the other countries surveyed), the Commission's most recent Measuring Broadband America report suggests otherwise.[61] Moreover, just as we saw in the *Fourth IBDR*,[62] United States broadband providers appear to be more effective than European providers in delivering (or exceeding) promised broadband speeds to consumers when comparing results of hardware-based speed tests.[63]

31.   As in past reports, we compare other quality measures of broadband connections, including latency and jitter.[64] From 2013 to 2014, latency in the United States decreased from 80.33 ms to 77.66 ms and the U.S. ranking improved from 27th (of 40 countries) to 15th (of 32 countries).[65] All but four countries saw increases in jitter between 2013 and 2014. The United States ranked 24th (of 32 countries) in 2014, compared to 35th (of 40 countries) in 2013.

D.   Broadband Pricing Plans

32.   The BDIA directs the Commission to collect information regarding the price of broadband service capability.[66] We recognize that the complexity in the pricing of residential broadband services makes any empirical analysis difficult. The features and quality of broadband service vary across countries and providers; service is often offered under a multi-part pricing scheme;[67] and broadband is frequently purchased as part of a bundle of services.[68] When broadband is bundled with other services, such as telephone or video service, it becomes even more difficult to identify the price of the broadband service. Promotional offers further complicate comparisons. In our research, we observed that broadband offerings around the world vary with respect to download and upload speeds; type of technology used to deliver broadband services; limitations on use, including limits on upload and download volumes; determinations of use limits (download traffic versus a combination of upload and download traffic versus download traffic at peak/non-peak usage times); and consequences of exceeding usage limits (*e.g.*, access speed reductions, surcharges, service cut-off).

33.   As noted above, with this Report we have elected to use Google's pricing dataset for our international price comparison. Google's fixed broadband dataset contains primarily stand-alone

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[61] *See* 2015 Measuring Broadband America Fixed Broadband Report: A Report on Consumer Fixed Broadband Performance in the United States, rel. Dec. 30, 2015, https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-broadband-america-2015 ("2015 MBA Report").

[62] *See Fourth IBDR*, Appendix F at 15.

[63] *See* Appendix F at 146-48.

[64] Latency (also known as ping) refers to several types of delays typically incurred during network data processing, and is typically measured in milliseconds. Jitter refers to the variance of latency over time, and is measured by the average deviation from the mean latency of the network. When packets of data traveling across the network fail to reach their destination, the phenomenon is termed packet loss. We discuss all three of these characteristics of network quality in more detail in Appendix F.

[65] The only country missing 2014 data that had a better 2013 ranking than the United States was Hong Kong.

[66] *See* 47 U.S.C. § 1303(b)(1).

[67] For example, the broadband service price often includes an installation charge, a monthly service fee, and possibly equipment rental charges.

[68] *See, e.g.*, Scott Wallsten, *Understanding International Broadband Comparisons: 2009 Update (Technology Policy Institute Paper)* June 2009, available at, http://ssrn.com/abstract=1434570 (discussing difficulties in comparing broadband prices due to differing characteristics of broadband services and the tendency of consumers to purchase services in bundles).

broadband plans, and for only 33 of the 40 countries that we typically review.[69] The fixed dataset yielded 619 fixed broadband plans for comparison.[70] Google's mobile broadband dataset includes primarily "wireless Internet" or "Internet on the go" types of data-only plans, and captured smartphone plans only when an operator did not have such a data-only plan.[71] As discussed above, we have supplemented Google's mobile pricing dataset with our own research into pricing plans for smartphones in all 40 countries in our study group.[72] Google's data provided us with 575 mobile post-paid and 405 pre-paid data-only plans in 32 countries and our smartphone research provided 3340 plans in 40 countries (of which 281 were pre-paid, 71 pay-as-you-go, and 2988 post-paid plans.[73]

34.   In Appendix C, we have converted all prices to U.S. dollars based on both purchasing power parity (PPP)[74] and exchange rates.[75] For each broadband service offering (both fixed and mobile), our dataset includes, among others, upload and download speeds as available, allowances on data usage, and information on the types of technology offered, including DSL, cable, fiber-to-the-home, fixed wireless, satellite, and public WiFi, for fixed services, and 3G or 4G for mobile.[76] The mobile dataset also contains certain bundle offers. Because mobile service bundles can have a wide assortment of

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[69] Communications Chambers, Broadband Pricing Database – Explanatory Notes (Fourth Edition), pp. 3-4, December 2014, available at
https://docs.google.com/document/d/18SGpg63RCZEchQ29HZ8ro5D5D1Kjx0DcYN0PLk7-fPA/edit?pli=1.

[70] In this Report, "plans" mean advertised broadband service offerings to consumers. For fixed and mobile broadband plans, Google gathered the data between October and December 2014. For smartphone plans, we gathered the data between April and August 2015. Although the collection of the data extended into 2015, for convenience we refer to the collection of all price data in this Report as "2014" data. Both Google and Commission staff assembled the data by visiting the websites of broadband providers serving the countries and communities in our sample. The price data reflects only what a given provider was offering at the specific point in time its website was accessed.

[71] Communications Chambers, Broadband Pricing Database – Explanatory Notes (Fourth Edition), p. 3, December 2014, available at https://docs.google.com/document/d/18SGpg63RCZEchQ29HZ8ro5D5D1Kjx0DcYN0PLk7-fPA/edit?pli=1.

[72] Although there are 40 comparison countries in total for the smartphone comparison, 33 countries in the fixed broadband comparison, and 32 countries in the mobile data-only comparison, not all countries are represented in every plan type and/or speed tier.

[73] Our raw data included 2988 post-paid plans, but we used 2904 of them for comparison purposes as some contained anomalies or missing elements.

[74] PPPs are currency conversion rates that convert to a common currency and equalize the purchasing power of different currencies. In other words, they eliminate the differences in price levels between countries in the process of conversion.

[75] Exchange rates fluctuate on a daily basis. For the fixed stand-alone and mobile plans (excluding smartphone plans) price conversions, we used the PPP and exchange rates reported by Google in its databases, http://policybythenumbers.blogspot.com/2015/02/global-broadband-pricing-study-updated.html. For the smartphone plan data, we used the "Implied PPP conversion rate" reported by International Monetary Fund in its World Economic Outlook Database for October 2015, https://www.imf.org/external/pubs/ft/weo/2015/02/weodata/index.aspx.

[76] The dataset includes information on advertised monthly recurring charges and nonrecurring charges such as connection and modem/equipment fees, to allow for a more complete pricing analysis of each broadband Internet access service offering. The dataset includes not only advertised price but also promotional discounts such as those associated with online sign-up and longer service contracts.

components, these variations present additional layers of complexity for comparison and analysis.[77] Appendices B and C contain our broadband pricing research. Below we present some of the highlights.

35. *Fixed Broadband*. Our research is based on advertised prices.[78] With regard to unlimited stand-alone fixed broadband pricing, our research indicates that U.S. plan prices range from the middle of the pack to higher than those in other countries surveyed depending on the offered speed. For plans with usage limits, however, U.S. plan prices divided by the number of GB of data allowed tend to be on the lower end.

36. The United States ranked 23rd least expensive out of 33 countries (by PPP) for overall fixed broadband plans (*i.e.*, when considering all fixed plans in the sample together).[79] This is close to the ranking in 2013, when the United States ranked 30th least expensive out of 37 countries for all stand-alone plans. The United States ranks seventh least expensive out of 15 countries for plans with speeds between 1 and 5 Mbps, 16th least expensive out of 27 countries for plans with speeds between 5 and 15 Mbps, and 22nd least expensive out of 30 countries for plans with speeds between 25 and 50 Mbps.[80] For all standalone plans with advertised download speeds of greater than 15 and up to and including 25 Mbps, the average price in the United States rose slightly from $59.40 in 2013 to $59.51 in 2014.[81] In 2013, the United States ranked 24th least expensive of the 30 countries with plans of this type, and ranked 19th least expensive out of 26 countries by this measure in 2014. [82]

37. For stand-alone broadband plans with data usage limits and taking those limits into account by calculating price per GB of data allowed, the United States was the third least expensive in 2014 with a price of $0.22 per GB for plans with speeds less than 25 Mbps out of nine countries.[83] The U.S. ranking was fourth least expensive with $0.33 per GB for plans with speeds greater than 25 Mbps of ten countries.[84] By comparison, Denmark was the least expensive country with $0.08 per GB for plans with speeds less than 25 Mbps and $0.02 per GB for plans with speeds greater than 25 Mbps, and India was the most expensive country with $6.73 per GB for plans with speeds less than 25 Mbps and $2.68 per

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[77] We use monthly and one-time costs and promotional discounts to generate an inclusive monthly estimated cost for service. We used this formula to determine the contract term price:

All-inclusive price for the contract term = (promotional price * number of months promotion lasts) + (standard price * (contract term – number of months promotion lasts)) + installation fee + activation fee + modem rental charge + other fees (incl. line charges) – rebates.

We calculated the monthly rate by dividing contract term rates by contract terms. We also calculated yearly rates by multiplying the monthly rate by 12. Each of the monthly rates in local currency were converted to PPP by applying the PPP adjustment factor.

[78] In cases where Google's fixed data lacked information regarding contract terms, we would make corrections based on our own supplemental research. Google's fixed data is available at https://www.google.com/fusiontables/DataSource?docid=15zECvTc1Sht5W1iQytI42FDQuJAPtMW9-rsjirm6#rows:id=1.

[79] *See* Appendix C, Table 1b.

[80] *See* Appendix C, Tables 2a, 2b, 2d. Rankings are based on averages of plans for all technologies, and as such averages can mask underlying trends. For example, although the United States ranks 18th least expensive out of 26 countries for plans with speeds between 25 and 50 Mbps, when examining only cable plans in this tier, the United States ranks fourth least expensive out of 17 countries. Fiber plan prices raise the overall U.S. average. *See* Appendix C, Table 2d.

[81] *See* Appendix C, Table 2c.

[82] *Id.*

[83] *See* Appendix C, Table 4a.

[84] *See* Appendix C, Table 4b.

GB for plans with speeds greater than 25 Mbps. Countries that have low prices and lower usage limits become expensive on a price per GB basis.

38. We compared countries according to average monthly cost of stand-alone broadband plans with unlimited usage and found that the United States ranks somewhere near the middle for several speed tiers. For example, the United States ranked eighth least expensive of 17 countries for unlimited plans with speeds less than 10 Mbps ($33.12), 19th least expensive out of 29 countries for unlimited plans with speeds greater than 10 Mbps and less than 25 Mbps ($44.99), 15th least expensive out of 29 countries for unlimited plans with speeds less than 25 Mbps ($32.60) and 17th least expensive out of 29 countries for unlimited plans with speeds greater than 25 Mbps and up to 50 Mbps ($52.49).[85]

39. Another useful metric for comparing broadband prices across different countries is the cost per unit of speed. The average price per Mbps in the United States was $4.18 in 2014. By this metric, the United States ranked 27th least expensive out of 33 countries in 2014 when comparing prices by PPP.[86] At $0.26, Hong Kong had the least expensive price per unit of speed for 2014 while India at $21.97 was the most expensive by this measure in 2014.

40. *Mobile Broadband*. Any discussion of mobile broadband pricing data must be prefaced with a word of caution. Mobile broadband pricing plans are complex and every country has different reporting and advertising standards. For example, advertising about the speed of the broadband appears to vary widely across countries. Most foreign carriers only list the theoretical maximum available speeds, *i.e.*, they report 100 Mbps for 4G and 42.2 Mbps for 3G and HSPA+. In contrast, in the United States, the advertised speed for a 3G plan is often 3.1 Mbps and advertised speeds for 4G plans range from 5 Mbps to 42 Mbps. Moreover, 4G/LTE networks are more widespread in the United States than in most of the countries surveyed, but the data do not reflect that a provider's 4G service may have only limited availability (*e.g*., in portions of a few cities). Plus, 3G and 4G/LTE plans are all grouped together. Device discounts and phone plans that have to be purchased along with data plans vary widely by country as well. Phone plans associated with mobile broadband also vary in terms of the number of voice minutes and text messages included in the plans. Also, mobile broadband can be purchased in pre-paid or post-paid plans, and we have data for both types of plans in this Report, available in Appendices B and C.[87] Given these issues, and other limitations, meaningful international comparisons of mobile pricing are extremely difficult. Since pre-paid/pay-as-you-go plans are not easily compared (the amount a user pays depends on how much data is used) to post-paid plans, we treat them separately.[88]

41. *Smartphone plans (post-paid)*. For smartphone plans with usage limits of less than 1 GB per month and limited voice minutes, Israel had the least expensive plans with a monthly average price of $6.08, and Ireland had the most expensive plans with an average monthly $64.54.[89] The United States did not have any plans in this category (same as in 2013).[90] For smartphone plans with data usage limits between 1 and 5 GB and unlimited minutes, the average monthly price for U.S. plans was $93.08 with an average usage limit of 2.38 GB in 2013 (27th least expensive of 28 countries). In 2014, the United States ranked 25th least expensive in this category (though out of 35 rather than 28 countries) while the average

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[85] *See* Appendix C, Tables 4c, 4d, 4e, 4f.

[86] *See* Appendix C, Table 3.

[87] Though Google's raw data is available at http://policybythenumbers.blogspot.com/2015/02/global-broadband-pricing-study-updated.html, our evaluation of this data in the form of data tables is provided in Appendix C. Data tables associated with our smartphone price data are also in Appendix C. The raw smartphone price data is provided in Appendix B.

[88] The raw data for the pre-paid plans is presented in Appendix B.

[89] *See* Appendix C, Table 5a.

[90] *See Fourth IBDR*, Appendix C, Table 7a.

monthly charge dropped to $63.33 (with an average usage limit of 2.15 GB).[91] In 2013, Lithuania had the least expensive average monthly price at $3.31 (for 1.5 GB), while Hungary had the most expensive plan at $129.26 with an average usage limit of 2.5 GB. In 2014, Israel had the least expensive plans in this category with an average monthly cost of $20.75 (3.00 GB usage limit) and Hungary the most expensive plans with an average monthly cost of $125.49 (2.22 GB usage limit).[92] The United States is one of a smaller group of countries with providers that offer smartphone plans with unlimited data and unlimited minutes. Among countries with such plans, the United States ranked 13th least expensive out of 17 countries in 2014 (compared to fourth least expensive out of five countries in 2013).[93] The number of countries with plans with unlimited data and unlimited minutes increased from five in 2013 to 17 in 2014 suggesting that more countries may be moving to fully unlimited plans, which would be a reversal of the trend we observed in the *Fourth IBDR*.[94]

42.   *Mobile data-only plans*. Google's mobile broadband dataset includes 575 post-paid data-only plans (the data do not distinguish between stick modem and tablet plans, as we did in the last IBDR) and 414 pre-paid plans.[95] The United States ranks 23rd least expensive out of 30 countries on price per GB ($24.91) for plans with usage limits less than 5 GB and 23rd least expensive out of 31 countries on price per GB ($7.10) for plans with usage limits greater than 5 GB.[96] Poland has the least expensive price per GB for plans that are below and above 5 GB ($3.57 and $1.12, respectively).[97] Mexico has the highest average cost per GB ($351.44) for plans with usage limits below 5 GB and Japan has the highest cost per GB ($9.31) for plans that have usage limits above 5 GB.[98] With regard to pre-paid plans, the United States ranked 13th least expensive out of 29 countries with a price per GB of $14.01.[99] Finland ranked least expensive with an average price per GB of $1.07 and Bulgaria ranked the most expensive with an average per GB cost of $127.04.[100]

E.   Other Relevant Information and International Developments

43.   ***Community Level Comparison***. In addition to requiring the Commission to gather data on broadband service capability, the BDIA directs the Commission to compare broadband development in communities similar to U.S. communities in terms of population size, density, and topographic profile.[101] Consistent with our approach in previous reports, we provide the most recent publicly available data for each variable in the community dataset in Appendix D. Data for communities not covered by the OECD

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[91] *See* Appendix C, Table 5d.

[92] *See* Appendix C, Table 5d.

[93] *See* Appendix C, Table 5h.

[94] *See Fourth IBDR* at para. 38 (observing that from 2012 to 2013, the number of countries with plans with unlimited data and unlimited minutes decreased from nine to five, suggesting that many countries are moving away from fully unlimited plans).

[95] Google's mobile broadband data included some smartphone plans, which we excluded from our analysis. Google included smartphone plans when other mobile data-only plans were not offered. Also, as we determined with Google's fixed broadband data, some of the mobile plans had one-time charges (such as for equipment) that were mistakenly identified as recurring monthly charges. This would lead to unusually high plan rates when costs are calculated over the course of a year. We corrected these errors when we found them. Also, some pre-paid plan data entries contained anomalies leading to their exclusion from the comparison. *See also supra* n. 73.

[96] *See* Appendix C, Tables 7a, 7b.

[97] *Id.*

[98] *Id.*

[99] *See* Appendix C, Table 8.

[100] *Id.*

[101] BDIA § 103(b)(3); 47 U.S.C. § 1303(b)(3).

and Eurostat datasets are drawn from national statistical agencies, communications ministries, and communications regulators.[102]

44.   ***Relevant Similarities and Differences***. The BDIA also directs the Commission, for the foreign communities selected, to identify "relevant similarities and differences" across several criteria.[103] For each foreign country included in this Report, Commission staff gathered, information on (1) topography, (2) the regulatory environment, including national broadband plans, (3) the market structure, including the number of competitors, (4) broadband penetration, and the types of network technologies deployed, (5) types of applications and services used, and (6) other media, specifically television and radio outlets, available to consumers. Appendix E contains the detailed information on the 39 foreign countries that we selected to use in this Report.

45.   ***Efforts to Improve International Broadband Data***. As we indicated in the previous reports, available data on international broadband are incomplete and generally challenging to compare because of significant gaps and variations in data collection methodologies across countries, limiting the conclusions we can draw from the data. In the *Fourth IBDR*, we detailed steps that the OECD and U.S. Government have taken to standardize broadband metrics.[104] Since then, the OECD and U.S. Government continued to work to standardize broadband metrics.

46.   On September 12, 2014, the Commission hosted an OECD Roundtable entitled "Hedonic Price Analysis of Communication Services," bringing together FCC experts from several bureaus as well as academics, statisticians and data analysts from the U.S. government, universities and international institutions.[105] An early draft of an OECD paper ("Triple- and quadruple-play bundles of communications services") served as the basis for the discussion.[106] The aim of the workshop was two-fold: (i) to learn from past experiences in applying hedonic price analysis to goods and services other than communications and, (ii) to improve and develop tools for hedonic price analysis of communication services, including future research areas.

47.   As a result of this discussion and expert review, in late 2014, OECD delegates agreed to a plan to produce an analysis of broadband services pricing across the OECD economies using a further refined hedonic methodology and a more robust data set. The initial findings were presented in a draft paper in June 2015 for initial review by OECD delegates, and a follow-up expert peer review of this work was conducted at the FCC in September 2015, with over 30 attendees from the FCC, U.S. government,

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[102] Eurostat is the Statistical Office of the European Communities that is tasked to provide the European Union with statistics that enable comparisons between countries and regions. *See* http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/introduction.

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

[104] *Fourth IBDR*, paras. 54-60.

[105] The OECD has been using the baskets methodology for comparing communication prices across countries for over 20 years. As concluded by the OECD project ("Towards a New OECD Metrics Checklist"), hedonic price analysis could complement the OECD baskets by adding a new perspective. A hedonic regression model estimates values for individual characteristics of a product or service. Hedonic models are based on the idea that products or services can be viewed as a bundle of characteristics that are valued by both buyers and sellers. Price represents the value of characteristics of the products or services. *See, e.g.*, Jack E. Triplett, *Economic Interpretation of Hedonic Methods,* Survey of Current Business, Bureau of Economic Analysis, Department of Commerce, January 1986, 36-40; *see also* OECD Glossary of Statistical Terms, available at http://stats.oecd.org/glossary/detail.asp?ID=1225.

[106] The OECD published this paper in June 2015. *See* OECD, Triple and Quadruple Play Bundles of Communication Services (2015), http://www.oecd-ilibrary.org/science-and-technology/triple-and-quadruple-play-bundles-of-communication-services_5js04dp2q1jc-en.

World Bank, and Canadian and Mexican regulatory officials collaborating on a set of final suggestions and observations for the authors to take into account as they finalized the OECD analysis.

48.   At the subsequent Working Party on Communication Infrastructures and Service Policy meeting in December 2015, OECD delegates agreed to publish the final paper in March 2016 (subject to some edits and minor adjustments to the methodology), and also reached consensus on "next steps" for what they viewed as an innovative and interesting work stream. These steps include to begin applying the new methodology, in parallel with the OECD's current broadband services price basket approach, using data provided by a "Beta-test" set of between three to six OECD member economies. Though the United States is a likely candidate, discussion of whether the Commission will participate will occur in early 2016.

IV.   CONCLUSION

49.   In conjunction with the Commission's adoption of the *2016 Broadband Progress Report*, the release of this Report fulfills the obligation imposed by Section 103(b) of the Broadband Data Improvement Act.[107]

V.   PROCEDURAL MATTERS

50.   IT IS ORDERED that, pursuant to Section 103(b) of the Broadband Data Improvement Act, 47 U.S.C. § 1303(b), and pursuant to authority delegated to the International Bureau in Section 0.261 of the Commission's rules, 47 C.F.R. § 0.261, this Report, with its associated Appendices A-G, is ADOPTED.

FEDERAL COMMUNICATIONS COMMISSION

Mindel De La Torre
Chief, International Bureau

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[107] 47 U.S.C. § 1303(b).

FIFTH INTERNATIONAL BROADBAND REPORT

APPENDICES

APPENDIX A: Country List

APPENDIX B: Broadband Price Dataset

APPENDIX C: Broadband Price Tables

APPENDIX D: Demographics Dataset

APPENDIX E: Market and Regulatory Background

APPENDIX F: Comparing International Fixed Broadband Speeds

APPENDIX G: Broadband Deployment Comparison with Europe

APPENDIX A:

Countries Included in the *IBDR*

COUNTRIES	Appendix B: Broadband Price Dataset	Appendix D: Demographics Dataset	Appendix E: Market and Regulatory Background	Appendix F: Actual Broadband Speeds
Australia	X	X	X	X
Austria	X	X	X	X
Belgium	X	X	X	X
Brazil	X		X	X
Bulgaria	X	X	X	X
Canada	X	X	X	X
Chile	X	X	X	X
Czech Republic	X	X	X	X
Denmark	X	X	X	X
Estonia	X	X	X	X
Finland	X	X	X	X
France	X	X	X	X
Germany	X	X	X	X
Greece	X	X	X	X
Hong Kong	X		X	X
Hungary	X	X	X	X
Iceland	X	X	X	X
India	X		X	X
Ireland	X	X	X	X
Israel	X	X	X	X
Italy	X	X	X	X
Japan	X	X	X	X
Korea	X	X	X	X
Lithuania	X	X	X	X
Luxembourg	X	X	X	X
Mexico	X	X	X	X
Netherlands	X	X	X	X
New Zealand	X	X	X	X

COUNTRIES	Appendix B: Broadband Price Dataset	Appendix D: Demographics Dataset	Appendix E: Market and Regulatory Background	Appendix F: Actual Broadband Speeds
Norway	X	X	X	X
Poland	X	X	X	X
Portugal	X	X	X	X
Singapore	X		X	X
Slovakia	X	X	X	X
Slovenia	X	X	X	X
Spain	X	X	X	X
Sweden	X	X	X	X
Switzerland	X	X	X	X
Turkey	X	X	X	X
United Kingdom	X	X	X	X
United States	X	X		X

APPENDIX B

Broadband Price Dataset

Google's fixed dataset and mobile dataset (excluding smartphones) can be found at http://policybythenumbers.blogspot.com/2015/02/global-broadband-pricing-study-updated.html.

The mobile dataset (smartphones) can be found on the FCC website at https://www.fcc.gov/reports-research/reports/international-broadband-data-reports/international-broadband-data-report-3.

APPENDIX C

Broadband Price Tables

Table 1a
Number of Standalone Fixed Broadband Plans

Country	Number of Standalone Fixed Broadband Plans
Australia	66
Austria	16
Belgium	6
Brazil	25
Bulgaria	14
Canada	22
Chile	14
Czech Republic	8
Denmark	19
Finland	7
France	1
Germany	17
Greece	8
Hong Kong	11
Hungary	28
India	64
Israel	7
Italy	8
Japan	28
Korea	14
Mexico	10
Netherlands	7
Poland	21
Portugal	8
Singapore	8
Slovak Republic	13
Slovenia	57
Spain	5
Sweden	24
Switzerland	8
Turkey	37
United Kingdom	13
United States	25

Table 1b
Average Monthly All-Inclusive Standalone Fixed Broadband Plans in U.S. Dollars
(PPP and Exchange Rate Conversion)

Country	Price $ (PPP)	Price $ (Exchange Rate)	Rank (PPP)	Rank (Exchange Rate)
France	18.81	20.13	1	2
Israel	28.05	30.29	2	9
Bulgaria	30.31	13.19	3	1
Spain	33.51	28.98	4	7
Slovak Republic	34.77	22.45	5	4
Austria	35.81	37.93	6	11
Poland	36.65	20.19	7	3
Czech Republic	36.95	23.46	8	5
United Kingdom	37.09	41.59	9	15
Denmark	41.54	54.36	10	23
Germany	41.54	41.21	11	14
Sweden	43.34	52.04	12	21
Netherlands	45.24	47.32	13	19
Greece	45.35	36.93	14	10
Korea	48.52	39.48	15	12
Hungary	52.93	27.62	16	6
Japan	53.50	50.50	17	20
Canada	58.30	64.41	18	25
Singapore	58.64	40.17	19	13
Belgium	61.76	66.25	20	26
Hong Kong	65.17	46.62	21	18
Finland	67.50	79.44	22	28
United States	69.93	69.93	23	27
Mexico	70.52	41.77	24	16
Portugal	73.63	57.02	25	24
Chile	78.76	46.54	26	17
Switzerland	79.15	114.58	27	32
Italy	84.77	81.56	28	29
India	108.08	29.48	29	8
Turkey	109.26	52.63	30	22
Slovenia	124.72	95.51	31	30
Australia	134.70	176.87	32	33
Brazil	146.91	96.44	33	31

Table 2a

**Average Monthly All-Inclusive Price of Standalone Fixed Broadband Plan ($ PPP)
by Technology
Advertised Download Speed >1 to 5<Mbps**

Country	All	Cable	DSL	Fiber	Hybrid	Average Download Speed
Brazil	43.86	43.95	43.83			2.43
Canada	41.71				41.71	5.00
Chile	42.19	40.78			44.99	3.33
Czech Republic	29.54		33.22		25.85	3.00
Greece	38.71		38.71			4.00
Hungary	5.74		35.74			5.00
India	88.52	49.22	98.39	82.57		2.69
Japan	28.81	28.81				1.00
Mexico	43.15		43.15			5.00
Slovak Republic	22.05		24.50		19.60	3.67
Slovenia	46.08		48.85		45.69	2.88
Sweden	11.35		11.35			2.00
Switzerland	24.46		24.46			1.00
Turkey	45.03		45.03			2.50
United States	29.63	27.42	25.41	38.28		2.50

Table 2b

Average Monthly All-Inclusive Price of Standalone Fixed Broadband Plan ($ PPP)
by Technology
Advertised Download Speed >5 to 15≤Mbps

Country	All	Cable	DSL	Fiber	Hybrid	Average Download Speed
Australia	74.32			74.32		12.00
Austria	27.84	20.49	29.31			8.33
Brazil	58.17	68.85	55.50			12.00
Bulgaria	23.42			23.42		15.00
Canada	51.61	57.65	39.34	45.75		12.00
Chile	62.82	61.89			64.69	13.33
Czech Republic	33.26				33.26	6.00
Denmark	26.59	30.45	24.65			11.67
Finland	55.46		26.78		69.80	9.33
Germany	29.17	28.05	30.29			9.00
Hungary	44.59		43.37		45.13	10.16
India	117.32			115.08	118.03	9.43
Israel	25.73	30.12	23.59	23.48		14.00
Italy	50.27		50.27			7.00
Japan	29.83	38.47	28.10			11.33
Mexico	49.90	37.39	62.40			10.00
Netherlands	36.31		36.31			10.00
Poland	28.03	29.64	26.95			10.00
Portugal	38.13		38.13			12.00
Singapore	36.38		36.38			15.00
Slovak Republic	29.40		39.20	19.60		8.00
Slovenia	60.71		69.01		59.42	10.40
Spain	35.25		35.25			10.00
Sweden	21.68		16.32	37.73		9.00
Switzerland	28.78		28.78			15.00
Turkey	52.81		52.81			8.00
United States	43.03	39.97	35.41	49.91		8.20

Table 2c

Average Monthly All-Inclusive Price of Standalone Fixed Broadband Plan ($ PPP)
by Technology
Advertised Download Speed >15 to 25≤Mbps

Country	All	Cable	DSL	Fiber	Hybrid	Average Download Speed
Australia	91.22		108.45	77.67		23.71
Austria	29.52		29.76	29.05		18.67
Brazil	79.72			79.72		25.00
Bulgaria	21.14	19.96		21.73		21.67
Canada	56.70	69.50	42.03		45.75	25.00
Chile	64.71	64.71				20.00
Czech Republic	35.09		44.33	25.85		20.00
Denmark	34.98	37.23	34.23			21.25
Finland	32.16		32.16			20.00
France	18.81		18.81			25.00
Germany	31.18	26.46	30.31		43.22	18.67
Greece	35.65		35.65			24.00
Hungary	52.38		51.32		52.91	18.61
India	191.18			165.99	216.37	16.67
Italy	70.87		60.31	102.55		20.00
Mexico	43.71	43.71				20.00
Netherlands	17.35		17.35			20.00
Poland	35.09		35.09			20.00
Portugal	42.76		42.76			22.00
Slovak Republic	24.53	19.65			29.40	22.50
Slovenia	70.06				70.06	20.56
Spain	21.44	24.74	18.15			20.00
Switzerland	35.32	35.32				20.00
Turkey	59.70		50.79	71.16		19.56
United Kingdom	15.50		15.50			17.00
United States	59.51	44.99		64.35		23.00

Table 2d

Average Monthly All-Inclusive Price of Fixed Standalone Broadband Plan ($ PPP)
by Technology
Advertised Download Speed >25 to 50≤Mbps

Country	All	Cable	DSL	Fiber	Hybrid	Average Download Speed
Australia	83.59			83.59		50.00
Austria	38.96		34.23	43.69		36.25
Belgium	43.65	33.63			47.00	30.00
Brazil	101.36	93.72		37.24	137.23	41.25
Bulgaria	27.31	28.88		26.92		42.00
Canada	71.09	82.26	52.81	55.86		46.00
Chile	75.03	74.55		75.94		40.00
Czech Republic	51.74		51.74			40.00
Denmark	39.59	26.99	45.29		40.79	37.50
Finland	75.18				75.18	50.00
Germany	40.18	33.69	39.50		43.78	50.00
Greece	54.29				54.29	45.00
Hungary	58.02	51.11	59.10		62.65	33.63
India	55.02	55.02				50.00
Israel	27.24		28.11	26.37		40.00
Italy	38.15				38.15	30.00
Japan	35.71	53.17	33.97			44.91
Korea	38.17	38.17				50.00
Mexico	68.72	68.72				50.00
Netherlands	34.09		34.09			45.00
Poland	26.90		26.90			50.00
Portugal	53.11	50.66		55.57		35.00
Slovak Republic	31.46	25.77		29.40	39.20	46.67
Slovenia	103.98				103.98	40.00
Spain	36.45	36.45				50.00
Sweden	58.92	80.29	37.55			40.00
Switzerland	42.84	38.91	46.78			45.00
Turkey	162.27			162.27		44.00
United Kingdom	31.67	44.96	27.98	13.67	26.78	42.8
United States	62.17	34.99		75.76		48.33

Table 3

Average Price of Fixed Standalone Plans (US$ and PPP) per Mbps of download Speed by Country, 2014

Country	$/Mbps	$PPP/Mbps
Australia	4.09	3.12
Austria	2.05	1.94
Belgium	1.34	1.25
Brazil	12.55	19.12
Bulgaria	0.35	0.79
Canada	2.77	2.51
Chile	2.90	4.91
Czech Republic	2.73	4.31
Denmark	1.64	1.25
Finland	3.89	3.31
France	0.81	0.75
Germany	1.36	1.37
Greece	1.96	2.41
Hong Kong	0.19	0.26
Hungary	1.43	2.74
India	5.99	21.97
Israel	1.18	1.09
Italy	2.83	2.94
Japan	1.88	1.99
Korea	0.31	0.38
Mexico	1.69	2.85
Netherlands	1.12	1.07
Poland	0.59	1.08
Portugal	1.17	1.51
Singapore	0.35	0.51
Slovak Republic	1.63	2.52
Slovenia	6.59	8.61
Spain	1.20	1.39
Sweden	2.75	2.29
Switzerland	5.81	4.01
Turkey	2.70	5.62
United Kingdom	0.76	0.68
United States	4.18	4.18

Table 4a

Standalone Fixed Broadband Plans with Usage Limits – Download Speed <25Mbps

Country	Average Monthly Price ($PPP)	Average Download Speed	Price per GB ($PPP/GB)	Data Limit	Plan Count	Average Monthly Price Rank	Price per GB Rank
Denmark	33.85	17.50	0.08	450.00	2	3	1
Germany	33.09	12.00	0.21	200.00	2	2	2
United States	54.23	12.60	0.22	250.00	5	7	3
Australia	90.97	14.73	0.65	345.91	22	8	4
Canada	40.76	11.00	0.76	84.00	5	4	5
Brazil	52.25	4.00	1.75	40.00	3	6	6
United Kingdom	19.59	17.00	1.96	10.00	1	1	7
Turkey	45.23	14.27	3.96	39.32	22	5	8
India	105.67	7.22	6.73	45.62	50	9	9

Table 4b

Standalone Fixed Broadband Plans with Usage Limits – Download Speed ≥25Mbps

Country	Average Monthly Price ($PPP)	Average Download Speed	Price per GB ($PPP/GB)	Data Limit	Plan Count	Average Monthly Price Rank	Price per GB Rank
Denmark	35.40	75.00	0.02	1650.00	6	2	1
Germany	76.15	75.00	0.18	400.00	2	5	2
Canada	68.44	102.86	0.26	438.57	14	4	3
United States	81.53	45.00	0.33	250.00	1	6	4
Belgium	46.70	36.00	0.40	140.00	5	3	5
Turkey	84.38	60.00	0.56	162.50	6	8	6
Brazil	291.12	177.50	1.15	237.50	4	10	7
Australia	84.14	58.33	1.25	276.15	39	7	8
United Kingdom	26.78	38.00	1.34	20.00	1	1	9
India	88.67	55.56	2.68	33.33	9	9	10

Table 4c

Standalone Fixed Broadband Plans with Unlimited Usage – Download Speed <10Mbps

Rank	Country	Average Monthly Price ($PPP)	Average Download Speed	Plan Count
1	Slovak Republic	22.05	4.25	4
2	Switzerland	24.46	1.00	1
3	Finland	26.78	8.00	1
4	Austria	29.31	8.00	5
5	Japan	30.73	4.50	2
6	Czech Republic	30.78	4.00	3
7	Sweden	32.39	5.00	4
8	United States	33.12	4.00	5
9	Hungary	35.74	5.00	2
10	Greece	38.71	4.00	1
11	Chile	42.19	3.33	3
12	Mexico	43.15	5.00	1
13	Brazil	44.85	2.27	7
14	Slovenia	46.11	3.44	18
15	Italy	50.27	7.00	1
16	Turkey	76.49	6.00	4
17	India	111.78	1.66	5

Table 4d

Standalone Fixed Broadband Plans with Unlimited Usage – Download Speed ≥10 to ≤25 Mbps

Rank	Country	Average Monthly Price ($PPP)	Average Download Speed	Plan Count
1	United Kingdom	13.45	17.00	2
2	France	18.81	25.00	1
3	Bulgaria	22.05	19.00	5
4	Israel	25.73	14.00	3
5	Spain	26.05	16.67	3
6	Netherlands	26.83	15.00	2
7	Austria	27.26	16.50	4
8	Slovak Republic	29.50	18.33	3
9	Germany	29.87	17.17	6
10	Japan	29.98	12.00	5
11	Poland	30.04	12.86	7
12	Denmark	30.40	17.00	5
13	Sweden	32.00	10.00	2
14	Switzerland	32.05	17.50	2
15	Czech Republic	35.09	20.00	2
16	Greece	35.65	24.00	3
17	Singapore	36.38	15.00	1
18	Portugal	40.47	18.67	3
19	United States	44.99	20.00	3
20	Mexico	46.80	15.00	4
21	Hungary	48.49	14.39	12
22	Finland	57.26	13.33	3
23	Brazil	60.35	15.00	5
24	Chile	63.29	15.00	4
25	Slovenia	65.84	14.77	22
26	Australia	69.81	19.00	3
27	Italy	70.87	20.00	4
28	Canada	119.21	17.50	2
29	Turkey	203.06	24.00	1

Table 4e

Standalone Fixed Broadband Plans with Unlimited Usage – Download Speed <25 Mbps

Rank	Country	Average Monthly Price ($PPP)	Average Download Speed	Plan Count
1	United Kingdom	13.45	17.00	2
2	Bulgaria	22.58	17.50	4
3	Israel	25.73	14.00	3
4	Spain	26.05	16.67	3
5	Slovak Republic	26.13	7.83	6
6	Netherlands	26.83	15.00	2
7	Austria	28.40	11.78	9
8	Denmark	29.09	15.00	4
9	Switzerland	29.52	12.00	3
10	Poland	30.04	12.86	7
11	Japan	30.20	9.86	7
12	Germany	30.77	15.60	5
13	Sweden	32.26	6.67	6
14	Czech Republic	32.51	10.40	5
15	United States	32.60	5.00	6
16	Singapore	36.38	15.00	1
17	Greece	36.41	19.00	4
18	Portugal	40.47	18.67	3
19	Mexico	46.07	13.00	5
20	Hungary	46.67	13.05	14
21	Brazil	48.72	5.99	11
22	Finland	49.64	12.00	4
23	Chile	54.25	10.00	7
24	Slovenia	56.27	9.28	39
25	Italy	66.75	17.40	5
26	Australia	68.71	16.00	2
27	Turkey	101.80	9.60	5
28	India	111.78	1.66	5
29	Canada	117.19	10.00	1

Table 4f

Standalone Fixed Broadband Plans with Unlimited Usage – Download Speed ≥25 to 50 Mbps

Rank	Country	Average Monthly Price ($PPP)	Average Download Speed	Plan Count
1	France	18.81	25.00	1
2	Bulgaria	26.09	39.17	6
3	Poland	26.90	50.00	1
4	Israel	27.24	40.00	2
5	Slovak Republic	28.57	41.25	4
6	United Kingdom	32.89	44.00	4
7	Netherlands	34.09	45.00	2
8	Japan	35.71	44.91	11
9	Germany	36.17	43.75	4
10	Spain	36.45	50.00	1
11	Italy	38.15	30.00	1
12	Korea	38.17	50.00	4
13	Austria	38.96	36.25	4
14	Denmark	42.62	37.14	7
15	Switzerland	42.84	45.00	2
16	Czech Republic	51.74	40.00	1
17	United States	52.49	37.50	4
18	Portugal	53.11	35.00	2
19	Greece	54.29	45.00	4
20	Hungary	58.01	33.63	9
21	Sweden	58.92	40.00	4
22	Mexico	68.72	50.00	2
23	Australia	73.67	37.50	2
24	Chile	75.01	40.00	3
25	Finland	75.18	50.00	2
26	Brazil	97.86	40.00	4
27	Slovenia	101.50	38.13	8
28	Canada	128.31	37.50	2
29	Turkey	285.01	42.50	2

Table 4g

Standalone Fixed Broadband Plans with Unlimited Usage – Download Speed > 50 Mbps

Rank	Country	Average Monthly Price ($PPP)	Average Download Speed	Plan Count
1	Israel	32.35	100.00	2
2	Czech Republic	40.67	80.00	2
3	Poland	40.95	147.69	13
4	Slovak Republic	44.13	233.33	3
5	Bulgaria	44.37	112.50	4
6	Italy	46.18	100.00	2
7	Japan	46.79	756.00	10
8	Germany	47.31	125.00	4
9	Korea	49.45	460.00	10
10	Spain	52.96	100.00	1
11	Austria	53.82	108.33	3
12	United Kingdom	55.47	116.00	5
13	Sweden	57.86	358.57	14
14	Hungary	61.31	132.00	5
15	Singapore	61.82	371.43	7
16	Netherlands	64.95	226.67	3
17	Hong Kong	65.17	481.82	11
18	Australia	81.95	100.00	1
19	Belgium	82.96	120.00	1
20	Portugal	96.30	133.33	3
21	Switzerland	109.89	158.33	3
22	United States	109.99	208.89	9
23	Mexico	112.47	133.33	3
24	Finland	123.58	100.00	1
25	Chile	124.48	107.50	4
26	Brazil	142.24	150.00	3
27	Slovenia	410.26	248.00	10
28	Turkey	731.20	550.00	2

Table 5a

Smartphone Data Plans with Usage Limits: <1 GB and Limited Minutes[1]

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Aver-age Month-ly Price ($PPP)	Data Cap	Advertised Download Speed	Average Minutes	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	1	Israel	24	6	0.25		200.00	6.08	6.08	2.00
2	13	New Zealand	26	20	0.75	7.20	300.00	19.75	19.75	1.00
3	3	Portugal	32	10	0.33		90.91	0.42	20.98	11.00
4	10	Norway	33	17	0.50	6.00	150.00	16.63	16.63	1.00
5	7	Switzerland	36	14	0.43	153.60	5.00	7.38	24.77	12.00
6	8	Spain	53	15	0.50	200.00	0.00	10.43	17.81	6.00
7	28	Chile	63	43	0.70	20.00	160.00	40.76	46.20	2.00
8	15	Mexico	65	25	0.42		236.67	18.18	36.25	12.00
9	22	Hong Kong	68	34	0.50		1400.00	27.82	35.78	4.00
10	18	Australia	72	27	0.40	40.00	350.00	26.39	27.78	2.00
11	27	Sweden	78	39	0.50	100.00	0.00	38.77	38.77	1.00
12	24	United Kingdom	78	35	0.44	30.00	472.73	7.16	265.04	22.00
13	17	Turkey	83	27	0.34		450.00	19.84	33.33	4.00
14	6	Iceland	88	13	0.27	100.00	110.00	7.55	22.10	5.00
15	9	Germany	91	16	0.24	71.10	108.33	9.51	32.99	12.00
16	4	Luxembourg	92	12	0.31		60.00	6.52	20.65	10.00
17	12	Poland	95	19	0.33		131.80	5.61	28.03	10.00
18	31	Brazil	95	48	0.50	4.00	45.00	40.61	54.88	4.00
19	14	Slovenia	97	21	0.26	7.47	257.14	14.74	24.82	7.00
20	11	Italy	102	19	0.33	100.00	353.33	7.98	25.27	3.00
21	32	India	113	48	0.48	15.72	4638.46	19.85	66.30	13.00
22	23	Hungary	114	34	0.33	16.60	106.00	20.51	60.93	10.00
23	33	Singapore	120	49	0.40	275.00	250.00	32.94	80.52	6.00
24	35	Ireland	129	65	0.50		400.00	64.54	64.54	1.00
25	16	Netherlands	141	26	0.42	25.00	154.00	6.93	33.56	5.00
26	21	Austria	174	32	0.30	4.50	1000.00	27.52	36.19	2.00
27	25	Korea	178	36	0.42	300.00	159.21	17.77	111.36	131.00
28	29	Canada	181	46	0.28	110.00	420.00	41.02	57.42	5.00
29	5	Belgium	194	13	0.20	105.60	135.00	8.35	21.36	6.00
30	34	Greece	321	54	0.26	222.60	894.23	34.90	81.17	52.00
31	26	Czech Republic	372	37	0.10	226.00	175.00	25.70	50.52	16.00

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[1] The United States did not have any plans in this category.

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Aver-age Month-ly Price ($PPP)	Data Cap	Advertis ed Downloa d Speed	Average Minutes	Min Average Monthly Price	Max Average Monthly Price	Plan Count
32	30	France	382	47	0.23	170.87	222.86	14.57	650.04	28.00
33	2	Lithuania	887	9	0.01	200.00	250.00	5.71	12.04	4.00
34	19	Slovakia	1228	29	0.24		72.86	8.23	50.32	21.00
35	20	Bulgaria	6768	30	0.29	42.00	502.35	5.64	96.68	34.00

Table 5b

Smartphone Data Plans with Usage Limits: <1 GB and Unlimited Minutes

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	2	Poland	40.36	20.18	0.50		20.18	20.18	1
2	6	Australia	55.56	27.78	0.50		27.78	27.78	1
3	7	India	56.77	28.38	0.50	3.10	28.38	28.38	2
4	12	Sweden	62.60	31.30	0.50	39.00	5.60	51.29	4
5	13	Brazil	64.76	32.38	0.50	5.00	26.89	37.87	4
6	14	Japan	76.25	34.68	0.52	142.50	26.16	38.56	5
7	9	Germany	85.38	29.62	0.40	78.37	17.08	45.67	6
8	10	Korea	87.54	30.43	0.40	300.00	15.40	45.02	18
9	5	Netherlands	95.92	24.77	0.43	50.00	1.28	38.49	6
10	3	Portugal	100.77	20.22	0.24	21.60	4.86	42.11	6
11	4	Norway	111.07	22.21	0.20	6.00	22.21	22.21	1
12	19	Slovakia	118.66	59.33	0.50		52.49	62.80	6
13	1	United Kingdom	121.78	12.18	0.10		12.18	12.18	1
14	20	Mexico	125.71	62.86	0.50		42.31	83.40	2
15	18	Canada	151.84	57.45	0.41	110.00	41.87	66.48	14
16	16	United States	161.11	48.33	0.30		45.00	61.67	10
17	21	Hungary	172.05	83.26	0.48	36.60	38.05	114.31	11
18	11	Italy	229.94	30.81	0.20		23.94	38.56	6
19	22	France	449.06	98.46	0.36	242.64	11.54	657.33	31
20	15	Czech Republic	475.65	41.73	0.13	198.33	25.70	66.13	12
21	8	Lithuania	801.53	29.15	0.16	200.00	14.57	43.72	4
22	17	Belgium	1073.43	53.67	0.05	90.00	53.67	53.67	1

Table 5c

Smartphone Data Plans with Usage Limits: ≥1 to <5 GB and Limited Minutes[2]

$per GB Rank	Aver-age Month-ly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Average Minutes	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	1	Denmark	4.33	12.98	3.00		360.00	12.98	12.98	1
2	2	Israel	4.80	14.40	3.00		5000.00	11.96	16.84	4
3	9	Iceland	9.21	27.64	3.00	100.00	250.00	27.64	27.64	1
4	3	Lithuania	9.48	15.45	1.75	233.33	291.67	14.10	18.86	12
5	20	Sweden	11.69	46.77	4.00	100.00	0.00	46.77	46.77	1
6	13	Poland	13.45	33.63	2.50		200.00	33.63	33.63	1
7	8	Italy	14.04	27.48	2.13	100.00	713.33	6.65	51.86	9
8	11	Belgium	15.99	28.12	1.85	117.00	212.31	10.35	60.02	13
9	4	Switzerland	16.09	19.09	1.34	226.80	6.00	12.51	33.03	10
10	5	Portugal	16.67	21.97	1.43		71.43	17.06	27.48	7
11	18	Austria	17.09	44.23	2.67	17.33	1666.67	24.13	60.31	3
12	19	Turkey	18.30	44.62	2.88	7.20	984.69	22.22	83.33	49
13	27	Singapore	19.57	64.18	3.30	255.00	260.00	48.24	98.02	10
14	6	Luxembourg	19.58	22.27	1.57	225.00	328.57	6.52	38.04	14
15	7	Slovenia	20.43	26.03	1.40	10.00	1240.00	24.67	31.29	5
16	10	Spain	23.63	28.06	1.20	212.50	91.67	16.39	37.26	12
17	22	Chile	26.39	53.56	2.29	14.86	350.00	27.15	81.53	14
18	12	New Zealand	27.11	31.68	1.19	7.20	375.00	26.57	47.00	4
19	17	Bulgaria	27.20	40.96	1.56	42.00	1388.89	32.00	47.98	18
20	14	Ireland	28.15	37.94	1.50		250.00	36.72	39.17	4
21	15	Netherlands	29.16	38.40	1.52	30.00	154.00	9.39	65.17	10
22	21	Korea	29.81	48.79	1.77	300.00	228.49	22.51	71.08	131
23	16	Australia	30.79	40.51	1.50	80.00	454.67	34.72	48.61	3
24	26	India	33.12	61.59	2.08	15.58	4760.61	19.91	87.63	33
25	23	United Kingdom	38.45	53.71	1.81	52.50	814.29	14.33	197.71	21
26	25	Canada	44.91	60.57	1.50	110.00	300.00	53.84	65.80	10
27	24	Slovakia	45.13	55.58	1.33		216.67	42.18	62.69	6
28	29	Mexico	45.59	72.04	1.65		838.64	33.82	169.60	44
29	28	Hong Kong	49.65	70.13	1.79	42.00	2552.94	25.36	308.79	17
30	30	Brazil	54.46	115.07	2.33	3.40	265.00	53.62	213.34	36
31	32	Greece	86.86	152.08	2.03	254.47	1718.42	81.17	286.53	38
32	31	France	107.68	147.99	1.43	148.14	175.71	4.25	657.33	28

[2] The United States did not have any plans in this category.

Table 5d

Smartphone Data Plans with Usage Limits: ≥1 to <5 GB and Unlimited Minutes

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	1	Israel	6.92	20.75	3.00		20.75	20.75	2
2	2	Denmark	7.93	22.59	3.00		12.98	29.38	5
3	5	Sweden	10.52	28.68	3.00	33.00	3.33	57.00	5
4	3	Lithuania	12.69	22.91	2.31	225.00	16.00	31.05	16
5	4	Japan	13.26	28.19	2.29	166.07	9.05	74.60	14
6	6	New Zealand	13.60	30.31	2.25	7.20	13.62	40.19	4
7	9	Norway	15.34	31.52	2.50	16.67	22.21	38.96	9
8	19	Australia	15.63	49.48	3.25	40.00	41.67	55.56	8
9	17	Spain	18.55	48.42	2.63	262.50	46.13	49.18	8
10	21	Belgium	18.63	52.34	2.80	119.25	31.21	90.04	5
11	8	Netherlands	19.71	31.34	1.75	40.00	1.03	49.57	12
12	11	Germany	20.79	37.13	2.00	131.94	17.00	70.49	16
13	10	Poland	20.88	33.73	1.85		16.82	72.87	13
14	7	Switzerland	24.88	31.22	1.50	200.33	23.02	38.04	8
15	16	Korea	25.62	47.69	2.16	300.00	21.32	81.74	39
16	22	Bulgaria	26.66	55.99	2.33	42.00	47.98	64.00	12
17	12	Slovenia	27.80	41.34	2.00	17.44	33.94	49.59	11
18	31	Chile	29.38	86.93	3.08	20.00	70.63	108.67	6
19	32	Austria	31.53	90.34	3.00	28.71	51.76	285.66	7
20	18	Ireland	32.64	48.96	1.50	75.00	48.96	48.96	1
21	23	United Kingdom	32.95	57.29	2.33	46.36	17.19	173.34	40
22	29	Czech Republic	33.35	76.91	2.55	205.95	48.25	117.68	42
23	15	Iceland	33.91	43.63	1.67	100.00	43.57	43.74	3
24	14	Portugal	33.97	43.59	1.33	21.60	12.99	66.65	6
25	25	United States	37.45	63.33	2.15	110.00	45.00	85.00	26
26	27	Canada	40.30	72.63	2.30	110.00	54.18	91.09	27
27	28	Mexico	40.35	75.67	2.08		36.37	121.11	12
28	26	Hong Kong	42.81	64.15	1.75	300.00	37.51	81.10	10
29	13	Ireland	42.84	42.84	1.00	75.00	42.84	42.84	1
30	24	Italy	43.63	59.61	2.03	100.00	26.99	165.29	12
31	30	Slovakia	46.78	83.07	2.33		73.11	92.78	6
32	20	India	51.13	51.13	1.00	3.10	51.13	51.13	2
33	33	France	51.41	109.99	2.28	183.72	17.62	668.26	72

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
34	35	Hungary	69.45	125.49	2.22	34.00	91.43	141.76	9
35	34	Singapore	94.55	115.82	1.25	300.00	104.05	127.58	4

Table 5e
Smartphone Data Plans with Usage Limits: ≥5 GB and Limited Minutes[3]

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Adver-tised Down-load Speed	Average Minutes	Min Aver-age Month-ly Price	Max Aver-age Month-ly Price	Plan Count
1	4	Denmark	1.98	20.55	12.00		840.00	18.23	21.70	3
2	1	Luxembourg	2.03	12.32	8.33		60.00	6.52	23.91	6
3	3	Netherlands	2.38	20.17	9.00		120.00	16.78	23.55	2
4	10	Sweden	3.26	69.62	25.33	100.00	0.00	58.19	81.04	3
5	2	Israel	3.37	16.84	5.00		5000.00	14.40	19.28	4
6	5	Ireland	4.90	24.48	5.00	75.00	0.00	24.48	24.48	1
7	23	France	5.04	251.88	50.00	35.00	120.00	14.58	602.54	6
8	6	Portugal	6.73	33.65	5.00		0.00	33.32	33.90	3
9	7	Spain	7.15	35.77	5.00	75.00	200.00	28.32	43.22	4
10	14	Korea	8.69	79.85	28.44	300.00	478.44	22.51	142.16	64
11	8	Italy	9.39	47.87	5.10		500.00	47.87	47.87	1
12	12	United Kingdom	9.49	75.93	8.00		600.00	41.55	141.83	3
13	9	Australia	11.00	65.97	6.00	100.00	683.00	65.97	65.97	1
14	15	Hong Kong	11.35	82.06	7.45		3772.73	50.39	113.93	11
15	11	Austria	12.06	72.38	6.00	42.00	3000.00	72.38	72.38	1
16	20	Chile	12.42	121.37	9.50	14.00	1333.33	51.61	190.23	12
17	13	Singapore	12.74	76.07	6.47	192.80	340.00	23.94	121.58	15
18	17	Bulgaria	13.43	91.65	6.67	42.00	7333.33	63.98	146.98	6
19	16	Turkey	14.46	83.25	5.80	7.20	3590.00	45.14	110.32	20
20	18	India	16.92	109.01	6.64	19.47	6666.67	86.68	227.46	21
21	19	Switzerland	22.65	113.24	5.00	21.00	0.00	113.24	113.24	2
22	21	Brazil	29.81	208.38	7.00	3.67	650.00	137.76	310.65	12
23	22	Greece	30.66	238.10	8.00	300.00	6666.67	194.81	324.68	6

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[3] The United States did not have any plans in this category.

Table 5f

Smartphone Data Plans with Usage Limits: ≥5 GB and Unlimited Minutes

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	4	Denmark	2.79	33.64	20.70		18.23	62.16	27
2	11	Sweden	2.84	58.23	31.71	57.18	11.31	102.72	17
3	3	Lithuania	4.00	30.84	8.67	200.00	17.75	43.56	6
4	2	Japan	4.06	30.51	10.47	156.62	9.05	105.60	34
5	1	Israel	4.06	28.88	7.50		24.16	43.02	8
6	26	Portugal	4.51	102.92	25.00	21.60	97.40	113.80	3
7	7	Slovenia	5.10	41.05	10.00	150.00	33.94	46.34	5
8	12	Norway	5.20	60.17	13.80	38.00	38.96	83.61	5
9	5	Netherlands	5.45	35.79	7.78	52.00	1.03	88.26	9
10	8	Switzerland	5.77	46.46	8.33	300.00	33.78	60.56	6
11	6	Luxembourg	5.84	38.24	8.00	225.00	21.63	71.74	10
12	25	Germany	7.73	99.84	13.00	154.17	28.30	255.07	12
13	14	United Kingdom	7.92	69.37	10.94	46.13	20.06	163.31	33
14	10	Belgium	8.25	55.39	7.00	121.20	41.67	70.83	5
15	22	Korea	9.08	85.55	12.21	300.00	11.85	152.82	116
16	21	Ireland	9.27	79.00	9.45	75.00	61.20	97.92	11
17	9	Poland	9.34	50.74	5.44		28.03	78.48	9
18	13	Australia	9.74	66.41	7.00	64.00	41.67	90.28	8
19	36	United States	10.19	256.79	29.67	19.38	45.00	805.00	180
20	17	Iceland	10.28	70.93	7.50		63.66	78.20	4
21	16	Hong Kong	10.40	70.65	7.00		58.01	82.32	4
22	19	New Zealand	10.76	72.55	6.94	7.20	47.00	101.50	8
23	18	Austria	10.91	71.01	6.80	128.40	57.67	75.88	5
24	28	Czech Republic	11.73	117.25	10.00	211.67	88.90	137.93	12
25	15	Spain	11.81	70.02	6.00	200.00	59.54	87.93	6
26	29	Canada	11.96	119.12	11.44	110.00	86.99	205.09	27
27	20	Ireland	12.24	73.44	6.00	75.00	73.44	73.44	1
28	24	Bulgaria	13.15	95.99	7.67	42.00	79.98	112.00	12
29	23	Turkey	15.28	91.67	6.00	7.20	79.86	103.47	4
30	32	France	15.80	152.86	12.37	264.46	7.28	645.07	76
31	27	Italy	15.93	110.00	8.20	100.00	46.54	178.59	5
32	30	Chile	16.37	126.34	8.00	7.00	97.80	171.18	6
33	31	Slovakia	16.56	130.38	8.43		83.42	207.13	14

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
34	34	Singapore	21.76	230.74	10.50	225.00	121.55	282.73	4
35	33	Brazil	25.35	171.24	6.50	4.00	48.85	310.65	16
36	35	Mexico	40.39	242.33	6.00		242.33	242.33	2

Table 5g

Smartphone Data Plans with Usage Limits: Unlimited Data and Limited Minutes[4]

Average Monthly Price Rank	Country	Average Monthly Price ($PPP)	Advertised Download Speed	Average Minutes	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	Mexico	1.21		10.00	1.21	1.21	2
2	Luxembourg	3.26	225.00	0.00	1.09	5.43	4
3	Lithuania	9.49	300.00	216.67	2.54	19.49	12
4	Switzerland	12.51	300.00	0.00	12.51	12.51	4
5	Iceland	13.13	100.00	550.00	12.40	13.85	2
6	France	14.41	143.03	111.43	9.71	19.43	14
7	Finland	21.02	46.67	0.00	16.14	26.98	6
8	Japan	26.17		202.00	7.20	64.91	13
9	Ireland	50.68		314.29	31.10	67.32	7
10	Korea	53.04		348.53	3.91	111.36	68
11	Estonia	55.88	300.00	270.00	28.92	97.32	10
12	United Kingdom	57.65		520.00	24.50	141.83	5

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[4] The United States did not have any plans in this category.

Table 5h

Smartphone Data Plans with Usage Limits: Unlimited Data and Unlimited Minutes

Average Monthly Price Rank	Country	Average Monthly Price ($PPP)	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	Sweden	12.17	38.33	3.31	17.02	4
2	Japan	18.46	150.00	9.05	30.63	9
3	France	18.89	47.93	17.00	22.66	3
4	Lithuania	23.57	300.00	13.46	41.68	6
5	Portugal	24.39		24.39	24.39	1
6	Iceland	29.04		15.86	36.64	4
7	Poland	40.92		39.24	42.60	2
8	Luxembourg	41.85		35.87	47.83	4
9	India	46.87	3.10	46.87	46.87	2
10	Ireland	55.81		24.48	85.68	5
11	Estonia	60.86		53.51	69.14	3
12	United Kingdom	63.35		12.89	141.83	5
13	United States	75.91	110.00	11.00	96.00	11
14	Korea	87.96	300.00	14.69	118.35	17
15	Austria	102.53	150.00	102.53	102.53	1
16	Slovenia	158.54	150.00	31.29	314.55	5
17	Switzerland	311.33	112.02	15.02	1275.53	32

Table 6a

Smartphone Data Plans with Usage Limits: <1 GB, Limited Text/SMS[5]

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Average Text/SMS	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	1	Israel	24.31	6.08	0.25		200.00	6.08	6.08	2
2	4	Switzerland	30.85	11.13	0.40	7.20	0.00	7.38	14.89	4
3	3	Portugal	31.77	10.21	0.33		90.91	0.42	20.98	11
4	8	Poland	33.18	14.80	0.45		19.40	5.61	22.42	5
5	10	Norway	33.27	16.63	0.50	6.00	150.00	16.63	16.63	1
6	9	Spain	52.99	15.13	0.50	200.00	0.00	10.43	17.81	6
7	25	Chile	62.84	43.48	0.70	20.00	700.00	40.76	46.20	2
8	13	Mexico	65.44	24.97	0.42		163.33	18.18	36.25	12
9	22	Hong Kong	67.57	33.79	0.50		15.00	27.82	35.78	4
10	17	Turkey	82.67	26.59	0.34		150.00	19.84	33.33	4
11	16	Australia	87.96	26.39	0.30	40.00	1000.00	26.39	26.39	1
12	5	Luxembourg	92.32	12.17	0.31		848.00	6.52	20.65	10
13	12	Slovenia	97.32	20.50	0.26	7.47	714.29	14.74	24.82	7
14	6	Germany	102.42	13.35	0.16	63.88	137.50	9.51	18.05	8
15	21	Singapore	110.71	33.21	0.30	300.00	500.00	32.94	33.35	3
16	27	India	112.85	48.07	0.48	15.72	638.46	19.85	66.30	13
17	26	Hungary	119.74	45.60	0.40	15.50	32.00	20.51	106.68	10
18	7	Iceland	125.75	14.48	0.13		133.33	7.55	22.10	3
19	29	Ireland	129.08	64.54	0.50		400.00	64.54	64.54	1
20	15	Netherlands	146.82	25.63	0.34	50.00	210.00	1.28	34.79	5
21	14	Italy	162.40	25.27	0.26	100.00	195.00	7.98	31.91	8
22	19	Austria	173.78	31.85	0.30	4.50	525.00	27.52	36.19	2
23	24	Korea	193.31	35.29	0.38	300.00	754.90	17.77	111.36	106
24	20	France	210.53	32.79	0.20	21.60	250.00	30.36	35.22	4
25	28	Greece	320.54	54.16	0.26	222.60	658.27	34.90	81.17	52
26	11	Belgium	344.14	17.21	0.05	90.00	300.00	13.06	21.36	2
27	2	Lithuania	887.31	8.87	0.01	200.00	5000.00	5.71	12.04	4
28	23	Slovakia	1335.90	34.18	0.25		23.68	8.23	62.80	19
29	18	Bulgaria	8830.59	30.07	0.24	42.00	0.00	5.64	96.68	26

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[5] The United States did not have any plans in this category.

Table 6b

Smartphone Data Plans with Usage Limits: <1 GB, Unlimited Text/SMS

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	4	New Zealand	26.34	19.75	0.75	7.20	19.75	19.75	1
2	1	Iceland	31.96	11.45	0.48	100.00	9.11	13.78	2
3	2	Switzerland	38.04	15.89	0.44	300.00	11.26	24.77	8
4	10	Australia	55.56	27.78	0.50	40.00	27.78	27.78	2
5	12	India	56.77	28.38	0.50	3.10	28.38	28.38	2
6	14	Sweden	65.59	32.80	0.50	51.20	5.60	51.29	5
7	11	Bulgaria	66.63	27.98	0.45	42.00	23.98	31.98	8
8	22	Chile	72.42	43.45	0.60	7.00	43.45	43.45	1
9	16	Japan	76.25	34.68	0.52	142.50	26.16	38.56	5
10	9	Germany	78.06	26.79	0.40	81.24	11.35	45.67	10
11	15	United Kingdom	79.55	34.04	0.43	30.00	7.16	265.04	23
12	21	Brazil	80.13	40.06	0.50	4.50	26.89	54.88	8
13	8	Netherlands	90.90	25.35	0.50	25.00	6.93	38.49	6
14	5	Portugal	100.77	20.22	0.24	21.60	4.86	42.11	6
15	17	Korea	101.54	36.46	0.50	300.00	15.40	45.02	43
16	6	Norway	111.07	22.21	0.20	6.00	22.21	22.21	1
17	25	Mexico	125.71	62.86	0.50		42.31	83.40	2
18	26	Singapore	129.58	64.79	0.50	250.00	33.31	80.52	3
19	7	Poland	137.33	22.42	0.26		19.62	28.03	6
20	19	Slovakia	139.04	38.59	0.40		30.93	50.32	8
21	23	United States	153.61	53.75	0.36	19.60	20.00	85.00	20
22	24	Canada	159.39	54.51	0.38	110.00	41.02	66.48	19
23	27	Hungary	166.80	72.65	0.42	34.00	20.51	114.31	11
24	3	Belgium	310.22	19.61	0.23	109.50	8.35	53.67	5
25	18	Italy	385.64	38.56	0.10		38.56	38.56	1
26	20	Czech Republic	416.36	39.14	0.11	214.14	25.70	66.13	28
27	28	France	432.04	77.23	0.31	222.18	11.54	657.33	55
28	13	Lithuania	801.53	29.15	0.16	200.00	14.57	43.72	4

Table 6c

Smartphone Data Plans with Usage Limits: ≥1 to <5 GB and Limited Text/SMS[6]

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Adver-tised Down-load Speed	Average Text/SMS	Min Aver-age Month-ly Price	Max Aver-age Month-ly Price	Plan Count
1	1	Israel	4.80	14.40	3.00		5000.00	11.96	16.84	4
2	2	Lithuania	9.93	15.65	1.70	200.00	2660.00	14.10	18.86	10
3	4	Portugal	16.67	21.97	1.43		71.43	17.06	27.48	7
4	13	Austria	17.09	44.23	2.67	17.33	1333.33	24.13	60.31	3
5	17	Singapore	17.34	59.90	3.43	300.00	1085.71	48.24	74.52	7
6	3	Luxembourg	18.24	21.38	1.67	225.00	373.33	6.52	38.04	12
7	14	Turkey	18.30	44.62	2.88	7.20	1510.20	22.22	83.33	49
8	9	Italy	18.52	30.46	1.87	100.00	387.27	6.65	51.86	11
9	7	Slovenia	19.37	26.37	1.50	10.00	1500.00	24.67	31.29	4
10	8	Spain	22.11	26.83	1.23	125.00	0.00	16.39	34.28	6
11	5	Switzerland	22.47	24.34	1.10	4.10	500.00	22.39	26.28	4
12	10	Netherlands	24.58	33.51	1.40	50.00	210.00	1.28	45.87	5
13	6	Poland	25.22	25.22	1.00		19.75	16.82	33.63	4
14	19	Chile	27.29	63.57	2.53	16.40	1167.50	27.15	108.67	20
15	12	Bulgaria	28.75	44.17	1.67	42.00	100.00	32.00	64.00	18
16	15	Korea	29.71	44.93	1.65	300.00	450.40	22.51	71.08	82
17	18	India	33.12	61.59	2.08	15.58	724.24	19.91	87.63	33
18	16	Hong Kong	38.11	56.86	1.72	276.55	6528.70	25.36	81.10	23
19	11	France	41.30	41.30	1.00	21.60	1000.00	41.30	41.30	2
20	20	Mexico	45.59	72.04	1.65		791.36	33.82	169.60	44
21	21	Greece	86.86	152.08	2.03	254.47	1742.11	81.17	286.53	38

[6] The United States did not have any plans in this category.

Table 6d

Smartphone Data Plans with Usage Limits: ≥1 to <5 GB and Unlimited Text/SMS

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	1	Israel	6.92	20.75	3.00		20.75	20.75	2
2	2	Denmark	7.33	20.99	3.00		12.98	29.38	6
3	9	Sweden	10.72	31.70	3.17	46.40	3.33	57.00	6
4	3	Lithuania	12.08	21.97	2.28	240.00	14.42	31.05	18
5	6	Japan	13.26	28.19	2.29	166.07	9.05	74.60	14
6	8	Norway	15.34	31.52	2.50	16.67	22.21	38.96	9
7	10	Belgium	16.72	34.85	2.11	117.53	10.35	90.04	18
8	12	Poland	18.40	37.12	2.25		22.42	72.87	10
9	4	Switzerland	19.29	24.52	1.50	300.00	12.51	38.04	14
10	19	Australia	19.76	47.03	2.77	52.00	34.72	55.56	11
11	7	New Zealand	20.36	30.99	1.72	7.20	13.62	47.00	8
12	13	Germany	20.79	37.13	2.00	131.94	17.00	70.49	16
13	17	Spain	21.37	40.22	2.00	278.57	17.88	49.18	14
14	11	Netherlands	23.84	34.86	1.72	31.82	1.03	65.17	17
15	22	Bulgaria	24.35	51.18	2.17	42.00	41.58	63.98	12
16	16	Slovenia	27.53	39.95	1.92	17.44	24.67	49.59	12
17	5	Luxembourg	27.61	27.61	1.00	225.00	27.61	27.61	2
18	15	Iceland	27.73	39.63	2.00	100.00	27.64	43.74	4
19	23	Korea	28.04	51.90	2.06	300.00	21.32	81.74	88
20	14	Ireland	31.09	38.92	1.40	75.00	36.72	42.84	5
21	31	Austria	31.53	90.34	3.00	28.71	51.76	285.66	7
22	20	Ireland	32.64	48.96	1.50	75.00	48.96	48.96	1
23	30	Czech Republic	33.35	76.91	2.55	205.95	48.25	117.68	42
24	18	Portugal	33.97	43.59	1.33	21.60	12.99	66.65	6
25	24	United Kingdom	34.85	56.06	2.15	48.00	14.33	197.71	61
26	29	Mexico	40.35	75.67	2.08		36.37	121.11	12
27	27	Canada	41.54	69.37	2.08	110.00	53.84	91.09	37
28	28	United States	41.69	73.35	2.18	26.26	30.00	125.00	78
29	25	Italy	44.61	62.75	2.30	100.00	26.60	165.29	10
30	26	Slovakia	45.95	69.32	1.83		42.18	92.78	12
31	33	Chile	49.58	100.52	2.33	7.00	57.04	171.18	6
32	21	India	51.13	51.13	1.00	3.10	51.13	51.13	2
33	34	Brazil	54.46	115.07	2.33	3.40	53.62	213.34	36
34	32	Singapore	64.65	97.97	2.00	235.71	50.01	127.58	7

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
35	35	France	67.69	122.25	2.06	176.87	4.25	668.26	98
36	36	Hungary	69.45	125.49	2.22	34.00	91.43	141.76	9
37	37	Hong Kong	98.91	131.47	2.13		44.46	308.79	4

Table 6e

Smartphone Data Plans with Usage Limits: ≥5 GB and Limited Text/SMS[7]

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Average Text/SMS	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	1	Netherlands	0.26	1.28	5.00	50.00	200.00	1.28	1.28	1
2	2	Luxembourg	2.03	12.32	8.33		60.00	6.52	23.91	6
3	3	Israel	3.37	16.84	5.00		5000.00	14.40	19.28	4
4	5	Japan	3.74	26.16	7.00	150.00	3.00	26.16	26.16	2
5	4	Ireland	4.90	24.48	5.00	75.00	0.00	24.48	24.48	1
6	6	Portugal	6.73	33.65	5.00		0.00	33.32	33.90	3
7	7	Spain	7.15	35.77	5.00	75.00	0.00	28.32	43.22	4
8	11	Korea	7.95	81.65	32.67	300.00	457.41	22.51	142.16	54
9	8	Italy	10.23	52.19	5.10		300.00	47.87	54.52	4
10	15	Hong Kong	12.05	96.82	8.42	300.00	7095.00	46.20	183.57	24
11	9	Austria	12.06	72.38	6.00	42.00	1000.00	72.38	72.38	1
12	14	Singapore	13.13	94.30	7.25	208.88	1912.50	23.94	244.71	16
13	12	Bulgaria	13.43	91.65	6.67	42.00	666.67	63.98	146.98	6
14	10	Turkey	14.26	81.15	5.75	7.20	2437.50	45.14	110.32	16
15	18	Chile	15.32	135.26	8.94	16.00	2000.00	51.61	190.23	18
16	13	Belgium	16.81	93.04	5.50	129.00		78.03	108.04	2
17	16	India	16.92	109.01	6.64	19.47	1123.81	86.68	227.46	21
18	17	Switzerland	22.65	113.24	5.00	21.00	0.00	113.24	113.24	2
19	19	Greece	30.66	238.10	8.00	300.00	2000.00	194.81	324.68	6

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[7] The United States did not have any plans in this category.

Table 6f

Smartphone Data Plans with Usage Limits: ≥5 GB and Unlimited Text/SMS

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	4	Denmark	2.79	33.64	20.70		18.23	62.16	27
2	11	Sweden	2.84	58.23	31.71	57.18	11.31	102.72	17
3	3	Lithuania	4.00	30.84	8.67	200.00	17.75	43.56	6
4	2	Japan	4.06	30.51	10.47	156.62	9.05	105.60	34
5	1	Israel	4.06	28.88	7.50		24.16	43.02	8
6	26	Portugal	4.51	102.92	25.00	21.60	97.40	113.80	3
7	7	Slovenia	5.10	41.05	10.00	150.00	33.94	46.34	5
8	12	Norway	5.20	60.17	13.80	38.00	38.96	83.61	5
9	5	Netherlands	5.45	35.79	7.78	52.00	1.03	88.26	9
10	8	Switzerland	5.77	46.46	8.33	300.00	33.78	60.56	6
11	6	Luxembourg	5.84	38.24	8.00	225.00	21.63	71.74	10
12	25	Germany	7.73	99.84	13.00	154.17	28.30	255.07	12
13	13	United Kingdom	7.92	69.37	10.94	46.13	20.06	163.31	33
14	10	Belgium	8.25	55.39	7.00	121.20	41.67	70.83	5
15	22	Korea	9.08	85.55	12.21	300.00	11.85	152.82	116
16	21	Ireland	9.27	79.00	9.45	75.00	61.20	97.92	11
17	9	Poland	9.34	50.74	5.44		28.03	78.48	9
18	36	United States	10.13	258.83	29.94	19.59	45.00	805.00	178
19	14	Australia	10.14	69.94	7.14	64.00	55.56	90.28	7
20	17	Iceland	10.28	70.93	7.50		63.66	78.20	4
21	16	Hong Kong	10.40	70.65	7.00		58.01	82.32	4
22	19	New Zealand	10.76	72.55	6.94	7.20	47.00	101.50	8
23	18	Austria	10.91	71.01	6.80	128.40	57.67	75.88	5
24	28	Czech Republic	11.73	117.25	10.00	211.67	88.90	137.93	12
25	15	Spain	11.81	70.02	6.00	200.00	59.54	87.93	6
26	29	Canada	11.96	119.12	11.44	110.00	86.99	205.09	27
27	20	Ireland	12.24	73.44	6.00	75.00	73.44	73.44	1
28	24	Bulgaria	13.15	95.99	7.67	42.00	79.98	112.00	12
29	23	Turkey	15.28	91.67	6.00	7.20	79.86	103.47	4
30	32	France	15.80	152.86	12.37	264.46	7.28	645.07	76
31	27	Italy	15.93	110.00	8.20	100.00	46.54	178.59	5
32	30	Chile	16.37	126.34	8.00	7.00	97.80	171.18	6
33	31	Slovakia	16.56	130.38	8.43		83.42	207.13	14

$per GB Rank	Average Monthly Charge Rank	Country	Price GB of Data ($PPP/GB)	Average Monthly Price ($PPP)	Data Cap	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
34	34	Singapore	21.76	230.74	10.50	225.00	121.55	282.73	4
35	33	Brazil	25.35	171.24	6.50	4.00	48.85	310.65	16
36	35	Mexico	40.39	242.33	6.00		242.33	242.33	2

Table 6g

Smartphone Data Plans with Usage Limits: Unlimited Data and Limited Text/SMS[8]

Average Monthly Price Rank	Country	Average Monthly Price ($PPP)	Advertised Download Speed	Average Text/SMS	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	Luxembourg	3.26	225.00	0.00	1.09	5.434783	4
2	Lithuania	9.75		2500.00	2.54	19.49489	8
3	France	13.35	364.00	300.00	9.71	16.99879	4
4	Iceland	18.43	100.00	300.00	12.40	29.02345	3
5	Japan	26.44		0.00	7.20	64.91116	12
6	Korea	53.09		282.26	3.91	111.357	62
7	Estonia	55.88	300.00	135.00	28.92	97.31618	10

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[8] The United States did not have any plans in this category.

Table 6h

Smartphone Data Plans with Usage Limits: Unlimited Data and Unlimited Text/SMS

Average Monthly Price Rank	Country	Average Monthly Price ($PPP)	Advertised Download Speed	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	Mexico	1.21		1.21	1.21	2
2	Sweden	12.17	38.33	3.31	17.02	4
3	France	15.77	53.09	10.92	22.66	13
4	Lithuania	17.73	300.00	6.34	41.68	10
5	Japan	18.90	150.00	9.05	30.63	10
6	Finland	21.02	46.67	16.14	26.98	6
7	Portugal	24.39		24.39	24.39	1
8	Iceland	29.05		15.86	36.64	3
9	Poland	40.92		39.24	42.60	2
10	Luxembourg	41.85		35.87	47.83	4
11	India	46.87	3.10	46.87	46.87	2
12	Ireland	55.35		24.48	85.68	13
13	United Kingdom	60.50		12.89	141.83	10
14	United States	73.46	110.00	11.00	96.00	13
15	Korea	78.72	300.00	14.69	118.35	23
16	Austria	102.53	150.00	102.53	102.53	1
17	Estonia	116.05		32.39	230.70	7
18	Slovenia	158.54	150.00	31.29	314.55	5
19	Switzerland	278.13	138.87	12.51	1275.53	36

Table 7a

Mobile Data Plans excluding Smartphone with Usage Limits: <5GB

$ per GB Rank	Average Monthly Price Rank	Country	Price Per GB	Average Monthly Price ($PPP)	Data Cap	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	2	Poland	3.57	10.96	3.07	10.96	10.96	1
2	1	Austria	6.62	6.78	1.02	6.78	6.78	1
3	10	Italy	8.63	15.66	2.25	11.84	21.71	5
4	11	France	8.96	15.70	1.79	10.64	23.70	4
5	6	Sweden	9.53	13.82	2.37	5.62	22.82	7
6	14	Australia	11.52	18.36	2.62	3.31	33.11	11
7	18	Czech Republic	11.60	20.01	2.27	6.59	38.45	9
8	22	Singapore	12.13	24.84	2.05	13.68	38.77	5
9	16	Spain	12.40	19.21	1.69	8.78	35.13	9
10	12	United Kingdom	13.02	16.12	1.68	7.19	23.02	12
11	8	Hungary	13.05	14.73	1.78	4.59	24.92	8
12	20	India	13.11	23.37	1.91	4.47	44.75	20
13	24	Korea	14.89	29.62	2.30	14.57	49.52	12
14	29	Chile	15.24	34.26	2.55	27.86	45.02	8
15	3	Bulgaria	15.25	13.53	1.44	4.30	23.42	12
16	4	Turkey	15.73	13.65	0.99	6.37	26.41	8
17	9	Portugal	16.10	15.11	1.14	4.89	20.42	6
18	17	Greece	16.46	19.99	1.67	7.77	31.09	7
19	5	Denmark	18.35	13.71	1.27	8.47	20.39	4
20	13	Slovak Republic	18.49	17.63	1.66	5.88	31.34	9
21	19	Germany	19.16	20.13	1.66	11.47	27.58	8
22	28	Brazil	24.04	33.46	1.93	18.03	43.46	9
23	26	United States	24.91	31.25	2.32	10.00	50.00	8
24	30	Japan	25.96	53.17	2.05	53.17	53.17	1
25	21	Netherlands	29.80	24.09	1.33	10.29	48.35	12
26	7	Belgium	31.09	14.16	1.44	5.90	17.70	5
27	23	Hong Kong	36.90	29.51	1.32	22.67	42.46	6
28	27	Switzerland	54.58	33.10	0.96	13.67	46.77	4
29	15	Canada	84.50	19.11	0.76	5.05	36.37	12
30	25	Mexico	351.44	29.89	1.22	9.88	49.90	14

Table 7b

Mobile Data Plans excluding Smartphone with Usage Limits: >5GB

$ per GB Rank	Average Monthly Price Rank	Country	Price Per GB	Average Monthly Price ($PPP)	Data Cap	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	1	Poland	1.12	21.04	23.55	9.29	49.31	14
2	7	Denmark	1.58	33.49	87.38	12.80	65.65	15
3	2	Austria	2.04	26.46	14.17	12.75	61.61	12
4	9	Sweden	2.16	36.78	24.47	14.84	80.17	20
5	4	France	3.15	31.17	12.16	17.63	47.20	8
6	3	Italy	3.17	27.82	9.51	18.42	39.47	7
7	8	Greece	3.47	36.39	11.95	23.16	54.40	9
8	17	Hungary	3.61	44.71	14.64	24.06	74.36	10
9	5	United Kingdom	3.73	32.26	11.12	21.58	43.16	7
10	14	Portugal	3.81	43.76	14.56	24.51	65.38	9
11	19	Australia	3.90	47.18	13.06	29.80	79.47	12
12	11	Korea	4.05	42.11	19.53	11.65	92.05	14
13	12	Bulgaria	4.35	43.04	12.40	27.68	59.15	8
14	13	Czech Republic	4.89	43.63	9.05	21.41	74.00	6
15	16	Slovak Republic	4.89	44.41	12.25	29.40	68.58	6
16	18	Turkey	4.91	46.48	9.73	21.85	90.15	16
17	21	Netherlands	5.49	48.19	9.04	34.49	60.45	4
18	20	Germany	5.80	47.66	10.02	31.89	91.39	7
19	26	Chile	5.83	70.89	14.68	41.92	101.01	15
20	15	Switzerland	5.87	44.25	7.68	28.06	64.04	4
21	6	Israel	6.52	33.40	5.12	29.61	37.19	2
22	28	India	6.69	82.39	15.90	29.89	286.31	18
23	31	United States	7.10	179.29	26.15	40.00	730.00	28
24	22	Spain	7.24	49.77	7.17	43.92	61.48	3
25	23	Canada	7.24	56.20	8.06	28.29	84.87	8
26	27	Brazil	7.25	75.90	13.82	44.70	124.29	12
27	10	Belgium	7.30	37.36	5.12	35.39	41.30	3
28	24	Hong Kong	7.91	56.39	7.37	41.20	78.45	5
29	25	Singapore	8.22	62.12	7.85	22.69	123.33	15
30	29	Mexico	8.40	96.45	12.52	49.90	212.48	9
31	30	Japan	9.31	120.42	13.75	55.10	236.84	7

Table 7c

Mobile Data Plans excluding Smartphone with Unlimited Usage [9]

$ per GB Rank	Country	Average Monthly Price ($PPP)	Min Average Monthly Price	Max Average Monthly Price	Plan Count
1	Austria	37.85	25.90	55.77	3
2	Czech Republic	51.04	51.04	51.04	1
3	Finland	22.12	13.87	32.23	9
4	Israel	39.65	37.14	42.16	2
5	Poland	27.41	27.41	27.41	1
6	Portugal	49.03	49.03	49.03	1
7	Switzerland	32.56	5.40	64.76	6
8	Turkey	58.28	53.72	62.83	2

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[9] The United States did not have any plans in this category.

Table 8

2014 Mobile Prepaid Excluding Smartphones

$ per GB Rank	Country	Price Per GB of Data ($PPP/GB)	Plan Count
1	Finland	1.07	4
2	Italy	3.96	5
3	Sweden	4.07	15
4	Chile	6.35	22
5	Poland	7.19	22
6	Australia	8.41	18
7	Japan	10.15	2
8	Austria	11.64	6
9	Slovak Republic	11.94	3
10	India	12.56	69
11	United Kingdom	12.88	15
12	France	13.26	5
13	United States	14.01	17
14	Turkey	14.13	16
15	Israel	15.95	5
16	Germany	17.72	12
17	Spain	18.44	2
18	Portugal	18.46	11
19	Singapore	18.75	17
20	Switzerland	19.99	11
21	Greece	21.60	12
22	Hungary	29.12	13
23	Brazil	34.85	13
24	Netherlands	36.95	9
25	Mexico	39.26	51
26	Czech Republic	50.96	9
27	Belgium	53.11	5
28	Canada	61.40	7
29	Bulgaria	127.04	9

Appendix D

Demographics Dataset

Below is a concise version of the demographics dataset, containing only the most recent data available for the countries surveyed. A complete version containing historical data going back several years is available at https://www.fcc.gov/reports-research/reports/international-broadband-data-reports/international-broadband-data-report-3.

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
ALA0 Australia	**77**	**23490700**	**3**	**844925**	**37187**	**40**
ALA1 New South Wales	75	7518470	9	261109	35741	42
ALA2 Victoria	77	5841670	26	188456	33464	43
ALA3 Queensland	78	4722450	3	162653	35602	34
ALA4 South Australia	75	1685710	2	52723	31832	35
ALA5 Western Australia	79	2573390	1	136997	56234	37
ALA6 Tasmania	72	514762	8	13865	27070	30
ALA7 Northern Territory	79	245079	0.2	10658	45312	36
ALA8 Australian Capital Territory	85	385996	164	18466	49226	57
AT0 Austria	**79**	**8506890**	**103**	**303700**	**36136**	**21**
AT11 Burgenland	80	287318	78	6932	24331	17
AT12 Lower Austria	76	1626260	86	48032	29797	18
AT13 Vienna	83	1765580	4470	79104	46148	32
AT21 Carinthia	73	555743	59	17188	30789	18
AT22 Styria	78	1214930	75	37971	31365	18
AT31Upper Austria	79	1425980	122	51432	36409	17
AT32 Salzburg	84	534185	76	22182	41717	21
AT33 Tyrol	79	721574	58	26484	37299	19
AT34 Vorarlberg	81	375323	148	14260	38548	19
BE0 Belgium	**79**	**11204000**	**370**	**364167**	**33104**	**40**
BE1 Brussels Capital Region	76	1183840	7353	68931	60637	47
BE2 Flemish Region	81	6429060	481	209426	33107	40
BE3 Wallonia	75	3591090	214	85571	24185	37

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
BG0 Bulgaria	**56**	**7245677**	**67**	**No Data**	**No Data**	**No Data**
BG31 Severozapaden	45	810401	44	No Data	No Data	No Data
BG32 Severen tsentralen	58	835813	58	No Data	No Data	No Data
BG 33 Severoiztochen	56	954536	66	No Data	No Data	No Data
BG 34 Yugoiztochen	52	1063690	55	No Data	No Data	No Data
BG 41 Yugozapaden	63	2127618	106	No Data	No Data	No Data
BG 42 Yuzhen tsentralen	55	1453619	67	No Data	No Data	No Data
Canada	**80**	**35540400**	**4**	**1554950**	**44741**	
CA1 Newfoundland And Labrador	82	526977	1	28905	54864	27
CA2 Prince Edward Island	82	146283	26	4741	32661	20
CA3 Nova Scotia	76	942668	18	32819	34727	21
CA4 New Brunswick	82	753914	11	26961	35616	25
CA5 Quebec	77	8214670	6	305875	37837	20
CA6 Ontario	81	13678700	15	576506	42984	24
CA7 Manitoba	74	1282040	2	49784	39826	30
CA8 Saskatchewan	72	1125410	2	66609	61247	22
CA9 Alberta	81	4121690	6	266590	68554	22
CA10 British Columbia	84	4631300	5	188037	41388	24
Yukon Territory	No data	36510	0.1	2249	62041	No Data
Northwest Territories	No Data	43623	0.04	3996	91607	No Data
Nunavut	No data	36585	0.02	1879	54137	No Data
Chile	**36**	**17819100**	**24**	**215238**	**12368**	**32**
CL01 Tarapaca	38	328782	8	5265	16008	39
CII Antofagasta	54	613328	5	23017	39136	27
CIII Atacama	32	308247	4	5646	19836	28
CIV Coquimbo	25	759228	19	6874	9299	36
CV Valparaiso	38	1808300	110	17660	9834	24
CVI O'Higgins	18	910577	56	9654	10725	20
CVII Maule	16	1035590	34	7599	7423	28
CVIII Bio-Bio	25	2100490	57	17049	8270	23

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
CIX Araucania	17	983499	31	4816	4882	29
CX Los Lagos	23	834714	17	5464	6376	28
CXI Aisen	21	107334	1	1096	10250	39
CXII Magallanes y Anta(a)rtica	33	163748	1	1823	11417	41
CRMS Santiago	50	7228580	469	105121	15001	24
CL14 Los Rios	21	401548	22	2739	7174	29
CL15 Arica Y Parinacota	49	235081	14	1417	7811	No data
CZ0 Czech Republic	**76**	**10512400**	**136**	**252993**	**24125**	**21**
CZ01 Prague	88	1243200	2569	62924	50990	40
CZ02 Central Bohemian Region	77	1302340	120	27444	21695	20
CZ03 Southwest	75	1210180	71	25248	20917	19
CZ04 Northwest	68	1125430	133	21115	18649	13
CZ05 Northeast	70	1506500	123	29841	19779	18
CZ06 Southeast	78	1680290	122	36555	21812	23
CZ07 Central Moravia	76	1222660	134	23943	19480	17
CZ08 Moravia-Silesia	74	1221830	230	25923	20995	19
DK0 Denmark	**85**	**5627240**	**131**	**174065**	**31192**	**32**
DK01 Capital (DK)	89	1749410	687	68508	39956	42
DK02 Zealand	86	816726	113	18457	22566	27
DK03 Southern Denmark	82	1202510	98	34450	28676	27
DK04 Central Jutland	86	1277540	98	36760	29020	30
DK05 North Jutland	80	581057	74	15890	27397	26
Estonia	**81**	**1315820**	**30**	**24389**	**18198**	**39**
FI0 Finland	**89**	**5451270**	**18**	**172735**	**32135**	**39**
FI13 Western Finland	88	1374400	24	39517	29056	37
FI18 Helsinki-Uusimaa	93	1585470	174	65199	42550	47
FI19 Southern Finland	88	1161880	37	32688	28238	36
FI1A Eastern and Northern Finland	86	1300850	6	34175	26342	35
FI20 Åland	64	28666	18	1074	38363	32

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
France	78	63920200	117	1958737	31056	35
FR10 Île de France	84	12005100	999	595674	50256	45
FR21 Champagne-Ardenne	76	1338120	52	34004	25451	27
FR 22Picardy	77	1927390	99	43974	22925	24
FR 23 Upper Normandy	80	1851910	150	48561	26401	28
FR 24 Centre-Val de Loire	75	2577470	66	64098	25069	30
FR 25 Lower Normandy	65	1478210	84	34387	23302	29
FR 26 Burgundy	69	1638490	52	40945	24925	30
FR 30 Nord-Pas-de-Calais	79	4058330	327	98173	24288	34
FR 41 Lorraine	74	2346290	100	54072	23003	31
FR 42 Alsace	76	1868770	226	51788	27958	32
FR 43 Franche-Comté	81	1178940	73	27960	23827	30
FR 51 Pays de la Loire	78	3689470	115	95860	26620	31
FR 52 Brittany	73	3273340	120	79428	24684	36
FR53 Poitou-Charentes	77	1796430	70	42686	24011	26
FR61 Aquitaine	73	3335130	81	85803	26367	32
FR 62 Midi-Pyrénées	78	2967150	65	76140	26224	42
FR 63 Limousin	72	735880	43	16933	22850	29
FR 71 Rhône-Alpes	76	6448920	148	189146	30102	37
FR 72 Auvergne	72	1359400	52	32484	24050	30
FR 81 Languedoc-Roussillon	81	2757560	101	61758	23130	33
FR 82 Provence-Alpes-Côte d'Azur	75	4964860	158	140897	28661	36
FR 83 Corsica	70	323092	37	7908	25145	28
DE0 Germany	87	80767500	226	2831835	34640	28
DE1 Baden-Württemberg	85	10631300	297	418163	38885	30
DE2 Bayern	86	12604200	179	498375	39747	29
DE3 Berlin	88	3421830	3855	110473	31922	37
DE4 Brandenburg	78	2449190	83	61686	24642	30

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
DE5 Bremen	87	657391	1568	29442	44562	27
DE6 Hamburg	91	1746340	2312	102070	57136	32
DE7 Hessen	89	6045430	286	247051	40720	31
DE8 Mecklenburg-Vorpommern	78	1596510	69	38751	23595	27
DE9 Niedersachsen	89	7790560	164	244984	30939	24
DEA Nordrhein-Westfalen	88	17571900	515	625083	35028	26
DEB Rheinland-Pfalz	87	3994370	201	125538	31355	26
DEC Saarland	88	990718	386	34410	33816	23
DED Sachsen	83	4046390	220	104184	25108	33
DEE Sachsen-Anhalt	84	2244580	110	56223	24078	26
DEF Schleswig-Holstein	88	2815960	178	82346	29054	24
DEG Thüringen	84	2160840	134	53055	23738	30
GR0 Greece	**65**	**10903700**	**83**	**252068**	**22287**	**30**
GR1 Northern Greece	59	3520210	63	62373	17373	28
GR2 Central Greece	62	2366080	44	43917	17696	23
GR3 Athens	70	3856060	1013	121261	29475	39
GR4 Aegean Islands and Crete	67	1161350	67	24516	21812	23
HU0 Hungary	**74**	**9877370**	**106**	**171943**	**17219**	**25**
HU10 Central Hungary	80	2965410	428	83949	28254	35
HU21 Central Transdanubia	82	1069190	96	16555	15131	20
HU22 Western Transdanubia	76	984521	87	17436	17529	19
HU23 Southern Transdanubia	77	917492	65	10761	11441	22
HU31 Northern Hungary	73	1176890	88	12186	10200	20
HU32 Northern Great Plain	66	1484380	84	16219	10945	20
HU33 Southern Great Plain	68	1279480	71	14837	11339	21

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
Iceland	**93**	**329100**	**3**	**10696**	**33587**	**31**
IS01 Capital Region	93	211282	203			41
IS02 Other Regions	91	117818	1			25
Ireland		**4605500**	**67**	**165337**	**36173**	**43**
IE01 Border - Midlands and Western	74	1232780	38	29792	24076	38
IE02 Southern and Eastern	82	3372720	93	135544	40664	45
Israel	**70.7**	**8134500**	**376**	**No Data**	**No Data**	**58**
IL01 Jerusalem	53.1	1008400	1544	No Data	No Data	46
IL02 Northern	61.5	1341500	300	No Data	No Data	39
IL03 Haifa	67.2	951900	1100	No Data	No Data	47
IL04 Central	77.4	1976300	1527	No Data	No Data	48
IL05 Tel Aviv	77.7	1331300	7740	No Data	No Data	50
IL06 Southern	73.6	1168600	82	No Data	No Data	40
IT0 Italy	**71**	**60782700**	**207**	**1644465**	**27125**	**19**
ITC1 Piedmont	71	4436800	178	131104	29413	18
ITC2 Aosta Valley	68	128591	40	4503	35120	17
ITC3 Liguria	68	1591940	299	45781	28316	22
ITC4 Lombardy	75	9973400	437	350826	35374	19
ITF1 Abruzzo	69	1333940	125	31292	23311	19
ITF2 Molise	67	314725	72	6674	20870	18
ITF3 Campania	64	5869970	438	97430	16700	18
ITF4 Puglia	66	4090270	213	72810	17797	16
ITF5 Basilicata	61	578391	60	11179	19028	19
ITF6 Calabria	61	1980530	134	34395	17100	18
ITG1 Sicilia	62	5094940	200	87359	17295	17
ITG2 Sardegna	75	1663860	70	34416	20542	16
ITH1 Province of Bolzano-Bozen	79	515714	70	20014	39423	15
ITH2 Province of Trento	77	536237	87	17234	32551	18
ITH3 Veneto	73	4926820	280	155587	31509	17
ITH4 Friuli-Venezia	77	1229360	163	38113	30840	19

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
Giulia						
ITH5 Emilia-Romagna	77	4446350	207	148389	33478	19
ITI1 Toscana	74	3750510	166	110310	29417	18
ITI2 Umbria	71	896742	109	22406	24717	21
ITI3 Marche	74	1553140	163	42534	27172	19
ITI4 Lazio	73	5870450	347	179227	31286	23
JP0 Japan	**75**	**127297000**	**341**	**4063407**	**31732**	**35**
JPA Hokkaido/Tohoku	61	5431000	65	151082	27440	27
JPB Tohoku	62	9095000	137	254218	27233	23
JPC Northern-Kanto, Koshin	68	9870000	279	308024	30799	29
JPD Southern-Kanto	90	35793000	2730	1311822	36830	46
JPE Hokoriku	69	5360000	164	168435	30945	27
JPF Toukai	74	15050000	674	507227	33565	33
JPG Kansai Region	81	20802000	793	632683	30268	38
JPH Chugoku	66	7470000	238	227803	30121	32
JPI Shikoku	59	3905000	209	110165	27707	29
JPJ Kyushu, Okinawa	60	14521000	332	391948	26851	28
KR0: Korea	**98.5**[11]	**50424000**	**507**	**..**	**..**	**42**
KR01: Capital region	99.2	25029700	2138	660105	26718	47
KR02: Gyeongnam region	98.3	7823230	634	244771	31348	38
KR03: Gyeonbuk region	97.8	5100340	256	134183	26209	38
KR04: Jeolla region	97.6	5071360	248	142716	28058	37
KR05: Chungcheong region	97.4	5317220	321	172990	33124	38
KR06: Gangwon region	97.2	1501040	91	34496	22953	33
KR07: Jeju	98.2	581069	315	13175	23582	40
Lithuania	**65**	**2943472**	**47**	**No data**	**No data**	

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[11] Korean data includes households with subscriptions to wireless broadband only.

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
Luxembourg (Grand-Duché)	**93**	**549680**	**213**	**34997**	**68374**	**43**
Mexico	**34**	**119713000**	**61**	**1522414**	**13006**	**21**
ME01 Aguacalienetes	38	1270180	226	16430	13315	23
ME02 Baja California Norte	52	3432940	48	42867	12878	20
ME03 Baja California Sur	44	741038	10	11253	16181	22
ME04 Campeche	27	894136	16	76746	88583	22
ME05 Coahuila	35	2925600	19	51589	18074	25
ME06 Colima	45	710986	126	8645	12614	22
ME07 Chiapas	10	5186570	70	27607	5466	14
ME08 Chihuahua	43	3673340	15	41803	11616	19
ME09 Distrito Federal	53	8874730	5980	249685	28018	33
ME10 Durango	30	1746800	14	18739	10960	19
ME11 Guanajuato	28	5769530	188	59454	10489	15
ME12 Guerrero	21	3546710	56	21799	6229	16
ME13 Hidalgo	26	2842790	136	25355	9157	16
ME14 Jalisco	41	7838010	100	95106	12442	21
ME15 Mexico	33	16618900	744	139894	8686	20
ME16 Michoacan	24	4563850	78	35532	7905	15
ME17 Morelos	38	1897390	388	17813	9624	20
ME18 Nayarit	36	1201200	43	9774	8459	21
ME19 Nuevo Leon	55	5013590	78	108946	22376	28
ME20 Oaxaca	14	3986210	43	24977	6354	14
ME21 Puebla	24	6131500	179	49426	8235	18
ME22 Queretaro	32	1974440	169	30554	15973	23
ME23 Quintana Roo	47	1529880	36	22811	15840	20
ME24 San Luis Potosi	27	2728210	45	29781	11132	20
ME25 Sinaloa	38	2958690	52	31556	10860	26
ME26 Sonora	46	2892460	16	44623	15881	23
ME27 Tabasco	29	2359440	95	53039	22970	21
ME28 Tamaulipas	37	3502720	44	45304	13249	23
ME29 Tlaxcala	25	1260630	315	8499	6940	19

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
ME30 Veracruz	21	7985890	111	82048	10441	18
ME31 Yucatan	30	2091520	53	22386	10991	19
ME32 Zacatecas	26	1563320	21	18376	11959	17
NL0 Netherlands	**95**	**16829300**	**499**	**618703**	**37146**	**33**
NL1 Northern Netherlands	94	1718030	207	63543	36992	29
NL2 Eastern Netherlands	95	3559280	367	109980	31146	30
NL3 Western Netherlands	95	7952690	920	309484	39525	36
NL4 Southern Netherlands	94	3599280	510	129715	36265	30
NZ0 New Zealand	**75**	**4509100**	**17**	**114128**	**25745**	**38**
NZ1 North Island	75	3450700	30	87866	25889	38
NZ2 South Island	75	1058400	7	26262	25288	36
NO0 Norway	**88**	**5107970**	**17**	**231757**	**47102**	**38**
NO01 Oslo and Akershus	95	1209990	242	55138	48160	50
NO02 Hedmark and Oppland	77	382230	8	9950	26078	30
NO03 South-Eastern Norway	88	969415	29	26114	27815	34
NO04 Agder and Rogaland	84	751632	32	26589	37003	35
NO05 Western Norway	87	875475	19	30346	35874	36
NO06 Trøndelag	83	441193	11	13273	31141	36
NO07 Northern Norway	90	478033	4	14005	29910	33
PL0 Poland	**71**	**38017900**	**122**	**692212**	**17966**	**30**
PL11 Lodzkie	66	2498860	137	42242	16615	26
PL12 Mazovia	75.3	5292570	149	154793	29389	39
PL21 Lesser Poland	71.7	3316100	218	51616	15469	30
PL22 Silesia	68.2	4548180	369	89826	19380	30
PL31 Lublin Province	70.8	2134410	85	26520	12173	28
PL32 Podkarpacia	74.3	2083550	117	25833	12140	26
PL33 Swietokrzyskie	66.5	1253040	107	17137	13362	30
PL34 Podlasie	70.8	1165450	58	15509	12887	29

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
PL41 Greater Poland	74.6	3441440	115	64525	18720	27
PL42 West Pomerania	66.5	1691400	74	26135	15162	28
PL43 Lubusz	63.3	1008560	72	15199	14854	25
PL51 Lower Silesia	71.9	2869580	144	59384	20356	30
PL52 Opole Region	71.5	960226	102	14615	14367	24
PL61 Kuvavian-Pomerania	69.9	2068420	115	30979	14761	24
PL62 Warmian-Masuria	64.1	1421260	59	18848	12965	25
PL63 Pomerania	78.8	2264820	124	39050	17161	31
PT0 Portugal	**63.2**	**10427300**	**113**	**228780**	**21640**	**20**
PT11 North (PT)	61.1	3644200	171	65074	17615	18
PT15 Algarve	64.3	442358	88	9562	21190	18
PT16 Central Portugal	56.9	2281160	81	42285	18144	17
PT17 Lisbon	72.4	2807530	95	84990	30106	28
PT18 Alentejo	53.4	743306	24	14785	19495	17
PT20 Azores (PT)	69	247440	107	4965	20124	14
PT30 Madeira (PT)	67.1	261313	326	6873	25641	18
SK0 Slovakia	**76.3**	**5415950**	**110**	**112773**	**20913**	**21**
SK01 Bratislava	78	618380	301	31100	51839	38
SK02 West Slovakia	76	1836660	122	36804	20015	17
SK03 Central Slovakia	74	1347230	83	22105	16383	19
SK04 East Slovakia	78	1613670	102	22766	14189	18
SI0 Slovenia	**75**	**2061090**	**102**	**51602**	**25169**	**30**
SI01 Eastern Slovenia	73	1079660	89	22759	21002	26
SI02 Western Slovenia	78	981430	122	28843	29841	35
ES0 Spain	**73**	**46512200**	**93**	**1240303**	**26874**	**36**
ES11 Galicia	69	2747230	94	66311	24231	36
ES12 Asturias	72	1058980	100	26638	25236	42
ES13 Cantabria	72	587682	112	15118	26128	41
ES21 Basque Counry	77	2167170	301	76881	35920	52
ES22 Navarra	76	636450	62	21508	34572	43
ES23 La Rioja	69	315223	63	9467	30230	38

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
ES24 Aragón	70	1331300	28	39482	30026	37
ES30 Comunidad de Madrid	83	6378300	801	223380	35072	47
ES41 Castile and León	68	2495690	27	65589	26326	37
ES42 Castile-la Mancha	66	2075200	26	43993	21495	28
ES43 Extremadura	62	1096420	27	20097	18552	28
ES51 Catalonia	76	7416240	232	230303	31404	36
ES52 Valencia	70	4956430	215	117794	23538	33
ES53 Balearic Island	77	1115840	224	30782	28279	27
ES61 Andalusia	70	8388880	97	167854	20330	29
ES62 Murcia	72	1461800	130	32215	21943	30
ES63 Ceuta	81	84674	4387	1777	23453	25
ES64 Melilla	82	83870	6259	1586	21409	28
ES70 Canary Islands	71	2114850	284	48267	22982	29
SE0 Sweden	**87**	**9747360**	**24**	**329417**	**34986**	**35**
SE11 Stockholm	88	2198040	331	99623	48494	44
SE12 East Middle Sweden	88	1621570	42	47234	30100	34
SE21 Småland with Is	85	826243	25	24905	30686	28
SE22 South Sweden	85	1443070	104	41667	29835	36
SE23 West Sweden	90	1942680	66	61953	32957	35
SE31 North Middle Sweden	78	833585	13	24312	29405	27
SE32 Central Norrland	84	369826	5	11891	32198	29
SE33 Upper Norrland	85	512349	3	17739	34926	33
CH0 Switzerland	**85.9**	**8139630**	**204**	**311067**	**39525**	**37**
CH01 Lake Geneva Region	85	1545820	187	60300	40642	38
CH02 Espace Mitteland	81	1808480	185	59700	34004	34
CH03 Northwestern Switzerland	87	1104350	560	47031	43921	39
CH04 Zurich	93	1425540	848	68016	49536	44
CH05 Eastern	87	1134780	99	36602	33165	30

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
Switzerland						
CH06 Central Switzerland	87	774123	179	27445	36619	34
CH07 Ticino	77	346539	125	11872	35571	33
TUR Turkey	**46**	**77695900**	**101**	**994251**	**13486**	**19**
TR10 Istanbul	63	14377000	2767	270017	20370	26
TR21 Thrace	63	1650740	84	26937	17706	18
TR22 Southern Marmara - West	41	1700850	70	21302	12967	17
TR31 Izmir	57	4113070	342	65614	16616	22
TR32 Southern Aegean	39	2915190	90	34662	12654	14
TR33 Northern Aegean	32	2995290	67	35697	11877	11
TR41 Eastern Marmara - South	55	3809780	133	63545	17674	20
TR42 Eastern Marmara - North	54	3522350	174	62458	19241	22
TR51 Ankara	55	5150070	210	85822	17985	34
TR52 Central Anatolia - West and South	40	2349170	49	23306	10374	16
TR61 Mediterranean region - West	50	2898240	81	39535	14722	18
TR62 Mediterranean region - Middle	36	3892850	132	39347	10540	17
TR63 Mediterranean region - East	38	3115680	134	25746	8569	14
TR71 Central Anatolia - Middle	44	1508200	48	15362	10267	17
TR72 Central Anatolia - East	40	2378050	400	22735	9662	19
TR81 Western Black Sea - West	49	1019530	107	12706	12276	13
TR82 Western Black Sea – Middle and East	37	756983	29	7086	9536	13
TR83 Middle Black Sea	35	2717040	72	26743	9758	13
TR90 Eastern Black Sea	35	2566840	73	24239	9633	14

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
TRA1 Northeastern Anatolia - West	28	1067560	26	9154	8568	17
TRA2 Northeastern Anatolia - East	41	1138770	38	6641	5858	9
TRB1 Eastern Anatolia - West	41	1690840	47	13869	8534	13
TRB2 Eastern Anatolia - East	15	2111070	51	10362	5124	10
TRC1 Southeastern Anatolia - West	31	2616080	172	17535	7261	15
TRC2 Southeastern Anatolia - Middle	20	3480720	103	20100	6296	11
TRC3 Southeastern Anatolia - East	28	2153920	83	13733	6916	14
UK0 United Kingdom	**88**	**64308300**	**265**	**2063148**	**33002**	**39**
UKC North East	86	2612920	305	62450	23870	31
UKD North West	87	7115250	504	193854	27862	35
UKE Yorkshire and The Humber	86	5352880	347	140164	26334	34
UKF East Midlands	89	4610500	295	120826	26872	34
UKG West Midlands	85	5687060	438	147184	26916	33
UKH Eastern	87	5977010	313	173229	29542	36
UKI London	92	8472440	5389	459903	58344	56
UKJ South East	91	8821330	463	297299	34727	42
UKK South West	90	5392670	226	152190	28748	37
UKL Wales	85	3092900	149	70400	23379	35
UKM Scotland	84	5337460	68	160615	30661	44
UKN Northern Ireland	86	1835850	135	44053	24429	34
US0 United States	**75.1**	**318857000**	**35**	**13637131**	**43442**	**26**
US01 Alabama	65.8	4849380	37	160802	33347	21
US02 Alaska	81.4	736732	0.5	45433	62113	25
US04 Arizona	75.5	6731480	23	233818	35680	25
US05 Arkansas	63.5	2966370	22	95981	32545	19
US06 California	80	38802500	96	1755208	46139	28
US08 Colorado	81.2	5355870	20	240088	46281	34
US09 Connecticut	80.5	3596680	287	200900	55956	34
US10 Delaware	75.5	935614	185	57807	63033	27

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
US11 Dist. of Columbia	73.4	658893	4144	96187	152118	48
US12 Florida	75.8	19893300	142	680858	35246	25
US13 Georgia	73.4	10097300	67	379841	38291	25
US15 Hawaii	80.6	1419560	85	63449	45571	27
US16 Idaho	73.6	1634460	8	51026	31976	23
US17 Illinois	75.5	12880600	90	609084	47307	29
US18 Indiana	71.4	6596860	71	261619	40019	21
US 19 Iowa	74.2	3107130	22	133546	43441	24
US 20 Kansas	74.5	2904020	14	121734	42182	27
US 21 Kentucky	68.9	4413460	43	151970	34693	20
US 22 Louisiana	66.6	4649680	41	213119	46311	20
US 23 Maine	74.9	1330090	17	47007	35365	26
US 24 Maryland	80.1	5976410	236	278311	47295	34
US 25 Massachusetts	80.5	6745410	332	353781	53231	36
US 26 Michigan	72.9	9909880	67	350874	35501	24
US 27 Minnesota	78.3	5457170	26	258206	48001	31
US 28 Mississippi	59.1	2994080	25	88913	29787	18
US 29 Missouri	71.6	6063590	34	226758	37655	24
US 30 Montana	72.9	1023580	3	35413	35232	27
US 31 Nebraska	74.8	1881500	10	87220	47006	27
US 32 Nevada	76.3	2839100	10	117030	42419	20
US 33 New Hampshire	82.1	1326810	57	56680	42916	32
US 34 New Jersey	80.9	8938180	465	445051	50206	34
US 35 New Mexico	67.5	2085570	7	70612	33858	23
US 36 New York	76.5	19746200	162	1056491	53985	31
US 37 North Carolina	72.4	9943960	79	399469	40962	25
US 38 North Dakota	74.7	739482	4	40314	57622	25
US 39 Ohio	73.9	11594200	109	446269	38657	23
US 40 Oklahoma	69.2	3878050	22	141008	36963	21
US 41 Oregon	78.9	3970240	16	174079	44643	27
US 42 Pennsylvania	73.9	12787200	110	526434	41245	26
US 44 Rhode Island	76.5	1055170	390	44642	42504	29
US 45 South Carolina	68.1	4832480	62	154380	32682	23

Community	% Households with broadband	Population Total	Population density (persons per square kilometer)	GDP total (US$m), PPP (purchasing power parity) (constant real prices 2005)	GDP per cap, (US$) PPP (constant real prices 2005)	Education (% of labor force with tertiary education)
US 46 South Dakota	71.6	853175	4	37202	44641	24
US 47 Tennessee	68.2	6549350	61	242706	37592	22
US 48 Texas	73	26957000	40	1224207	46978	24
US 49 Utah	81.7	2942900	14	114316	40037	27
US 50 Vermont	76.3	626562	26	23913	38200	32
US 51 Virginia	77.2	8326290	81	390623	47719	32
US 53 Washington	81.9	7061530	41	329170	47726	29
US 54 West Virginia	66.2	1850330	30	60782	32760	17
US 55 Wisconsin	75.3	5757560	41	229137	40014	25
US 56 Wyoming	76.1	584153	2	33661	58397	22

Sources

	% households with broadband	Population Total	Population density	GDP total	GDP per cap, PPP	Education
Australia	2013, OECD	2014, OECD	2014, OECD	2012, OECD	2012, OECD	2013, OECD
Austria	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Belgium	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Bulgaria	2014, Eurostat	2014, Eurostat	2013, Eurostat			
Canada	2014, CRTC	2014, OECD	2014, OECD	2012, OECD	2012, OECD	2013, OECD
Chile	2012, OECD	2015, OECD	2014, OECD	2012, OECD	2012, OECD	2013, OECD
Czech Republic	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Denmark	2014, OECD	2014, OECD	2014, OECD	2012, OECD	2012, OECD	2013, OECD
Estonia	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Finland	2014, OECD for Aland, 2007, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
France	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Germany	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Greece	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Hungary	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Iceland	2012, OECD	2015, OECD	2015, OECD	2011, OECD	2011, OECD	2012, OECD
Ireland	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Israel	2013, OECD	2014, OECD	2014, OECD			2013, OECD
Italy	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Japan	2012, OECD	2013, OECD	2013, OECD	2010, OECD	2010, OECD	2010, OECD
Korea	2014, OECD	2014, OECD	2014, OECD	2012, OECD	2012, OECD	2013, OECD
Lithuania	2014, Eurostat	2014, Eurostat	2012, Eurostat			
Luxembourg	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Mexico	2014, OECD	2014, OECD	2014, OECD	2012, OECD	2012, OECD	2010, OECD
Netherlands	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
New Zealand	2012, OECD	2014, OECD	2014, OECD	2012, OECD	2012, OECD	2012, OECD

	% households with broadband	Population Total	Population density	GDP total	GDP per cap, PPP	Education
Norway	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Poland	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Portugal	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Slovakia	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Slovenia	2014, OECD	2015, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Spain	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Sweden	2014, OECD	2015, OECD	2015, OECD	2011, OECD	2011, OECD	2013, OECD
Switzerland	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
Turkey	2013, OECD	2015, OECD	2015, OECD	2011, OECD	2011, OECD	2013, OECD
United Kingdom	2014, OECD	2014, OECD	2014, OECD	2011, OECD	2011, OECD	2013, OECD
United States	2014, Census Bureau	2015, OECD	2014, OECD	2012, OECD	2012, OECD	2012, OECD

APPENDIX E

Market and Regulatory Background

This Appendix contains updated information on regulatory and market developments for the 39 foreign countries for which we obtained smartphone pricing data in Appendix C. In our previous IBDRs, we likewise included market and regulatory background information in Appendix E, as well as information about topography and television and radio broadcast stations of various foreign countries. Much of the information reported in Appendix E of our earlier IBDRs has not changed. We incorporate by reference Appendix E from the *Second*, *Third* and *Fourth IBDRs*, as supplemented by the new information contained herein.

Table 1: Fixed Broadband Subscriptions per 100 Inhabitants by Technology (Dec. 2014)

Source: OECD Broadband Portal, Table 1.2.1[1]

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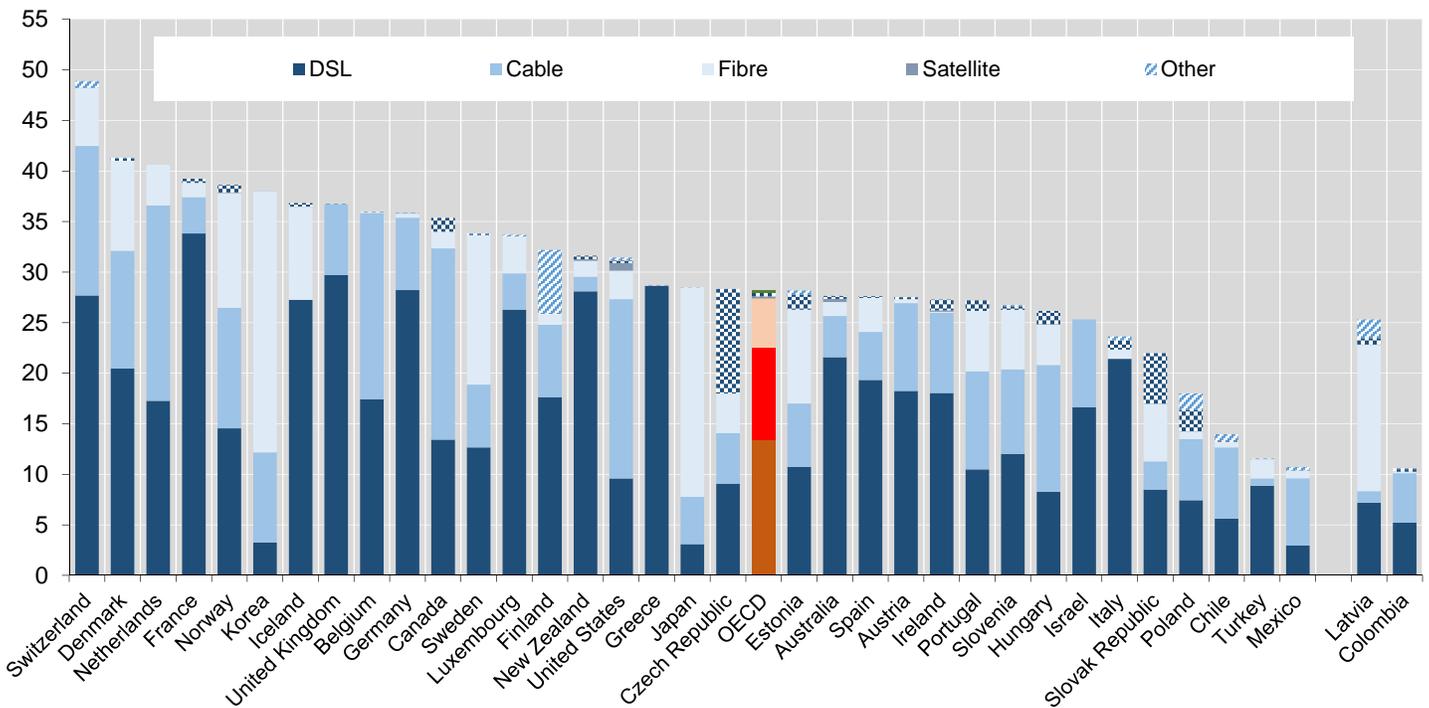
[1] Although this appendix includes information on 39 countries, OECD rankings only include information for the OECD Member States (plus two countries, Latvia and Colombia, in the process of accession). *See generally* OECD Broadband Portal, http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm. The shades of red representing OECD averages correspond to shades of blue for individual OECD countries (*i.e.*, dark red corresponds to dark blue, light red to light blue, etc.).

Table 2: Mobile Broadband Subscriptions per 100 Inhabitants (Dec. 2014)

Source: OECD Broadband Portal, Table 1.2.2
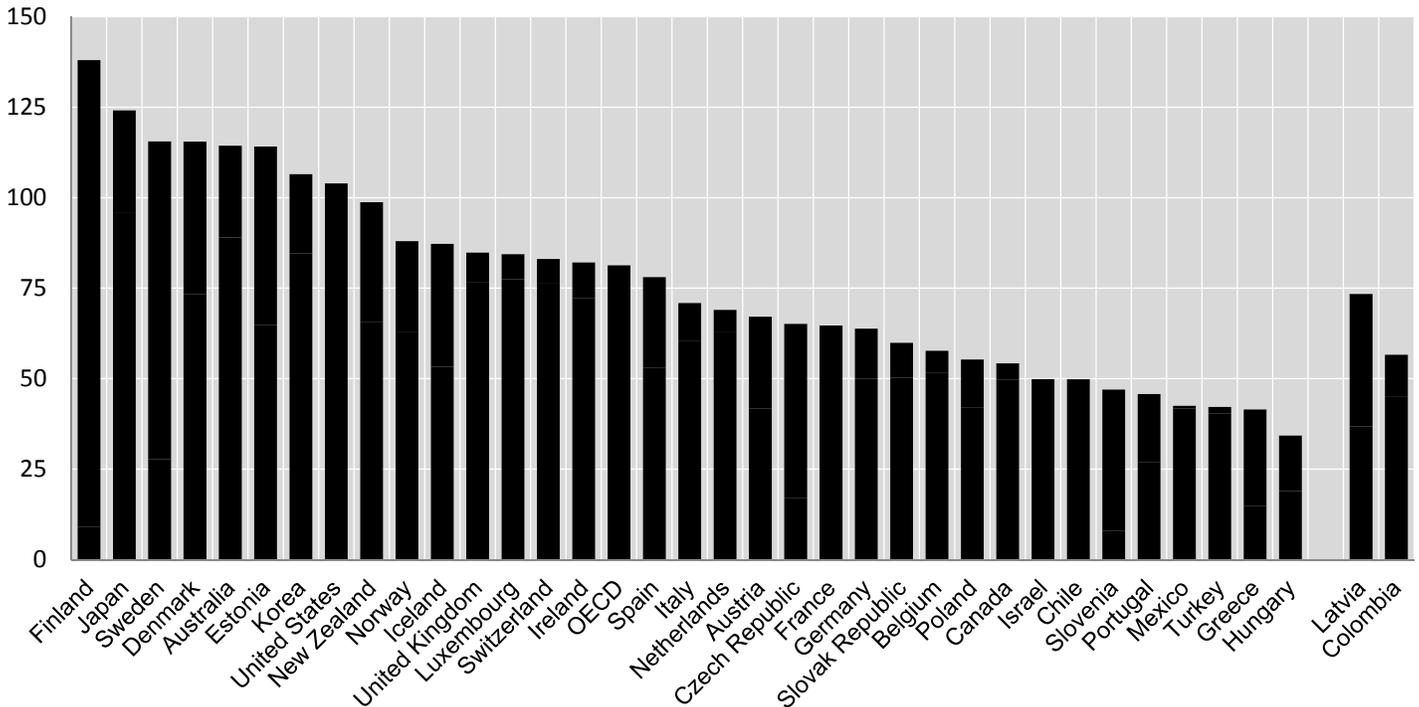
1. Australia

Regulation: In May 2014, then Minister for Communications Malcolm Turnbull called on his ministry to work with the independent regulator, the Australian Communications and Media Authority (ACMA), on a Spectrum Review as part of the ruling party's deregulation agenda.[2] In November 2014, the Ministry released a consultation paper that included 11 reform proposals for comment, such as transparency and accountability measures.[3] In March 2015, the Spectrum Review concluded that "current spectrum management arrangements are slow, rigid and administratively cumbersome" and therefore recommended overhauling spectrum legislation, improving the management of broadcast spectrum and public sector agencies with spectrum interests, and reviewing spectrum pricing arrangements.[4]

In June 2015, Minister Turnbull announced that his ministry would conduct a review of the ACMA, in order to "ensure the regulator is able to effectively deal with challenges arising from a rapidly changing

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[2] Dep't of Commc'ns, *Deregulation*, https://www.communications.gov.au/deregulation (last visited Nov. 21, 2015).

[3] Dep't of Commc'ns, *Consultations Open on Future Directions for Spectrum in Australia* (Nov. 11, 2014), http://www.minister.communications.gov.au/malcolm_turnbull/news/consultations_open_on_future_directions_for_spectrum_in_australia#.Vk-X-pdvk8p.

[4] Dep't of Commc'ns, Spectrum Review Report at 5 (Mar. 2015), https://www.communications.gov.au/publications/spectrum-review-report.

communications sector." (Minister Turnbull became Prime Minister of Australia in September 2015, when his party removed former Prime Minister Tony Abbott from his party leadership role.) The results of the review are due to the Minister by the end of 2015.[5]

Market and Competition: The Australian government-owned wholesale broadband network company (NBN Co) aims to reach eight million premises by 2020,[6] and as of the second quarter of 2015, it had reached 1,165 premises.[7] NBN Co uses a mix of technology, including fiber, wireless dongles, and satellite. In June 2015, the Australian government announced the new Mobile Blackspot Program, designed to improve mobile phone coverage and competition. The first phase of the program will upgrade or bring new mobile coverage to over 200 square kilometers.[8] In June 2015, Australia's leading wired broadband company by subscribers was Telstra (48.1 percent), followed by Singtel Optus (15.8 percent), iiNet (15.3 percent), TPG Telecom (12.5 percent), and M2 Group (7.7 percent). The remaining market share (0.6 percent) was taken by smaller players.[9]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[10]	27.7	1.4	4.1	21.6	0.6
Fixed broadband subs (Dec. 2014)[11]	6,536,000				
% of households with fixed broadband access (2013)[12]	77.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[13]	114.4				
Mobile wireless broadband subs (Dec. 2014)[14]	27,028,000				

2. Austria

Regulation: In July 2014, Austria's regulator, the Regulatory Authority for Telecoms and Broadcasting (Rundfunk & Telekom Regulierungs, or RTR) approved plans for the country's three wireless operators to refarm their existing GSM frequencies in the 900 MHz and 1800 MHz bands for 3G (UMTS) and 4G

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[5] Dep't of Commc'ns, *A Future-Focused Regulator for the Communications Market* (June 12, 2015), http://www.minister.communications.gov.au/malcolm_turnbull/news/a_future-focused_regulator_for_the_communications_market#.Vfw5HPlVhBc.

[6] NBN Co, 2015 Financial Results Presentation at 3 (2015), http://www.nbnco.com.au/content/dam/nbnco2/documents/FY15-annual-results-presentation.pdf.

[7] NBN Co, *Weekly Progress Report as of 10 September 2015*, http://www.nbnco.com.au/corporate-information/about-nbn-co/corporate-plan/weekly-progress-report.html (last visited Sept. 18, 2015).

[8] Dep't of Commc'ns, *Mobile Black Spot Programme*, https://www.communications.gov.au/what-we-do/phone/mobile-services-and-coverage/mobile-black-spot-programme (last visited Nov. 19, 2015).

[9] Telegeography GlobalComms Database: *Australia* (2015) (last visited Nov. 21, 2015).

[10] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[11] *Id.*

[12] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[13] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[14] *Id.*

(LTE) use.[15] According to RTR, the liberalization of the 900 MHz and 1800 MHz bands has increased the usable proportion of wireless broadband spectrum from 59 to 90 percent.[16]

In September 2013, Austria's digital dividend auction of 28 blocks of spectrum in the 800 MHz, 900 MHz, and 1800 MHz bands raised EUR2.01 billion (US$2.2 billion). A1 Telekom Austria (Telekom) paid EUR1.03 billion (US$1.13 billion) for 2×20 megahertz blocks in the 800 MHz band, 2×15 megahertz blocks in the 900 MHz band, and 2×35 megahertz blocks in the 1800 MHz band. T-Mobile Austria (T-Mobile) paid EUR655 million (US$720 million) for 2×10 megahertz blocks in the 800 MHz band, 2×15 megahertz blocks in the 900 MHz band, and 2×20 megahertz blocks in the 1800 MHz band. Lastly, Hutchison Drei Austria (Drei) paid EUR330 million (US$363 million) for 2×5 megahertz blocks in the 900 MHz band and 2×20 megahertz in the 1800 MHz band.[17] In December 2014, in response to legal challenges from T-Mobile and Drei, [18] the Austrian Administrative Court upheld the auction results and confirmed the legality of multi-band auctions as frequency allocation procedures.[19]

Market and Competition: Broadband in Austria is "ubiquitous and affordable."[20] Broadband is more affordable in Austria than in almost any other European Union (EU) country; on average, Austrians spend less than 1 percent of their income on a broadband connection, compared to an EU average of 1.4 percent.[21] From the second quarter to the third quarter of 2014, Austria experienced a 1.8 percent increase in mobile broadband connections.[22] During the same time period, mobile data increased 8 percent, and RTR expects data volumes to continue to grow exponentially.[23] Throughout 2014 and 2015, Austria's three wireless operators, equipped with new spectrum allocations from the 2013 multi-band auction, ramped up deployments in an effort to become the market leader.[24] As of April 2015, Telekom's 4G LTE network covered 60 percent of the country.[25] In November 2014, Telekom introduced its inaugural LTE-A network in Graz, Austria's second-largest city, using a pair of 20 megahertz blocks in the 800 MHz and

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[15] Telegeography CommsUpdate, *RTR to Permit Cellcos to Refarm 2G Frequencies for 3G, 4G* (July 30, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/07/30/rtr-to-permit-cellcos-to-refarm-2g-frequencies-for-3g-4g/.

[16] *Id. See also* Press Release, RTR, More Broadband: Regulatory Authority Allows Use of GSM Frequency Bands for UMTS and LTE (July 30, 2014), https://www.rtr.at/en/pr/PI30072014TK.

[17] Telegeography GlobalComms Database: *Austria* (2015) (last visited July 13, 2015).

[18] T-Mobile challenged the terms of the auction, arguing that it had the right to continue using until 2019 some of the frequencies that were being made available at the auction. *See* Telegeography CommsUpdate, *T-Mobile Challenges Rules of Upcoming Spectrum Auction* (Aug. 5, 2013), http://www.telegeography.com/products/commsupdate/articles/2013/08/05/t-mobile-challenges-rules-of-upcoming-spectrum-auction/. Drei asserted that the auction was illegal in form and substance and caused financial harm due to the exorbitant prices paid. *See* Telegeography CommsUpdate, *H3G to Spearhead Austrian Spectrum Appeal* (Nov. 28, 2013), http://www.telegeography.com/products/commsupdate/articles/2013/11/28/h3g-to-spearhead-austrian-spectrum-appeal/.

[19] Press Release, RTR, Regulatory Authority's Legal Opinion on Multiband Auction for Frequency Allocation Confirmed by VwGH Ruling (Dec. 11, 2014), https://www.rtr.at/en/pr/PI11122014TK.

[20] Eur. Comm'n, *Digital Agenda Scoreboard: Austria*, https://ec.europa.eu/digital-agenda/en/scoreboard/austria (last visited July 13, 2015).

[21] *Id.*

[22] RTR, RTR Telekom Monitor at 22 (Mar. 2015), https://www.rtr.at/en/inf/TKMonitor_1_2015/TM1_2015.pdf.

[23] *Id.* at 10. *See also* Press Release, RTR, RTR Publishes Telecom Monitor Annual Report: Mobile Telecommunications Sector Generated Roughly 60% of Overall Industry Revenues in 2014 (June 11, 2015), https://www.rtr.at/en/pr/PI11062015TK.

[24] Telegeography GlobalComms Database: *Austria* (2015) (last visited July 13, 2015).

[25] *Id.*

2600 MHz bands to support theoretical download speeds of up to 300 Mbps.[26] In February 2015, Telekom partnered with Eutelsat to provide satellite broadband connections to hard-to-reach "frontier zones and mountain regions."[27] Meanwhile, as of April 2015, T-Mobile's 4G LTE network also covered 60 percent of Austria; through an ambitious rollout program of 50 new base receiver stations per week, T-Mobile plans to cover 90 percent of the population by the end of 2015 and 95 percent by the end of 2016.[28] Finally, as of May 2015, Drei's LTE network reached 85 percent of the population, with 98 percent coverage expected by the end of 2015.[29]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[30]	27.5	0.4	8.7	18.2	0.2
Fixed broadband subs (Dec. 2014)[31]	2,351,905				
% of households with fixed broadband access (2014)[32]	79.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[33]	67.1				
Mobile wireless broadband subs (Dec. 2014)[34]	5,729,200				

3. Belgium

Regulation: In November 2014, Belgium's newly appointed Minister for the Digital Agenda, Telecommunications and Postal Services announced plans for a revamped digital agenda, which would include a target of broadband access above 100 Mbps and up to one gigabit per second for at least 50 percent of Belgian households by 2020.[35] Following a public consultation process, the government launched Digital Belgium in April 2015.[36] The action plan is based on five pillars: digital economy,

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[26] Telegeography CommsUpdate, *A1 Telekom Austria Introduces LTE-A in Graz; Ericsson Deployment Complements Slovenian Launch* (Nov. 26, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/11/26/a1-telekom-austria-introduces-lte-a-in-graz-ericsson-deployment-complements-slovenian-launch/.

[27] Telegeography CommsUpdate, *Telekom Austria, Eutelsat Unveil Satellite Broadband Solution* (Feb. 10, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/02/10/telekom-austria-eutelsat-unveil-satellite-broadband-solution/.

[28] Telegeography GlobalComms Database: *Austria* (2015) (last visited July 13, 2015).

[29] *Id. See also* Telegeography CommsUpdate, *3 Austria Expands LTE Coverage to 85%, Plans 98% By Summer 2015* (May 7, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/07/3-austria-expands-lte-coverage-to-85-plans-98-by-summer-2015/.

[30] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[31] *Id.*

[32] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 29, 2015).

[33] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[34] *Id.*

[35] Eur. Comm'n, *Belgium*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 34 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Belgium Report*].

[36] *Id.*

digital infrastructure, digital skills and jobs, digital confidence and security, and digital government.[37] The digital infrastructure pillar encourages operators to continuously roll out advanced broadband infrastructure using a mix of technologies.[38]

In February 2015, Belgium's regulator, the Belgian Institute for Postal Service and Telecommunications (BIPT), began accepting applications for the sale of wireless broadband spectrum in the 3.5 GHz band (3410-3500 MHz and 3510-3600 MHz).[39] BIPT intended to auction a total of four packets of frequencies, comprising two blocks of 2×20 megahertz, plus two blocks of 2×25 megahertz, with each bidder eligible to acquire up to two blocks.[40] By the deadline of March 27, 2015, BIPT had received only one application, from start-up Citymesh SA. BIPT subsequently awarded Citymesh two frequency blocks: 3430-3450 MHz and 3530-3550 MHz. The 10-year license, which became active on May 7, 2015, covers 13 Belgian municipalities.[41]

Market and Competition: In the fixed broadband sector, DSL remains the most popular access technology among high-speed Internet users, with state-owned incumbent Proximus (known as Belgacom until September 2014) providing virtually universal coverage.[42] In February 2014, Proximus activated a nationwide broadband access network based on VDSL2 vectoring, aiming to deliver nationwide download speeds of 70 Mbps by 2016.[43] Proximus's principal competitor is cable network operator Telenet. In August 2014, Telenet announced its plan to become the first regional network in the EU to offer at least 1 gigabit per second download speeds by 2020;[44] over the next five years, Telenet plans to invest EUR500 million (US$550 million) to upgrade its 600 megahertz hybrid fiber-coaxial (HFC) network from current peak download speeds of 160 Mbps to gigabit speed.[45] As of March 2015, Proximus led the market with 1.788 million subscribers (46.0 percent market share), followed by Telenet with 1.535 million subscribers (39.4 percent).[46]

In the wireless broadband sector, Belgium's three mobile network operators – Proximus, Mobistar, and BASE – each offer 4G LTE services to their entire customer base.[47] In April 2015, Telenet acquired BASE from its parent company KPN Belgium for EUR1.33 billion (US$1.46 billion), a move that will

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[37] Strategy Unit of the Minister for the Digital Agenda, Telecomm. & Postal Services, *Digital Belgium* (Apr. 2015), http://www.digitalbelgium.be/sites/default/files/downloads/adc_digital_engels.pdf.

[38] *Id.*

[39] BIPT, *Communication of the BIPT Council of 27 February 2015 on a Call for Candidates Wishing to Obtain User Rights for the 3410-3500/3510-3600 MHz Frequency Bands* (Mar. 2, 2015), http://www.bipt.be/public/files/fr/21429/Procdure_3500MHz_FR.pdf.

[40] Telegeography CommsUpdate, *Belgium Opens 3.5 GHz Sale* (Mar. 11, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/03/11/belgium-opens-3-5ghz-sale/.

[41] BIPT, *Communication by the BIPT Council on the Granting of User Rights in the 3.5 GHz Range Following the Call for Candidates of 27 February 2015* (June 3, 2015), http://www.bipt.be/public/files/fr/21498/Communication_Citymesh.pdf.

[42] Telegeography GlobalComms Database: *Belgium* (2015) (last visited July 14, 2015).

[43] *EC Belgium Report*, *supra* note 35, at 34.

[44] *Id.*

[45] Telegeography CommsUpdate, *Telenet to Upgrade Cable Networks to Support 1Gpbs Services* (Sept. 3, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/09/03/telenet-to-upgrade-cable-networks-to-support-1gbps-services/.

[46] Telegeography GlobalComms Database: *Belgium* (2015) (last visited July 14, 2015).

[47] *EC Belgium Report*, *supra* note 35, at 34.

enable Telenet to launch a fully converged suite of fixed, mobile, Internet, and TV services.[48] In May 2015, Mobistar introduced full-scale LTE-A commercial trials in three cities, although BIPT studies have demonstrated that these developments have not yet led to pricing models conducive to heavy mobile data use.[49]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[50]	36.0	0.1	18.4	17.4	0.1
Fixed broadband subs (Dec. 2014)[51]	4,011,201				
% of households with fixed broadband access (2014)[52]	81.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[53]	57.7				
Mobile wireless broadband subs (Dec. 2014)[54]	6,440,133				

4. Brazil

Regulation: As of January 2015, Internet packages offered under Brazil's National Broadband Plan, the Plano Nacional da Banda Larga (PNBL), covered over 90 percent of the country's 5570 municipalities.[55] In November 2014, the government announced a new plan to universalize broadband access (*Banda Larga para Todos*) with the goal of increasing broadband access to 95 percent of the population with high-speed broadband of at least 25 Mbps via fiber by 2018. The remaining 10 percent of connections, particularly in remote areas, would be made via wireless broadband, such as satellite and radio networks. Currently, fiber optic networks cover only 47 percent of cities and 10 percent of households.[56]

The auction of the 700 MHz band concluded on September 30, 2014, with Brazil's three main mobile operators, Vivo, TIM Brasil, and Claro, winning licenses.[57] The 700 MHz band is currently used by television broadcasters, who are under pressure to complete the digital television migration by 2018. The

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[48] Telegeography GlobalComms Database: *Belgium* (2015) (last visited July 14, 2015).

[49] *Id.*; *EC Belgium Report*, *supra* note 35, at 34.

[50] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[51] *Id.*

[52] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[53] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[54] *Id.*

[55] BNAmericas, *Brazil PNBL Broadband Coverage Hits 90%* (Jan. 28, 2015), http://www.bnamericas.com/news/privatization/brazil-pnbl-broadband-coverage-hits-90.

[56] Press Release, Ministry of Commc'ns, "Desafio do PNBL é universalize band larga," afirma diretor do MiniCom (Nov. 4, 2014), http://www.mc.gov.br/sala-de-imprensa/todas-as-noticias/telecomunicacoes/33200-desafio-do-pnbl-e-universalizar-banda-larga-afirma-diretor-do-minicom.

[57] Telegeography CommsUpdate, *700 MHz Spectrum Auction Underwhelms; Two Lots Go Unsold* (Oct. 1, 2014), http://www.telegeography.com/products/commsupdate/articles/2014/10/01/700mhz-spectrum-auction-underwhelms-two-lots-go-unsold/.

Minister of Communications has expressed the government's desire to finish the analog switch-off within a year of the 700 MHz auction so that 4G services can be deployed in the band.[58]

Given Brazil's vast geography and its dispersed communities in its more remote northern parts, the government is also encouraging the use of satellite-based broadband delivery systems to improve Internet access. Global satellite services provider O3B Networks is seeking to extend broadband coverage to remote areas of Brazil by partnering with Telebrás, the state-owned telecommunications entity that was revived in 2010 by the Ministry of Communications to be the entity responsible for the infrastructure supporting Brazil's National Broadband Plan.[59] Brazil is planning the launch of its first geostationary satellite by 2016, led jointly by Telebrás and Embraer, which would make broadband access available to the entire country using the Ka-band.[60]

Market and Competition: The main mobile broadband providers are Claro, Vivo, TIM Brasil and Oi. As of January 2015, 56.2 percent of mobile phones in Brazil are can access mobile broadband.[61] Since the 4G auction in June 2012 and as of May 2015, 43 percent of the population had access to 4G services. Vivo is the market leader in 4G coverage, with a 4G network that can reach 40.2 percent of the population, followed by Claro (38.3 percent), and TIM and Oi (each with approximately 31 percent).[62]

The main fixed broadband access technologies are DSL (60.1 percent) and cable (31.5 percent).[63] As of March 2015, Claro held 31.8 percent of the fixed broadband market, followed by Oi (23.9 percent), Telefônica (16.1 percent), Global Village Telecom (GVT) (12.5 percent), and Algar Telecom (1.7 percent).[64]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants (2013)[65]	10.08	n/a	n/a	n/a	n/a
Fixed broadband subs (2013)[66]	20,191,000				
% of households with fixed broadband access (2015)[67]	39.6				

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[58] Tecnologia, *4G: governo quer 700 MHz livre em grandes regiões em um ano* (May 16, 2014), http://tecnologia.terra.com.br/4g-governo-quer-700-mhz-livre-em-grandes-regioes-em-um-ano,2db1b87cd9106410VgnCLD2000000ec6eb0aRCRD.html.

[59] Telegeography CommsUpdate, *Satellite Provider O3B Seeking to Extend Broadband Coverage to Remote Parts of Brazil* (July 8, 2013), http://www.telegeography.com/products/commsupdate/articles/2013/07/08/satellite-provider-o3b-seeking-to-extend-broadband-coverage-to-remote-parts-of-brazil/.

[60] Ministry of Commc'ns, *Satélite geoestacionários* (Feb. 20, 2014), http://www.mc.gov.br/infraestrutura/satelites-geoestacionarios.

[61] Teleco, *3G: 3rd Generation Cellular in Brazil*, http://www.teleco.com.br/en/en_3g_brasil.asp (last visited July 13, 2015).

[62] Teleco, *4G: 4th Generation Cellular in Brazil*, http://www.teleco.com.br/4g_cobertura.asp (last visited July 13, 2015).

[63] Telegeography GlobalComms Database: *Brazil* (2014) (last visited July 13, 2015).

[64] *Id*.

[65] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[66] *Id.*

[67] Telegeography GlobalComms Database: *Brazil* (2015) (last visited Dec. 17, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[68]	52.04
Mobile wireless broadband subs (2014)[69]	157,868,000

5. Bulgaria

Regulation: In June 2014, Bulgaria adopted a National Broadband Infrastructure Plan for Next Generation Access. The plan sets two national targets: by 2020, 50 percent of households and 80 percent of businesses should have access to ultra-high speed fixed broadband connections with download speeds of 100 Mbps or more. In March 2015, the government announced its Updated Policy in the Field of Electronic Communications of the Republic of Bulgaria 2015–2018, which emphasizes the expedited roll-out of high-speed broadband infrastructure. In light of this new policy, Bulgaria plans to revise the National Broadband Infrastructure Plan by September 2015.[70]

In September 2014, prompted by "growing interest" in available spectrum resources, Bulgaria's regulator, the Communications Regulation Commission (CRC), launched a public consultation on the potential use of the 1800 MHz band.[71] CRC announced that it would reserve five megahertz of spectrum for new entrant Bulsatcom, while it would allocate the remaining available spectrum (2×13.4 megahertz) via auction.[72] Subsequently, wireless operator MobilTel initiated legal proceedings against CRC, claiming that current regulations required CRC to immediately provide MobilTel with requested spectrum for a flat fee.[73] In February 2015, CRC announced that it would decide on whether to award the disputed frequencies by March 2015;[74] as of June 2015, however, CRC had not made public any additional information as to the current status of the proceeding.

Market and Competition: Bulgaria's fixed broadband market is highly fragmented, with more than 860 providers offering Internet services as of June 2015. The ten largest ISPs, however, collectively control almost 70 percent of the market.[75] As of March 2015, Bulgaria's former fixed line incumbent Vivacom (registered as the Bulgarian Telecommunications Company, or BTC) claimed the largest percentage of

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[68] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[69] *Id.*

[70] Eur. Comm'n, *Bulgaria*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 49-50 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Bulgaria Report*]. *See also* Rep. of Bulg., Europe 2020: National Reform Programme at 59 (Apr. 2015), http://ec.europa.eu/europe2020/pdf/csr2015/nrp2015_bulgaria_en.pdf.

[71] Telegeography CommsUpdate, *CRC Consults on Use of Available Spectrum in 1800MHz Band* (Oct. 8, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/10/08/crc-consults-on-use-of-available-spectrum-in-1800mhz-band/.

[72] Telegeography CommsUpdate, *M-Tel, CRC Clash over LTE Spectrum in 1800MHz Band; M-Tel to Invest BGN150m in Networks in 2015* (Feb. 26, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/02/26/m-tel-crc-clash-over-lte-spectrum-in-1800mhz-band-m-tel-to-invest-bgn150m-in-networks-in-2015/.

[73] *Id.*

[74] Telegeography CommsUpdate, *CRC to Rule on Additional LTE Spectrum in 1800MHz Band on 12 March* (Feb. 27, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/02/27/crc-to-rule-on-additional-lte-spectrum-in-1800mhz-band-on-12-march/.

[75] Telegeography GlobalComms Database: *Bulgaria* (2015) (last visited July 14, 2015).

total fixed broadband subscribers (23.8 percent).[76] Because Vivacom holds a near-monopoly on DSL-based services, there is virtually no competition in the DSL retail market.[77]

As of December 2014, next generation access (NGA) technologies accounted for 66 percent of all fixed broadband subscriptions in Bulgaria, compared to an EU average of 31 percent.[78] The predominance of fiber and other NGA technologies have facilitated access to faster Internet speeds. As of December 2014, 47 percent of fixed broadband subscriptions had access to download speeds of more than 30 Mbps, and five percent to ultra-fast speeds of above 100 Mbps.[79]

In the wireless broadband sector, Bulgaria's four main mobile network operators – MobilTel, Telenor Bulgaria (formerly GloBul), Vivacom, and MAX – are each rolling out 4G LTE networks in various stages of development. New entrant MAX introduced Bulgaria's first LTE network in May 2014; as of June 2015, the network covered 17 cities and towns.[80] In June 2015, Telenor announced that its network was LTE-ready, pending the anticipated award of suitable frequencies in the 1800 MHz band.[81] Vivacom planned a commercial launch for June 2015, and MobilTel intends to offer commercial LTE services beginning in 2018.[82] Operators have attributed the slow deployment of LTE services to the fact that the majority of the 800 MHz band has not yet been freed up for mobile broadband use.[83]

Operators claim that the Bulgarian government has still not presented concrete plans or a timetable for the release of the spectrum, which would allow them to better develop their investment strategies.[84]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants (2013)[85]	19.39	n/a	n/a	n/a	n/a
Fixed broadband subs (Dec. 2014)[86]	1,396,579				
% of households with fixed broadband access (2014)[87]	56				

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[76] *Id.*

[77] *EC Bulgaria Report*, *supra* note 70, at 46.

[78] *Id.*

[79] *Id.* at 47.

[80] Telegeography GlobalComms Database: *Bulgaria* (2015) (last visited July 14, 2015).

[81] Telegeography CommsUpdate, *Telenor Bulgaria's Network LTE-Ready* (June 30, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/30/telenor-bulgarias-network-lte-ready/.

[82] Telegeography GlobalComms Database: *Bulgaria* (2015) (last visited July 14, 2015).

[83] *EC Bulgaria Report*, *supra* note 70, at 48. Bulgaria missed the EU's 2013 deadline to free up the band for electronic communications services via the transition from analog to digital television, and subsequently received permission to delay the frequency relocation until 2017. *See* Press Release, Eur. Comm'n, Europeans Suffering Because Most Member States Are Too Slow Delivering 4G Mobile Broadband Spectrum (July 23, 2013), http://europa.eu/rapid/press-release_IP-13-726_en.htm.

[84] *EC Bulgaria Report*, *supra* note 70, at 48.

[85] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[86] *Id.*

[87] Eurostat, Data Explorer (2015), http://ec.europa.eu/eurostat/data/database (last visited Dec. 17, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[88]	66.41
Mobile wireless broadband subs (Dec. 2014)[89]	4,760,000

6. Canada

Regulation: As part of a review of telecommunications services begun in April 2015, the Canadian Radio-television and Telecommunications Commission (CRTC) announced measures to foster more competition among broadband providers.[90] Starting in July 2015, incumbent ISPs were required to make their fiber facilities available to their competitors. The Connecting Canadians program was launched in July 2014 to bring Internet connections of at least 5 Mbps to an additional 280,000 households in mainly rural and remote regions by 2017. After a competitive bidding process to build the infrastructure in January 2015, the winning ISPs were announced beginning in May 2015, and infrastructure projects were expected to commence in summer 2015.[91]

Since 2012, over 99 percent of Canadians households have access to broadband speeds of at least 1.5 Mbps. In July 2014, Industry Canada launched the Digital Canada 150 program; one of the program's main goals is to extend broadband access at speeds of at least 5 Mbps to 98 percent of Canadian households, mainly in rural and remote communities, by 2017.[92]

Market and Competition: As of March 2015, there were five main companies providing broadband services in Canada. The largest broadband provider, by subscribers, is Bell Canada, with 26.6 percent market share, followed by Rogers Communications (16.3 percent), Shaw Communications (15.7 percent), Videotron (12.4 percent), and Telus Communications (12.1 percent).[93]

Videotron signed a contract to share Rogers Communications' 4G LTE mobile broadband infrastructure in May 2013, and by June 2015 they had a combined 84 percent LTE population coverage.[94] Bell Canada introduced its commercial 4G LTE service in the 2100 MHz band in Greater Toronto in September 2011, and Telus Communications started its commercial 4G LTE services in February 2012 using Bell's infrastructure. As of June 2015, both Bell and Telus had 91% LTE population coverage.[95]

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[88] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[89] *Id.*

[90] Gov't of Can., *CRTC Initiates Review of Basic Telecommunications Services for All Canadians* (Apr. 9, 2015), http://news.gc.ca/web/article-en.do?nid=960029; Gov't of Can., *CRTC Fostering Competition in the Broadband Internet Market* (July 22, 2015), http://news.gc.ca/web/article-en.do?nid=1004669.

[91] Gov't of Can., *Connecting Canadians*, http://www.ic.gc.ca/eic/site/028.nsf/eng/h_00587.html (last visited July 23, 2015).

[92] Gov't of Can., *Digital Canada 150: Connecting Canadians*, http://www.ic.gc.ca/eic/site/028.nsf/eng/h_00587.html (last visited Sept. 16, 2014).

[93] Telegeography GlobalComms Database: *Canada* (2015) (last visited July 21, 2015).

[94] *Id.*

[95]*Id.*

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[96]	35.4	1.7	18.9	13.4	1.4
Fixed broadband subs (Dec. 2014)[97]	12,569,087				
% of households with fixed broadband access (2014)[98]	80.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[99]	54.2				
Mobile wireless broadband subs (Dec. 2014)[100]	19,279,414				

7. Chile

Regulation: In June 2015, the Chilean Senate approved legislation introduced in May 2014 that guaranteed minimum Internet speeds for fixed and mobile connections.[101] Pursuant to the legislation, fixed Internet service providers must guarantee 70 percent of their advertised speeds for national connections and 50 percent in the case of international connections. Mobile ISPs must guarantee 60 percent of their advertised speeds for national connections and 40 percent for international connections. The Chilean telecommunications regulator, the Sub-Secretaria de Telecomunicaciones (Subtel) is responsible for determining the minimum speeds and implementing the initiative.[102]

In August 2015, the Ministry of Transport and Telecommunications announced that the rollout of the 4G LTE networks in the 700 MHz band can finally begin. Entel, Movistar and Claro won 4G licenses in the 700 MHz band in October 2013, but they did not receive the licenses immediately due to lawsuits filed by both industry and consumer groups regarding rollout obligations and spectrum caps. The 700 MHz band licenses include the obligation to provide connectivity to 1,281 municipalities and 854 kilometers of highway and provide mobile broadband to 503 educational establishments. Regulations also prohibit operators from charging more for the 4G service in more remote areas than prices charged in the capital of the region for the same service and obliges them to provide connectivity to schools free of charge for

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[96] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[97] *Id.*

[98] CRTC, Communications Monitoring Report at Fig. 5.3.14 (2015), http://www.crtc.gc.ca/eng/publications/reports/policymonitoring/2015/cmr5.htm#f5313 (last visited Dec. 28, 2015).

[99] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[100] *Id.*

[101] BNAmericas, *Chile Advances with Norm to Ensure Minimum Internet Speeds* (June 19, 2015), http://subscriber.bnamericas.com/Subscriber/en/news/telecommunications/chile-advances-with-norm-to-ensure-minimum-internet-speeds/.

[102] BNAmericas, *Chile to Legislate to Guarantee Internet Speeds* (May 7, 2014), http://subscriber.bnamericas.com/Subscriber/index.jsp?idioma=I&tipoContenido=detalle&pagina=content&idContenido=644989&tipoDocumento=1.

the first two years.[103] Entel has partnered with Ericsson to deploy the first LTE network in the APT 700 MHz band in Latin America.[104]

Chile is in the midst of creating a new agency, the Superintendency of Telecommunications. The legislation to create the new Superintendency of Telecommunications was submitted to the Senate in June 2013,[105] approved by the Committee of Transportation and Telecommunications of the Senate upper house on January 22, 2014, and has been sent to the Finance Committee of the upper house for approval.[106]

The new Superintendency of Telecommunications will not replace Subtel, but exist alongside it. The new legislation will delineate the responsibilities of the new regulator vis à vis the existing consumer protection authority, the National Consumer Service (Sernac), and will include a new framework for sanctions and financial penalties. The Superintendency of Telecommunications will be responsible for all technical issues, while Sernac will continue to handle matters relating to consumer law.[107]

Market and Competition: As of March 2015, Telefónica Chile (Movistar) was the largest fixed broadband provider in terms of subscribers, with a 39 percent market share, followed by VTR (37.6 percent), Claro Chile (11.2 percent), Grupo GTD (8.3 percent), and Entel (1.2 percent).[108]

As of March 2015, the top three mobile operators by subscribers were Movistar (39.9 percent), Entel PCS (35.7 percent), Claro Chile (23.1 percent), and newcomer WOM (1.3 percent). Claro was the first to launch an LTE network in Chile in June 2013, followed by Movistar in November 2013.[109]

Entel launched its LTE network in March 2014, after delaying its LTE launch until it could acquire a license to provide 4G services in the 700 MHz band in addition to the 2.6 GHz band.[110] By December 2014, Entel's LTE network had more than 800 points of presence in the country.[111]

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[103] BNAmericas, *Chile 700MHz Network Rollout Gets Green Light* (Aug. 10, 2015), http://subscriber.bnamericas.com/Subscriber/news/telecommunications/chile-700mhz-network-rollout-gets-green-light?idioma=en.

[104] Press Release, Ericsson, Ericsson and Entel Chile Renew Strategic Partnership until 2018 (Feb. 13, 2015), http://www.ericsson.com/news/150212-ericsson-and-entel-chile-renew-strategic-partnership_244069647_c.

[105] Estrategia On-Line, *Comisión Aprueba Proyecto que Crea Superintendencia de Telecomunicaciones* (Jan. 17, 2013), http://www.estrategia.cl/detalle_noticia.php?cod=71696. *See also* Telegeography CommsUpdate, *New Regulator Bill Gets Green Light* (June 5, 2013), http://www.telegeography.com/products/commsupdate/articles/2013/06/05/new-regulator-bill-gets-green-light/.

[106] Subtel, *Comisión de Transportes y Telecomunicaciones del Senado despachó proyecto que crea la Superintendencia de Telecomunicaciones* (Jan. 22, 2014), http://www.subtel.gob.cl/noticias/139-superintendencia/5236-comision-de-transportes-y-telecomunicaciones-del-senado-despacho-proyecto-que-crea-la-superintendencia-de-telecomunicaciones.

[107] Telegeography CommsUpdate, *New Regulator Due in 2013* (Oct. 16, 2012), http://www.telegeography.com/products/commsupdate/articles/2012/10/16/new-regulator-due-in-early-2013/.

[108] Telegeography GlobalComms Database: *Chile* (2015) (last visited July 21, 2015).

[109] *Id.*

[110] *Id.*

[111] Entel, Annual Report at 7 (2014), http://www.entel.cl/inversionistas/pdf/Memoria_2014_ENGLISH.pdf.

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[112]	14.0	0.6	7.0	5.6	0.8
Fixed broadband subs (Dec. 2014)[113]	2,489,717				
% of households with fixed broadband access (2012)[114]	36.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[115]	49.8				
Mobile wireless broadband subs (Dec. 2014)[116]	8,885,792				

8. Czech Republic

Regulation: In July 2014, the Czech Republic approved a new strategic plan, the Operational Programme Enterprise and Innovation for Competitiveness 2014–2020.[117] According to the program, the Czech Republic plans to allocate EUR521 million (US$575 million) in public funds, with an additional EUR275 million (US$303 million) of national co-financing, for high-speed broadband deployment, including the upgrade of current networks and the rollout of new networks.[118]

In April 2014, the Czech regulator, the Czech Telecommunications Office (CTU), published proposed rules for auctioning frequencies in the 3600-3800 MHz band.[119] CTU proposed holding a simultaneous multiple-round auction in which it would accept offers for sections of three 40 MHz blocks (8×5 megahertz) and one 80 MHz block (16×5 megahertz).[120] CTU suggested then allowing winning bidders to reach an agreement on the allocation of the individual 5 megahertz blocks within these sections; if the winning bidders could not agree, CTU would determine individual block placement by drawing lots. [121] The possibility of legislative amendments to spectrum pricing regulations delayed the auction planning

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[112] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[113] *Id.*

[114] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[115] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[116] *Id.*

[117] Ministry of Industry & Trade, *Government Approved the Operational Programme Enterprise and Innovation for Competitiveness 2014–2020 Proposed by MIT* (July 14, 2014), http://www.mpo.cz/dokument151397.html.

[118] Eur. Comm'n, *Czech Republic*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 79 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Czech Republic Report*].

[119] Telegeography CommsUpdate, *CTU Sets out Stall to Auction off 3.6 GHz-3.8 GHz Band for Broadband Services* (June 3, 2014), http://www.telegeography.com/products/commsupdate/articles/2014/06/03/ctu-sets-out-stall-to-auction-off-3-6ghz-3-8ghz-band-for-broadband-services/.

[120] CTU, *The Basic Principles of Awarding Rights for the Use of Radio Frequencies for Providing Electronic Communication Networks in the 3600-3800 MHz Frequency Band* (Apr. 29, 2014), http://www.ctu.eu/164/download/News-Events/basic_principles_29_04_2014_radio_frequencies_3600-3800_mhz.pdf.

[121] Telegeography CommsUpdate, *CTU Sets out Stall to Auction off 3.6 GHz-3.8 GHz Band for Broadband Services* (June 3, 2014), http://www.telegeography.com/products/commsupdate/articles/2014/06/03/ctu-sets-out-stall-to-auction-off-3-6ghz-3-8ghz-band-for-broadband-services/.

process.[122] In March 2015, CTU invited stakeholders to comment on the proposed auction rules.[123] Comments closed in May 2015, and CTU plans to hold the auction in late 2015.[124]

In June 2014, CTU announced its intention to re-auction available frequencies in the 1800 MHz and 2600 MHz bands that remained unsold during an earlier 2013 auction. The public consultation process closed in November 2014, and the CTU plans to auction these frequencies in late 2015, at the same time as the frequencies in the 3600-3800 MHz band.[125]

Market and Competition: The Czech fixed broadband market is characterized by strong infrastructure-based competition.[126] Incumbent O2 Czech Republic holds only 27.6 percent of the fixed broadband market as of September 2015, and the remainder is held by a large number of alternative operators, among the highest in the EU.[127] Leading alternative operators include UPC Ceska Republika (14.2 percent), GTS Czech (6.5 percent), Dial Telecom (4.8 percent), and T-Mobile Czech Republic (4.3 percent), with other smaller players making up the remaining 42.6 percent of subscribers.[128] As of December 2014, DSL remained the most popular access technology, but cable and fiber continued to gain traction.[129]

The annual growth rate for fixed broadband has declined steadily from 13.6 percent in 2012 to 8.0 percent in 2013 to 1.5 percent in 2014, reflecting the growing popularity of high-speed mobile connectivity.[130] Throughout 2014, all three main cellular operators – T-Mobile Czech Republic, O2 Czech Republic, and Vodafone Czech Republic – undertook large-scale LTE deployments.[131] As of March 2015, T-Mobile's LTE network covered 76 percent of the country,[132] and O2's LTE network covered 72 percent of the country, including 100 percent of Prague.[133] Lastly, as of May 2015, Vodafone's network covered 80 percent of the country. Vodafone plans to roll out LTE in the remaining areas by the end of summer 2015.[134] The three operators have continued to compete to upgrade their service offerings, with T-Mobile and O2 launching LTE-A in July 2014 and Vodafone following suit in September 2014.[135]

Because the conditions of the main operators' 4G licenses required them to provide wholesale offers, the mobile virtual network operator (MVNO) market has blossomed. As of June 2015, there were

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[122] CTU, Monthly Monitoring Report at 5 (Sept. 2014), http://www.ctu.eu/164/download/Monitoring_Reports/monitoring_report_09_2014_september.pdf.

[123] CTU, *An Invitation for Comments on the Draft Text of the Announcement of the Tender for the Award of Rights to Use Radio Frequencies to Ensure Electronic Communications Networks in the 3.7 GHz Frequency Band* (Mar. 5, 2015), http://www.ctu.cz/ctu-online/diskuzni-misto.html?action=detail&ArticleId=12322.

[124] Telegeography GlobalComms Database: *Czech Republic* (2015) (last visited July 23, 2015).

[125] *Id.*

[126] *EC Czech Republic Report*, *supra* note 119, at 77.

[127] *Id.*; Telegeography GlobalComms Database: *Czech Republic* (2015) (last visited Dec. 14, 2015).

[128] Telegeography GlobalComms Database: *Czech Republic* (2015) (last visited Dec. 14, 2015).

[129] *Id.*

[130] *Id.*

[131] *EC Czech Republic Report*, *supra* note 119, at 77.

[132] Telegeography GlobalComms Database: *T-Mobile Czech Republic* (2015) (last visited July 23, 2015).

[133] Telegeography GlobalComms Database: *O2 Czech Republic* (2015) (last visited July 23, 2015).

[134] Telegeography CommsUpdate, *Vodafone CR Announces 80% Territory Coverage for LTE* (June 29, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/29/vodafone-cr-announces-80-territory-coverage-for-lte/.

[135] Telegeography GlobalComms Database: *Czech Republic* (2015) (last visited July 23, 2015).

approximately 80 MVNOs in the Czech Republic. The proliferation of MVNOs has contributed to the wider choice of mobile broadband services for consumers and lower retail prices.[136]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[137]	28.34	3.9	5.0	9.1	10.3
Fixed broadband subs (Dec. 2014)[138]	2,979,400				
% of households with fixed broadband access (2014)[139]	76.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[140]	65.1				
Mobile wireless broadband subs (Dec. 2014)[141]	6,848,300				

9. Denmark

Regulation: Under its mandate, the Danish Business Authority (DBA), the nation's telecommunications regulator, is responsible for "market development, growth, and innovation, and for guaranteeing that all citizens have easy access to wireless communication technologies."[142] Since its launch of a national broadband strategy in March 2013, the Danish government has been steadily implementing the plan's 22 initiatives for the improvement of broadband services and mobile coverage.[143] The strategy calls for 100 percent access at minimum download speeds of 100 Mbps and minimum upload speeds of 30 Mbps for all households and businesses by 2020.[144]

In February 2015, Danish officials agreed on a further "Growth Plan for Digitization" split into four areas: (1) improved mobile and broadband coverage throughout the country; (2) increased use of ICTs and data in Danish businesses; (3) enhanced digital security; and (4) boosting digital skills and e-learning resources.

In order to focus on the first new specific priority, the government decided to free-up the 700 MHz band for mobile broadband via auction by 2019 at the latest, to set coverage requirements for future spectrum auction, to pass new legislation aimed at better utilization of pipes and cables for broadband, and to facilitate coordination and agreements between telecommunications providers and municipalities in view

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[136] *EC Czech Republic Report*, *supra* note 119, at 77.

[137] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[138] *Id.*

[139] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[140] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[141] *Id.*

[142] DBA, *Telecom and Spectrum,* http://danishbusinessauthority.dk/telecom-and-spectrum (last visited Dec. 14, 2015).

[143] DBA, *Broadband Mapping*, http://w2l.dk/file/475201/broadband-mapping.pdf (last visited Dec. 14, 2015).

[144] *Id.*

of improving the local mobile and broadband coverage in remote areas.[145]

In March 2015, the DBA introduced a new broadband coverage tool which relies on a modeling approach and a single database where operators report the speed of the broadband connections according to locations and end-users interactively report their experience. This tool will be developed further so it can be extended to mobile coverage.[146]

Market and Competition: Denmark's overall ICT sector, like many in Europe, suffered from the general economic downturn in 2014, with a marked decrease in terms of investment and revenues reported by operators. However, the market is characterized by growing competition and dynamism in the mobile sector and a fairly stable fixed sector, still dominated by the historic incumbent TDC, which claimed 1.3 million broadband subscribers, split between its DSL and cable platforms, as of end-June 2015. While the incumbent continues to be the country's largest broadband service provider, its overall market share (currently 53.8 percent) is being steadily eroded by a growing number of alternative operators. With more than 80 companies providing Internet access services at the end of 2014, the market is extremely fragmented, although consolidation amongst TDC's main rivals has meant that a few companies are now able to provide the incumbent with some level of competition.[147]

Denmark has four major mobile operators. As of mid-2015, TDC had a 37.6 percent market share of mobile subscribers followed by Telenor (21.7 percent), TeliaSonera (20.7 percent), and Hutchison Whampoa's Hi3G Access Denmark (14.2 percent).[148] As of mid-2015, TDC advertised LTE population coverage of 99.5%, and it is committed to bringing LTE coverage to 99.8% of residents in 207 of the country's most sparsely populated areas by end-2015.[149]

Since 2012, no additional spectrum has been made available or assigned for wireless broadband. In total, 1025 megahertz of spectrum are available today for wireless broadband, in the following bands: 800 MHz, 900 MHz, 1800 MHz, 2 GHz, 2.6GHz, and 3.4-3.8 GHz. Lack of market interest was reported with regard to the higher bands.[150]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[151]	41.3	8.9	11.6	20.5	0.3
Fixed broadband subs (Dec. 2014)[152]	2,331,830				
% of households with fixed broadband access (2014)[153]	85.0				

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[145] Eur. Comm'n, *Denmark*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 88-9 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Denmark Report*].

[146] *Id.*

[147] Telegeography GlobalComms Database: *Denmark* (2015) (last visited Sept. 13, 2015).

[148] Leila Abboud & Foo Yun Chee, *TeliaSonera, Telenor Prepare New Concessions on Denmark Mobile Deal: Sources* (Aug. 28, 2015), http://www.reuters.com/article/2015/08/28/us-teliasonera-telenor-m-a-exclusive-idUSKCN0QX20D20150828.

[149] Telegeography GlobalComms Database: *Denmark* (2015) (last visited Sept. 13, 2015).

[150] *EC Denmark Report*, *supra* note 146, at 90.

[151] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[152] *Id.*

[153] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[154]	115.5
Mobile wireless broadband subs (Dec. 2014)[155]	6,518,062

10. Estonia

Regulation: Most of the responsibilities under the European Commission (EC) telecommunications regulatory framework fall under one authority: the Estonian Technical Regulatory Authority (ETRA). The Ministry of Economic Affairs and Communications, however, approves Estonia's National Radio Frequency Allocation Table and National Numbering Plan, as well as promulgating regulations governing the provision of the universal service program.[156]

There has not yet been discussion in Estonia regarding the extension of the scope of universal service to include broadband connections, since wireless broadband is available to end-users throughout the country, with up to 3.1 Mbps download/1.8 Mbps upload speeds at a price deemed affordable by the government.[157] Moreover, Estonian officials have also created a public-private partnership to build a national fiber-based next-generation network providing 100Mb/s to all premises. This project is led by the Estonian Broadband Development Foundation (ELA), which was founded by eight major Estonian telecommunications companies: Elion, EMT, Elisa, Tele2, Levira, Ericsson, Eltel, and Televõrgu AS.[158] This non-profit entity operates at the wholesale level, renting dark fiber to any provider under the same commercial conditions. The overall layout of the network (designed in 2009) includes an all-fiber middle-mile network aimed at ensuring 98 percent of all households in Estonia will be located no further than 1.5 kilometers (or 0.75 miles) from the nearest network access point.[159]

Market and Competition: Estonia has one of the highest broadband penetration rates among Eastern European countries, a fact that is due in part to the continued commitment of its former Prime Minister, Andrus Ansip, to increasing the country's broadband network infrastructure and services. Mr. Ansip now serves as Vice President and European Commissioner for the Digital Single Market, a post he has held since November 2014.

There are currently two main broadband operators, Eesti Telekom (via Elion), the incumbent, and Starman, a cable operator. Fixed-line infrastructure has been upgraded and is geared towards offering broadband services and bundled offerings, with ADSL2+ and fiber-to-the-premises (FTTP) networks deployed in urban areas and wireless technologies such as WiMAX used to deploy either competing infrastructure or access into rural areas.[160]

Estonia's growing mobile broadband sector supports a range of mobile content and applications. In

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[154] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[155] *Id.*

[156] *See* Estonian Electronic Communications Act (Jan. 1, 2005), *available at* https://www.riigiteataja.ee/en/eli/ee/Riigikogu/act/501042015003/consolide.

[157] Eur. Comm'n, *Estonia*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 103 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990.

[158] *Id.*

[159] Telegeography GlobalComms Database: *Estonia* (2015) (last visited Sept. 28, 2015).

[160] Henry Lancaster, *Estonia – Key Statistics, Telecom Market and Regulatory Overviews* (May 15, 2015), http://www.budde.com.au/Research/Estonia-Key-Statistics-Telecom-Market-and-Regulatory-Overviews.html.

addition, aggressive LTE deployment continues. By January 2014, three mobile operators – EMT, Elisa, and Tele2 – had obtained 800 MHz licenses to help improve their rollout of 4G services, and in March 2014, Tele2 announced that it had acquired a second 2100 MHz spectrum concession, enabling it to double its 3G mobile broadband capacity and giving it the largest spectrum portfolio of all the Estonian players.[161] By spring 2015, Estonia had achieved nationwide 4G coverage.[162]

Wired	**Total**	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[163]	28.2	9.3	6.3	10.7	1.9
Fixed broadband subs (Dec. 2014)[164]	371,009				
% of households with fixed broadband access (2014)[165]	81.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[166]	114.2				
Mobile wireless broadband subs (Dec. 2014)[167]	1,502,044				

11. Finland

Regulation: The Finnish Information Society Code entered into force on January 1, 2015. The Code updates and consolidates under a single legal instrument a number of regulations in areas such as e-privacy, consumer protection, and communications networks and data security, as well as granting additional powers to FICORA, the Finnish telecommunications regulatory agency.[168]

In addition, on April 16, 2015, the Finnish Ministry of Transport and Communications issued a decree setting a new minimum speed of 2 Mbps for universal broadband services, beginning in November 2015.[169] The government argued that such high speeds would be possible because of the dedicated use of the 800 MHz band for wireless broadband and the strict licensee coverage requirement (97 to-99 percent after five years). Moreover, in 2017, the government will undertake a new review of the universal speed requirement, and it announced a new goal of 10 Mbps by 2020.[170]

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[161] Telegeography GlobalComms Database: *Estonia* (2015) (last visited Sept. 13, 2015).

[162] *Id.*

[163] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[164] *Id.*

[165] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[166] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[167] *Id.*

[168] Eur. Comm'n, *Finland*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 108 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Finland Report*].

[169] *Id.* at 112.

[170] *Id.*

Market and Competition: Finland's four major wireline broadband operators – Elisa, TeliaSonera, DNA, and the Finnet Group – together account for more than 98 percent of the market.[171] DSL connections remain the most popular broadband access technology, but cable modem connections continue to rise in popularity.[172]

In October 2013, after nine months of bidding, FICORA completed its 800 MHz digital dividend auction, generating EUR 108.01 million (US$119 million).[173] Since that time, DNA, Elisa, and TeliaSonera have all used spectrum in the 800 MHz band to improve and enlarge 4G LTE coverage.[174] In late 2014, as forecasted, Finnish start-up Ukko Mobile launched the world's first 4G LTE wireless broadband network using the 450 MHz band.[175] No additional spectrum was made available or assigned for wireless broadband over the past year. While the 700 MHz band is currently being used for television broadcasting, this band will become available for wireless broadband services by 2017.[176]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[177]	32.2	1.1	7.2	17.6	6.3
Fixed broadband subs (Dec. 2014)[178]	1,758,500				
% of households with fixed broadband access (2014)[179]	89.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[180]	138.0				
Mobile wireless broadband subs (Dec. 2014)[181]	7,537,800				

12. France

Regulation: Between July 2014 and June 2015, the French regulator Autorité de Régulation des Communications Électroniques et des Postes (ARCEP) gained significant regulatory powers over the fixed and mobile markets. In August 2014, Decree 2014-867 restored ARCEP's authority to sanction operators with a new procedure that separates the investigative and enforcement arms of the agency.[182] In February 2015, the economic reform law "Loi Macron" was adopted by the National Assembly and will

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[171] Telegeography GlobalComms Database: *Finland* (2015) (last visited Sept. 13, 2015).

[172] *Id.*

[173] FICORA, *End of 4G Spectrum Auction* (Oct. 31, 2013), https://www.viestintavirasto.fi/en/ficora/news/2013/endof4gspectrumauction.html.

[174] *Id.*

[175] Telegeography CommsUpdate, *Ukko Aims for LTE-450 World-First Launch* (June 19, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/06/19/ukko-aims-for-lte-450-world-first-launch/.

[176] *EC Finland Report*, *supra* note 169, at 109.

[177] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[178] *Id.*

[179] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[180] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[181] *Id.*

[182] Telegeography GlobalComms Database: *France* (2015) (last visited July 21, 2015).

allow ARCEP to regulate roaming arrangements between mobile operators.[183] Loi Macron also requires operators to provide nationwide 2G coverage by 2015 and full 3G/4G coverage by 2017. On June 29, 2015, ARCEP submitted a draft recommendation for public consultation on the operator requirement to roll out fiber in sparsely populated areas.[184]

In December 2014, ARCEP announced that the 700 MHz band used for digital terrestrial television will be available for tender in the second half of 2015 and is expected to generate EUR 2.1 billion (US$2.3 billion). In December 2015, the spectrum will be awarded, but the actual transfer will take place between October 2017 and June 2019, depending on the region.

Market and Competition: In March 2015, Orange published its new strategic plan for fiber-to-the-home (FTTH) rollout. The plan triples Orange's current investment in fiber through 2020 and will increase the number of connected households from 3.6 million to 20 million by 2022. Additionally, Orange's Essentials 2020 plan will attempt to launch a Voice-over-Wi-Fi service in 2015.

In April 2015, Orange announced it would create fibered zones in nine cities to facilitate the switch-off of the copper local loop. Currently, Orange and SFR-Numericable are due to renegotiate the distribution of FTTH deployment opportunities in rural areas, but no public announcement has been made.

In July 2014, Orange rejected notions that it would attempt to consolidate the wireless market. In October 2014, France conditionally approved the Numericable purchase of SFR. The conditions require SFR-Numericable to allow competitors to use its networks while they develop their own and to divest its mobile operators in the French overseas territories of Reunion and Mayotte. This is the first infrastructure-sharing condition on an acquisition issued in Europe.

In June 2015, Altice offered EUR 10.1 billion (US$11.1 billion) for Bouygues Telecom, which prompted SFR-Numericable to announce its exclusive negotiations with Illiad Group for the "resale of a portfolio of assets."[185] As of March 2015, the market share of SFR-Numericable is 24.9 percent, with Orange France at 39.8 percent, Illiad at 22.7 percent, and Bouygues Telecom at 9.6 percent.

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[186]	39.2	1.4	3.6	33.8	0.4
Fixed broadband subs (Dec. 2014)[187]	25,969,000				
% of households with fixed broadband access (2014)[188]	77.0				

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[183] Anne Morris, *Arcep to Review Free Mobile's National Roaming Deal with Orange* (Feb. 23, 2015), http://www.fiercewireless.com/europe/story/arcep-review-free-mobiles-national-roaming-deal-orange/2015-02-23.

[184] Press Release, ARCEP, ARCEP Submits to Consultation a Draft Recommendation on Implementing an Obligation of Completeness for Fibre Rollouts (June 29, 2015), http://www.arcep.fr/index.php?id=1&L=1.

[185] Telegeography CommsUpdate, *Altice Offers EUR10.1bn in Cash for Bouygues Telecom* (June 22, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/22/altice-offers-eur10-1bn-in-cash-for-bouygues-telecom/.

[186] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[187] *Id.*

[188] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[189]	64.7
Mobile wireless broadband subs (Dec. 2014)[190]	42,810,000

13. Germany

Regulation: Germany's Digital Agenda 2014-2017 requires that 700 MHz spectrum be used for mobile broadband coverage by 2018.[191] In December 2014, consensus between the national and state governments regarding the auction of the 700 MHz band was reached and the Federal Network Agency (FNA, also known as Bundesnetzagentur or BNetzA) published its final conditions in January 2015. The FNA planned to auction 270 megahertz in the 700 MHz, 900 MHz, 1500 MHz, and 1800 MHz bands with the condition that the winning bidders must provide 98 percent of all homes with 50 Mbps mobile download speeds. In June 2015, the auction concluded and raised EUR 5.08 billion (US$5.6 billion), which made Germany the first European country to sell 700 MHz spectrum for mobile broadband.[192]

In June 2014, the EC gave BNetzA three months to lower mobile termination rates, which are more than 80 percent higher than in other EU member states. In September 2014, BNetzA published a proposal for mobile termination rate cuts between December 2014 and November 2016. In June 2015, the EC approved a EUR 3 billion (US$3.3 billion) program for developing next generation access networks in rural areas.[193]

Market and Competition: In July 2014, the EC approved Telefonica's acquisition of E-plus for EUR 8.55 billion (US$9.4 billion), combining the two smallest fixed line broadband providers into the nation's largest.[194] As part of the conditions, Telefonica agreed to sell 20 percent of its mobile network capacity to Drillisch, an MVNO, and allow Drillisch to purchase up to 10 percent more capacity. Additionally, Telefonica agreed to offer 20 megahertz of spectrum in the 2100 MHz and/or 2600 MHz bands to a new operator and extend contracts with wholesale partners through 2025. In August 2014, the EC gave final clearance on the conditions and the acquisition was completed on October 1, 2014. In January 2015, Tele Colombus announced it planned to enter the mobile market during 2015.[195]

Nationally, BNetzA conditioned the Telefonica Deutschland and E-Plus merger on the return of spectrum in the 900MHz/1800MHz bands by December 31, 2015.[196] The regulator will conduct a frequency

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[189] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[190] *Id.*

[191] Telegeography GlobalComms Database: *Germany* (2015) (last visited July 27, 2015).

[192] Telegeography CommsUpdate, *German Spectrum Auction Raises EUR5.08bn* (June 22, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/22/german-spectrum-auction-raises-eur5-08bn/.

[193] Press Release, Eur. Comm'n, State Aid: Commission Approves €3 Billion Aid Scheme in Germany to Support High Speed Internet Roll-Out (June 22, 2015), http://europa.eu/rapid/press-release_IP-15-5186_en.htm.

[194] Press Release, Eur. Comm'n, Mergers: Commission Clears Acquisition of E-Plus by Telefónica Deutschland, Subject To Conditions (July 2, 2014), http://europa.eu/rapid/press-release_IP-14-771_en.htm.

[195] Telegeography CommsUpdate, *Tele Columbus Entering Mobile Market This Year; Not Planning Sale of Company alongside IPO* (Jan. 14, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/01/14/tele-columbus-entering-mobile-market-this-year-not-planning-sale-of-company-alongside-ipo/.

[196] Press Release, BNetzA, Merger of Telefónica and E-Plus (Oct. 20, 2014), http://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/Oef

distribution analysis once the spectrum auction is over to determine whether any additional action is needed. In April 2015, Telefonica abolished all roaming charges between its various national networks, including O2 and E-Plus. As of March 2015, Germany only has three mobile providers: Telefonica Deutschland Holding (38.7 percent market share), Telekom Deutschland (32.6 percent), and Vodafone Germany (28.7 percent).[197] Telekom Deutschland allotted EUR 6 billion (US$8.3 billion) for fixed line broadband infrastructure development between 2013 and 2020.[198] Using these funds, Telekom Deutschland plans to increase VDSL coverage to 65 percent of households using 10,000 kilometers of fiber by the end of 2016. In September 2014, United Internet acquired Versatel, increasing its market share for fixed broadband from 12.7 percent in September 2014 to 14.2 percent in March 2015.[199] The largest provider is Telekom Deutschland (41.7 percent), followed by Vodafone Germany (18.3 percent), Unitymedia KabelBW (9.8 percent), and Telefonica Deutschland Holding (7.1 percent).[200]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[201]	35.9	0.4	7.2	28.2	0.0
Fixed broadband subs (Dec. 2014)[202]	29,572,818				
% of households with fixed broadband access (2014)[203]	87.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[204]	63.8				
Mobile wireless broadband subs (Dec. 2014)[205]	52,575,423				

14. Greece

Regulation: Greece's independent regulator, the Hellenic National Telecommunications & Post Commission (EETT), is currently preparing a new five-year national broadband plan (the previous plan covered 2007-2013), following a public consultation with relevant stakeholders in 2014.[206] The plan

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fentlicheNetze/Mobilfunknetze/ZusSchlussvorhTelefonicaEPlus/ZusammenschlussvorhabenTelefonicaEPlus-node.html.

[197] Telegeography GlobalComms Database: *Germany* (2015) (last visited July 27, 2015).

[198] Press Release, Telekom Deutschland, Deutsche Telekom Launches European Network (Mar. 2, 2015), http://www.telekom.com/media/company/269056.

[199] http://www.united-internet.de/en/investor-relations/publications/announcements/announcements-detail/news/united-internet-acquires-100-of-versatel-shares.html (last visited January 28, 2016).

[200] http://uk.practicallaw.com/0-619-2253 (last visited January 28, 2016).

[201] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[202] *Id.*

[203] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[204] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[205] *Id.*

[206] Eur. Comm'n, *Greece*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 139-40 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Greece Report*].

centers on encouraging private investment in high-speed broadband networks by reducing the cost of network deployment (*e.g.*, simplifying administrative procedures, speeding up the granting of right-of-way authorizations issued by local authorities, encouraging better targeting of investments through infrastructure and service availability mapping, etc.). The EETT is also focusing on increasing broadband availability in rural areas through a dedicated fund of EUR 120 ($USD 132 million), in order to achieve 100 percent population coverage with 30 Mbps by 2020.[207]

Market and Competition: Overall, Greece continues to rank near the bottom among western European countries in terms of broadband adoption.[208] Despite the unprecedented deepening of the economic crisis that has plagued Greece over the last year, the ICT sector has had been one of the most positive aspects of the overall economy, with the sector contributing 3 percent of the nation's GDP in 2014-15.[209]

The incumbent provider, OTE, with 44.6 percent market share, has rolled-out ADSL infrastructure to 99 percent of its network and, despite the uncertain economic climate, is slowly pursuing its plan for VDSL deployment.[210] By mid-2015, approximately 34 percent of its access lines were VDSL-enabled, covering approximately 40 percent of Greek households.[211] Other retail operators that provide fixed broadband services primarily via unbundled local loop access include ForthNet (19 percent market share), Hellas Online (15 percent), and Wind Hellas (11 percent).[212] Broadband services delivered over technologies other than xDSL represent a small fraction of total connections, less than 0.5 percent of overall subscribers, the smallest percentage among EU Member States.[213] There are no cable-based services in the country, while fixed wireless and direct fiber broadband services that do exist are either corporate use only, restricted to limited areas, or in the early stages of development.[214]

As of June 2015, Cosmote (wholly-owned by OTE) led the mobile sector with 43.2 percent market share, followed by Vodafone (30.7 percent), and Wind Hellas (26.2 percent).[215] In November 2011, these three wireless operators acquired technology-neutral spectrum licenses in the 900 MHz and 1800 MHz bands.[216] The new licenses allowed the three companies to expand 3G services and launch 4G LTE services. In November 2012, Cosmote launched the country's first commercial LTE network, and its LTE coverage reached 70 percent of the Greek population by the start of 2015, up from 65 percent in October 2014, with coverage over 80 percent in Athens and 90 percent in Thessaloniki.[217] In June 2013, Vodafone rolled out its own 4G network, and by January 2015, it had expanded coverage to over 60 percent in both major cities.[218] The effects of Greece's debt crisis and economic austerity measures have led to less disposable income for consumers and a reduction in demand for new mobile subscriptions; nevertheless, mobile broadband subscriber levels have increased modestly over the last few years.[219]

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[207] *Id.* at 140.

[208] *See generally* OECD Broadband Portal.

[209] *EC Greece Report*, *supra* note 205, at 136.

[210] Telegeography GlobalComms Database: *Greece* (2015) (last visited Oct. 14, 2015).

[211] *EC Greece Report*, *supra* note 205, at 138.

[212] Telegeography GlobalComms Database: *Greece* (2015) (last visited Oct. 14, 2015).

[213] *Id.*

[214] *Id.*

[215] *Id.*

[216] *Id.*

[217] *Id.*

[218] *Id.*

[219] *Id.*

There are currently no concrete plans in Greece for the 700 MHz band, as the band is currently the primary means of broadcasting services and is used by the Greek Army. The 800 MHz band was assigned to the mobile operators after completion of the analogue switch-off has completed.[220]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[221]	28.7	0.0	0.0	28.6	0.1
Fixed broadband subs (Dec. 2014)[222]	3,156,071				
% of households with fixed broadband access (2014)[223]	65.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[224]	41.5				
Mobile wireless broadband subs (Dec. 2014)[225]	4,559,958				

15. Hong Kong

Regulation: In December 2014, the Office of the Communications Authority (OFCA), Hong Kong's telecommunications regulator, completed its auction of 49.2 megahertz of paired spectrum in the 2100 MHz band. The auction raised a total of US$312 million from China Mobile (US$124.2 million for 19.6 megahertz), SmarTone (US$126.5 million for 19.8 megahertz), and Hutchison 3 (US$60.9 million for 9.8 megahertz) for 15-year licenses.[226]

Market and Competition: In May 2015, Hong Kong-based PCCW Global, China Telecom Global, and Taiwan's Chunghwa Telecom signed agreements to establish a unified Internet Protocol Exchange platform spanning Greater China. The agreement includes support for Voice over Internet Protocol Exchange, general packet radio service (GPRS) roaming exchange, high definition calling, high definition video conferencing, Ethernet, cloud offerings, and software-defined networking (SDN). The platform will connect Internet protocol services between mobile and fixed networks using Multiprotocol Label Switching (MPLS).[227]

In May 2015, Hutchinson 3 Hong Kong and WhatsApp announced Hong Kong's first local and roaming WhatsApp-based messaging and VoIP-calling packages, called WhatsApp Roaming Pass. The new

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[220] *EC Greece Report*, *supra* note 205, at 142.

[221] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[222] *Id.*

[223] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[224] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[225] *Id.*

[226] Affirunisa Kankudti, *Hong Kong 3G Spectrum Auctions; China Mobile, SmarTone Spend Big* (Dec. 9, 2014), http://nextelecomasia.com/2g-3g-4g/hong-kong-3g-spectrum-auctions-china-mobile-smartone-spend-big/.

[227] Press Release, PCCW Global, PCCW Global, China Telecom Global and Chunghwa Telecom International Create A Unified IPX Platform For Greater China (May 13, 2015), https://www.pccwglobal.com/en/about/newsroom/2015/364-pccw-global-china-telecom-global-and-chunghwa-telecom-international-create-a-unified-ipx-platform-for-greater-china.

international roaming packages enable customers to make over-the-top (OTT) calls and send messages to friends and family whether in Hong Kong or overseas for a fixed daily fee.[228]

Triple-play provider Hong Kong Broadband Network (HKBN) was Hong Kong's biggest initial public offering of 2015, and the second largest in Asia Pacific, when it raised US$750 million in March.[229] In October 2014, Chinese technology heavyweight ZTE announced that it supported the commercial launch of voice-over-LTE (VoLTE) services by Hong Kong mobile provider CSL (part of the PCCW-HKT group), which has enabled all CSL users to access VoLTE voice and video calling services with compatible devices.

In June 2015, PCCW was the leader by subscribers in the retail wired broadband market (56.0 percent), followed by HKBN (27.9 percent), Hutchison Global Communications (7.7 percent), i-Cable (6.5 percent), with other smaller players accounting for the remaining subscribers (1.9 percent).[230]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants (2013)[231]	30.82	n/a	n/a	n/a	n/a
Fixed broadband subs (Jan. 2014)[232]	2,220,000				
% of households with fixed broadband access (2014)	n/a				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[233]	104.54				
Mobile wireless broadband subs (Jan. 2014)[234]	5,432,000				

16. Hungary

Regulation: The telecommunications sector in Hungary is subject to an extensive taxation regime.[235] In early October 2014, the government introduced a controversial new plan to tax Internet usage. The proposed plan charged Internet service providers (ISPs) (not customers) 150 forints (US$0.62) for every gigabyte of data traffic, with a monthly cap of 700 forints (US$2.49) per individual subscription or 5,000

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[228] Hutchison 3, *WhatsApp Mobile Roaming Plan*,
http://www.three.com.hk/website/appmanager/three/home?_nfpb=true&_pageLabel=P200470391219567710594&lang=eng&pageid=0031f0506 (last visited Sept. 18, 2015).

[229] Prudence Ho, *HKBN Raises $750 Million in Hong Kong's Biggest IPO This Year* (Mar. 4, 2015), http://www.wsj.com/articles/hkbn-raises-750-million-in-hong-kongs-biggest-ipo-this-year-1425516808.

[230] Telegeography GlobalComms Database: *Hong Kong* (2015) (last visited Nov. 21, 2015).

[231] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[232] *Id.*

[233] *Id.*

[234] *Id.*

[235] European Commission, *Hungary*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 153 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Hungary Report*].

forints (US$17.80) per corporate subscription.[236] Following mass protests across Hungary, the government withdrew the proposal in late October 2014.[237] In May 2015, the government announced that, as of January 2016, it may lower the value-added tax (VAT) applicable to Internet subscriptions from the current rate of 27 percent to 18 percent. The reduction, however, would only apply to subscriptions from service providers involved in the deployment of ultra-fast broadband networks.[238] The government also announced that it may phase out a sector-based utilities tax currently levied on telecommunications companies.[239]

In February 2015, the Prime Minister's Office launched a comprehensive public consultation on the future of the Internet in Hungary.[240] With respect to broadband, the consultation sought public input on proposed measures to expand the scope of universal service, accelerate the construction of high-speed networks, and stimulate the growth of domestic Internet service providers (ISPs).[241]

Market and Competition: As of June 2015, four operators – Magyar Telekom (MTel), UPC Hungary, DIGI Telecommunications, and Invitel Holdings – account for approximately 86 percent of the fixed broadband market, with the remaining 14 percent highly fragmented among smaller players.[242] According to a March 2015 report by Hungary's regulator, the National Media and Infocommunications Authority (NMHH), the fixed broadband market continues to experience solid growth across all access platforms, including DSL, cable modem, fiber, and WiMAX.[243] With respect to mobile broadband, Hungary has three major mobile networks operators – MTel, which operates under the T-Mobile brand (47.8 percent of subscribers as of June 2015); Telenor Hungary (28.1 percent); and Vodafone (24.1 percent).[244] Market leader T-Mobile launched commercial LTE services in Hungary in January 2012, covering approximately 80 percent of the population by May 2015.[245] Telenor launched LTE services in July 2012; during 2014, it spent HUF 44.8 billion (US$160 million) to expand its 4G network, which covered 65 percent of the population as of May 2015.[246]

In February 2015, MTel and Telenor Hungary agreed to jointly develop their respective 800 MHz 4G networks in all parts of Hungary, excluding Budapest. According to the agreement, T-Mobile will gradually implement and operate the 800 MHz network in the Transdanubian region, while Telekom will do so in the rest of Hungary, minus Budapest. Additionally, the two operators each plan to install and manage 800 base transceiver stations by the end of 2015. As a result of the agreement, T-Mobile and Telenor expect to increase their 4G footprints to 97 percent and 95 percent, respectively, by the end of

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[236] Chris Harris, *All You Need to Know about Hungary's Internet Tax* (Oct. 14, 2014), http://www.euronews.com/2014/10/29/all-you-need-to-know-about-hungarys-internet-tax/.

[237] Margit Feher, *Hungary Drops Internet Tax Plan for Now* (Oct. 31, 2014), http://www.wsj.com/articles/hungary-drops-internet-tax-plan-1414744757.

[238] Telegeography CommsUpdate, *Hungarian Internet Tax Could Fall from 27% to 18% in 2016* (May 12, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/12/hungarian-internet-tax-could-fall-from-27-to-18-in-2016/.

[239] *Id.*

[240] *EC Hungary Report*, *supra* note 234, at 158.

[241] *See* InternetKon, https://www.internetkon.hu/ (last visited Oct. 30, 2015).

[242] Telegeography GlobalComms Database: *Hungary* (2015) (last visited Oct. 30, 2015).

[243] *Id.*

[244] *Id.*

[245] *Id.*

[246] *Id.*

2015.[247] Despite efforts to increase the availability of mobile broadband across Hungary, mobile data consumption remains among the lowest in Europe, at less than a fifth of a gigabyte per month per person.[248]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[249]	26.2	4.0	12.5	8.3	1.4
Fixed broadband subs (Dec. 2014)[250]	2,580,537				
% of households with fixed broadband access (2014)[251]	74.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[252]	34.3				
Mobile wireless broadband subs (Dec. 2014)[253]	3,380,935				

17. Iceland

Regulation: In November 2012, Iceland's Parliament adopted a four-year Telecommunications Implementation Plan. The plan sets out a number of short-term and long-term goals, including: 90 percent of homes and businesses must have access to a 30 Mbps connection by 2014 (100 percent by 2022); 70 percent of homes and businesses must have access to a 100 Mbps connection by 2014 (99 percent by 2022); and 98 percent of homes and businesses must have access to high-speed mobile networks by 2014 (99.9 percent by 2022).[254]

Market and Competition: Broadband adoption in Iceland remains among the highest in the world. In a September 2014 report, the UN Broadband Commission ranked Iceland as first in the world for Internet usage per capita, at 96.5 percent.[255] Stimulated by government policies, FTTH has been expanded in the capital and major outlying towns.[256]

Incumbent operator Siminn is the principal provider of fixed broadband services, accounting for 48.4 percent of subscribers as of June 2015.[257] Siminn operates a comprehensive ADSL network in addition to

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[247] Telegeography CommsUpdate, *MTel, Telenor Agree 800MHz 4G Pact* (Feb. 27, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/02/27/mtel-telenor-agree-800mhz-4g-pact/.

[248] Nancy Scola, *Hungary's Crazy-Expensive Internet is Driving People to Throw Their Computers into the Street* (Oct. 28, 2014), https://www.washingtonpost.com/news/the-switch/wp/2014/10/28/hungarys-crazy-expensive-internet-is-driving-people-to-throw-their-computers-into-the-street/.

[249] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[250] *Id.*

[251] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[252] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[253] *Id.*

[254] Telegeography GlobalComms Database: *Iceland* (2015) (last visited Oct. 30, 2015).

[255] UN Broadband Comm'n, The State of Broadband 2014: Broadband for All (Sept. 2014), http://www.broadbandcommission.org/Documents/reports/bb-annualreport2014.pdf.

[256] Business Wire, Research and Markets, *Iceland – Telecoms, IP Networks, Digital Media and Forecasts* (Feb. 2014), http://www.researchandmarkets.com/research/bxxg4r/iceland_telecoms.

[257] Telegeography GlobalComms Database: *Iceland* (2015) (last visited Oct. 30, 2015).

an extensive fiber optic network, which provides coverage to more than 80,000 households.[258] With 28.9 percent of subscribers, Vodafone is Siminn's chief competitor.[259] Vodafone is also Iceland's largest fiber-based access provider, accounting for approximately 70 percent of all fiber connections at the end of 2014.[260] Fiber-based technologies represent the fastest growing segment of the fixed broadband market, with subscriptions increasing approximately 6 percent from December 2013 to December 2014.

There are three key players in Iceland's mobile market: Siminn (35.6 percent market share as of June 2015), Nova (35.1 percent), and Vodafone (29.4 percent).[261] All three companies have taken steps to expand 4G LTE coverage over the past year. As of May 2015, Siminn has the largest footprint, with its networking reaching 84 percent of the population.[262] However, newcomer 365 Media, which acquired a 4G license in Iceland's April 2013 spectrum auction, plans to build a mobile network that extends to 99.5 percent of the population by the end of 2016, with expected peak download speed of 100 Mbps.[263]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[264]	36.8	9.2	0.0	27.3	0.3
Fixed broadband subs (Dec. 2014)[265]	119,917				
% of households with fixed broadband access (2014)[266]	93.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[267]	87.3				
Mobile wireless broadband subs (Dec. 2014)[268]	284,193				

18. India

Regulation: Spurred by the Digital India initiative, the Department of Telecommunications established a review committee and released its Report of the Committee on National Optical Fibre Network (NOFN) on March 31, 2015. Its recommendations included renaming the NOFN to BharatNet and designing BharatNet as a multi-technology network. As BharatNet, the national network will connect Indians for less than US$2.30 per month in poor states, and around US$3.80 in wealthier areas.

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[258] *Id.*

[259] *Id.*

[260] *Id.*

[261] *Id.*

[262] Telegeography CommsUpdate, *Siminn Extends LTE Footprint to 85% of Population* (May 29, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/29/siminn-extends-lte-footprint-to-84-of-population/.

[263] *Id.*

[264] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[265] *Id.*

[266] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[267] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[268] *Id.*

The government has reduced its goal speeds from up to 100 Mbps nationwide, to a range between 2 Mbps and 20 Mbps. BharatNet is projected to cost Rs 72,000 crore (US$10.9 billion). [269] The recommendations were accepted by the government on April 2, 2015.[270]

In March 2015, India held a spectrum auction for frequencies in the 800 MHz, 900 MHz, 1800 MHz, and 2100 MHz bands and raised US$18 billion. Bharti, Vodafone, and Idea's bids represented over 75 percent of the total money raised, as they each sought to win back expiring licenses. Reliance Communications also sought to win back expiring spectrum licenses, but lost its 900 MHz licenses in five markets.[271]

Competition: Loop Mobile, a small player as compared to Bharti Airtel, chose not to renew its 900 MHz license when it did not participate in India's 2014 spectrum auction, and its license expired at the end of 2014. In February 2015, after a protracted battle for government approval, Airtel finalized a deal to acquire Loop Mobile for US$110 million, including its spectrum licenses and its customers.[272] In June 2015, Idea increased data fees by up to 100 percent for prepaid 2G and 3G customers in the Delhi market, and soon afterward Bharti Airtel similarly raised data prices for prepaid 2G and 3G customers in the Delhi market.[273]

In June 2015, Bharat Sanchar Nigam had the most wireline broadband subscribers in India (61.8 percent of the market), Bharti Airtel has the second most (9.0 percent), followed by Mahanagar Telephone Nigam (7.1 percent), Atria Convergence Technologies (4.5 percent), and YOU Broadband (2.9 percent). A collection of smaller players account for the remaining market share (14.7 percent).[274]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[275]	1.21	n/a	n/a	n/a	n/a
Fixed broadband subs (Jan. 2014)[276]	15,320,000				
% of households with fixed broadband access (2015)[277]	6.3				

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[269] Dep't of Telecomm., Report of the Committee on National Optical Fibre Network (Mar. 31, 2015), http://www.dot.gov.in/sites/default/files/rs/Report%20of%20the%20Committee%20on%20NOFN.pdf.

[270] Economic Times Bureau, *National Optical Fibre Network Renamed as BharatNet* (Apr. 2, 2015), http://articles.economictimes.indiatimes.com/2015-04-02/news/60756567_1_national-optical-fibre-network-broadband-network-digital-india-programme.

[271] Bianca Vázquez Toness, *Idea, Bharti Lead Spectrum Bids as India Sale Raises $18 Billion* (Mar. 25, 2015), http://www.bloomberg.com/news/articles/2015-03-25/india-said-to-raise-18-billion-from-wireless-airwaves-auction.

[272] Press Release, Bharti Airtel, Airtel and Loop Mobile Announce Agreement to Create Mumbai's Largest Mobile Network (Feb. 18, 2014), http://www.airtel.in/.

[273] Press Trust of India, *Idea Cellular Hikes Mobile Data Rates By Up To 100% In Delhi* (June 4, 2015), http://telecom.economictimes.indiatimes.com/news/3g-4g/idea-cellular-hikes-mobile-data-rates-by-up-to-100-in-delhi/47541803; Press Trust of India, *Airtel Hikes Data Rates For Pre-Paid Customers In Delhi* (June 9, 2015), http://www.thehindu.com/business/Industry/bharti-airtel-hikes-data-rates-for-prepaid-customers-in-delhi/article7298725.ece.

[274] Telegeography GlobalComms Database: *India* (2015) (last visited Nov. 22, 2015).

[275] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[276] *Id.*

[277] Telegeography GlobalComms Database: *India* (2015) (last visited Nov. 22, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[278]	5.52
Mobile wireless broadband subs (Jan. 2014)[279]	69,990,000

19. Ireland

Regulation: In August 2012, the Department of Communications, Energy and Natural Resources (DCENR) announced its new National Broadband Plan (NBP), which aimed to bring connectivity at speeds of at least 30 Mbps to every home in the country by 2015.[280] Although the NBP accelerated the rollout of high-speed services, most of the investment occurred in urban areas, with many sparsely-populated rural areas experiencing no investment or improvements in the availability of quality broadband services.[281] In April 2014, in order to address the growing urban-rural digital divide, DCENR updated the plan and announced the NBP Intervention Strategy, a major state-led fiber build-out to rural areas.[282] DCENR launched a public consultation on the proposed strategy in July 2015.[283]

In April 2014, in tandem with the NBP Intervention Strategy, DCENR embarked on a comprehensive broadband mapping project, intended to identify proposed locations for the fiber-based connections.[284] The interactive map, completed in November 2014, indicates the areas that will have access to commercial high-speed broadband services by the end of 2016, as well as the proposed sites for state intervention.[285]

In July 2014, DCENR launched a comprehensive spectrum policy review.[286] To inform the review, DCENR opened a public consultation in July 2014; by the close of the comment period in September 2014, it had received 16 total comments from stakeholders. DCENR planned to issue a revised Spectrum Policy in 2015; however, as of October 2015, it had not yet published the new policy.[287]

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[278] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[279] *Id.*

[280] DCENR, The National Broadband Plan: Delivering a Connected Society (Aug. 30, 2012), http://www.dcenr.gov.ie/NR/rdonlyres/1EA7B477-741B-4B74-A08E-6350135C32D2/0/NBP.pdf.

[281] Eur. Comm'n, *Ireland*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 162 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Ireland Report*].

[282] *See* DCENR, *Ireland's Broadband Intervention Strategy* (2015), http://www.dcenr.gov.ie/communications/Lists/Consultations%20Documents/NBP%20Intervention%20Strategy%20consultation%20reports/NBP%20Intervention%20Strategy%20Report.pdf.

[283] DCENR, *National Broadband Plan Intervention Strategy Public Consultation*, http://www.dcenr.gov.ie/communications/en-ie/Pages/Consultation/NBP-Strategy-Intervention-Public-Consultation.aspx (last visited Oct. 30, 2015).

[284] *EC Ireland Report*, *supra* note 281, at 162.

[285] *Id. See also* DCENR, *Connecting Communities*, http://www.dcenr.gov.ie/communications/en-ie/Broadband/Pages/Connecting-Communities.aspx (last visited Oct. 30, 2015).

[286] Nick Wood, *Ireland Launches Spectrum Policy Review* (July 28, 2014), http://www.totaltele.com/view.aspx?ID=487085.

[287] DCENR, *Spectrum Policy Consultation*, http://www.dcenr.gov.ie/communications/en-ie/Pages/Consultation/Spectrum-Policy-Consultation.aspx (last visited Oct. 30, 2015).

Market and Competition: There are two key players in the Irish fixed broadband market: incumbent eir (formerly Eircom) (36.4 percent of subscribers as of June 2015) and its chief competitor Virgin Media Ireland (formerly UPC) (30.4 percent of subscribers).[288] At the end of 2014, the Commission for Communications Regulation (ComReg), Ireland's regulatory agency, reported that 49.6 percent of residential fixed broadband subscribers accessed download speeds of 30 Mbps or higher.[289]

Top-placed eir has taken the lead in the deployment of high-speed fiber networks. In October 2014, eir announced its plans to deliver FTTH technology to 1.6 million homes and businesses (approximately 70 percent of the population) by mid-2016.[290] In June 2015, eir increased this target by an additional 300,000 premises, announcing plans to invest EUR 400 million (US$440 million) over the next five years to extend its fiber footprint to 1.9 million homes by 2020.[291]

In the mobile sector, Hutchison 3G Ireland (3 Ireland) completed its long-contested EUR 850 million (US$935 million) takeover of rival O2 Ireland in July 2014, reducing the number of mobile network operators in the country from four to three.[292] In September 2013, Meteor Mobile became the first Irish operator to launch LTE service, quickly followed by market leader Vodafone less than a month later.[293] As of March 2015, Meter Mobile's 4G network covered approximately 55 percent of the population, while Vodafone's network extended to approximately 90 percent.[294] The merger with O2 delayed the rollout of LTE by 3 Ireland; however, as of March 2015, the network covered 40 cities and towns.[295]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[296]	27.3	0.1	7.9	18.0	1.2
Fixed broadband subs (Dec. 2014)[297]	1,258,758				
% of households with fixed broadband access (2014)[298]	80.0				

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[288] Telegeography GlobalComms Database: *Ireland* (2015) (last visited Oct. 30, 2015).

[289] *Id.*

[290] Telegeography CommsUpdate, *Eircom Welcomes Government's National Broadband Plan* (Nov. 25, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/11/25/eircom-welcomes-governments-national-broadband-plan/.

[291] Telegeography CommsUpdate, *Eircom to Supply 1Gbps Broadband to an Additional 300,000 Rural Premises* (June 4, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/04/eircom-to-supply-1gbps-broadband-to-additional-300000-rural-premises/.

[292] Telegeography CommsUpdate, *3 Ireland Completes Purchase of Rival O2* (July 16, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/07/16/3-ireland-completes-purchase-of-rival-o2/.

[293] Telegeography GlobalComms Database: *Ireland* (2015) last visited Oct. 30, 2015).

[294] *Id.*

[295] *Id.*

[296] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[297] *Id.*

[298] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[299]	82.1
Mobile wireless broadband subs (Dec. 2014)[300]	3,787,863

20. Israel

Regulation: In November 2014, the Ministry of Communications (MoC), the Israeli telecommunications regulator, approved wholesale broadband reforms intended to boost competition in the fixed-line broadband market and reduce costs for consumers.[301] The reforms require Bezeq, Israel's dominant fixed-line incumbent, to provide wholesale access to its infrastructure.[302] They also allow consumers to connect to the Internet without separately contracting with an infrastructure provider and an Internet service provider (ISP), as previously required.[303] In May 2015, the Minister of Communications announced plans to draft legislation to break up Bezeq.[304]

In July 2014, MoC launched an auction of 4G-suitable spectrum in the 1800 MHz band, offering eight available 5 MHz frequency blocks. Six bidders, including all five of Israel's existing mobile network operators, submitted applications by the October 2014 deadline. In January 2015, MoC announced the results of the auction, which had raised ILS 250.5 million (US$65.6 million). Pelephone acquired the most spectrum, paying a total of ILS 96 million (US$25 million) for 15 megahertz (3×5 megahertz). Partner Communications, Cellcom, HOT Mobile, Golan Telecom, and 018 Xfone each acquired a single 5 MHz block, with the price per block ranging from ILS 32.5 million (US$8.5 million) (Cellcom) to ILS 34.5 million (US$9 million) (HOT).[305] The license conditions require the operators to launch 4G services within a year of the spectrum allocation, or lose their licenses with no refund. Moreover, the operators are required to establish LTE networks over 30 percent of the country within 18 months, 65 percent within 36 months, and 100 percent within 48 months.[306] As of March 2015, however, MoC had yet to allocate the spectrum to the winning bidders, with no additional information on the status available as of June 2015.[307]

In October 2011, the Israeli government announced plans for a 25,000-kilometer fiber optic network alongside the nationwide electric grid, aimed at bringing ultra-high speed Internet to Israel and increasing

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[299] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[300] *Id.*

[301] Telegeography CommsUpdate, *Israel Finalises Wholesale Market Reforms* (Nov. 19, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/11/19/israel-finalises-wholesale-market-reforms/.

[302] Telegeography CommsUpdate, *Israel's Fixed Line Sector Gets a Shake-Up as Wholesale Market Reforms Take Effect* (Feb. 18, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/02/18/israels-fixed-line-sector-gets-a-shake-up-as-wholesale-market-reforms-take-effect/.

[303] Telecompaper, *Israel Opens up Wholesale Broadband Market* (Feb. 19, 2015), http://www.telecompaper.com/news/israel-opens-up-wholesale-broadband-market--1066232.

[304] Telecompaper, *Outgoing Minister Plans Bill to Break up Bezeq* (May 19, 2015), http://www.telecompaper.com/news/outgoing-minister-plans-bill-to-break-up-bezeq--1082766.

[305] Telegeography GlobalComms Database: *Israel* (2015) (last visited July 23, 2015).

[306] Press Release, Ministry of Commc'ns, The Auction for Operating Fourth Generation Services Has Ended (Jan. 12, 2015), http://www.moc.gov.il/sip_storage/FILES/9/4089.pdf.

[307] Telegeography GlobalComms Database: *Israel* (2015) (last visited July 23, 2015).

competition in the broadband sector.[308] The Israel Broadband Company (IBC), a new joint venture between the Israel Electric Corporation (IEC) and a consortium of private companies, began offering services under the "Unlimited" banner in May 2014.[309] According to the IEC, the network will cover about 70 percent of Israel by 2020, with FTTH connections available in many parts of the Tel Aviv area by the end of 2015.[310] In November 2014, however, press reports indicated that the IBC was struggling to retain customers.[311] As of March 2015, five of Israel's smaller ISPs offered customer access via IBC's infrastructure; however, the market's largest providers, including Bezeq, had not signed distribution agreements with IBC.[312]

Market and Competition: MoC enacted new wholesale reforms in an effort to overhaul the fixed broadband market by facilitating the entry of alternative operators and lowering costs for consumers by up to 20 percent.[313] Operators began announcing price reductions as soon as the regulations came into effect. In February 2015, for example, both 018 Xfone and 012 Smile (owned by Partner Communications) began offering Internet access with download speeds of 100 Mbps for ILS 100 (US$26) per month.[314]

Bezeq has 66.1 percent of total subscribers as of March 2015 and HOT has 33.9 percent.[315] Bezeq began migrating its customers to Internet Protocol (IP)-based networks in June 2009, and by the end of 2014, Bezeq had extended its next-generation infrastructure to 99 percent of Israeli households, offering speeds of 100 Mbps.[316] By virtue of a July 2014 MoC decision that allowed operators to refarm a small block of spectrum in the 1800 MHz band for the provision of LTE-based services prior to the official auction, some wireless operators began to offer mobile broadband by launching limited commercial 4G services.

Partner Communications inaugurated its 4G network in July 2014, and Cellcom and Pelephone followed suit in August 2014. The allocation of the frequencies awarded in January 2015 is anticipated to bolster the rollout of 4G networks.[317]

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[308] Ari Rabinovitch, *Israel Seeks Investor for New Fiber Optic Network* (Oct. 9, 2011), http://www.reuters.com/article/israel-telecom-idUSL5E7L90AT20111009.

[309] Telegeography GlobalComms Database: *Israel Broadband Company (IBC)* (2015) (last visited July 24, 2015).

[310] David Shamah, *Israel Gets 'Revolutionary' Fast Fiber Optic Net* (May 21, 2014), http://www.timesofisrael.com/israel-gets-revolutionary-fast-fiber-optic-net/.

[311] Telegeography CommsUpdate, *Israeli Fibre Broadband Provider Struggling to Retain Customers?* (Nov. 25, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/11/25/israeli-fibre-broadband-provider-struggling-to-retain-customers/.

[312] Telegeography GlobalComms Database: *Israel Broadband Company (IBC)* (2015) (last visited July 24, 2015).

[313] Telegeography CommsUpdate, *Israel's Fixed Line Sector Gets a Shake-Up as Wholesale Market Reforms Take Effect* (Feb. 18, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/02/18/israels-fixed-line-sector-gets-a-shake-up-as-wholesale-market-reforms-take-effect/.

[314] Gad Perez, *Broadband Policy Reform Lowers Prices* (Feb. 18, 2015), http://www.globes.co.il/en/article-broadband-policy-reform-lowers-internet-prices-1001011183.

[315] Telegeography GlobalComms Database: *Israel* (2015) (last visited July 24, 2015).

[316] Telegeography GlobalComms Database: *Bezeq (Israel Telecommunication Corporation)* (2015) (last visited July 24, 2015).

[317] Telegeography GlobalComms Database: *Israel* (2015) (last visited July 24, 2015).

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[318]	25.3	0.0	8.7	16.6	0.0
Fixed broadband subs (Dec. 2014)[319]	2,077,000				
% of households with fixed broadband access (2013)[320]	70.7				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[321]	49.9				
Mobile wireless broadband subs (Dec. 2014)[322]	4,090,000				

21. Italy

Regulation: In March 2015, in an effort to accelerate the country's sluggish broadband development, the Italian government announced an ambitious new national broadband plan, the Strategy for Italian Broadband and Digital Growth 2014-20.[323] The plan aims to exceed the objectives of the EU's Digital Agenda by bringing high-speed broadband of 100 Mbps to 85 percent of Italians by 2020 (compared to the 50 percent goal set by the Digital Agenda).[324] To achieve this goal, the plan envisions EUR 6 billion (US$6.6 billion) in public funding, coupled with an additional EUR 6 billion investment through public-private partnerships.[325] The strategy will offer operators incentives, such as tax exemptions, to invest in upgrading their networks, particularly in the less-developed southern part of Italy.[326] Some of the proposed measures, such as the plan to offer vouchers to users migrating to ultra-fast fiber connections, have caused concern among operators, potentially delaying final governmental approval of the strategy.[327]

Market and Competition: Italy is one of Western Europe's least developed broadband markets.[328] The EU Digital Scoreboard reported in June 2015 that only 59 percent of Italians regularly use the Internet, while 31 percent have never used the Internet, among the lowest percentages in the EU on both

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[318] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[319] *Id.*

[320] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[321] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[322] *Id.*

[323] Telecompaper, *Italian Cabinet Approves EUR 6 Bln National Broadband Plan* (Mar. 4, 2015), http://www.telecompaper.com/news/italian-cabinet-approves-eur-6-bln-national-broadband-plan--1068912.

[324] Eur. Comm'n, *Italy*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 173 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990.

[325] Federico Guerrini, *Italy's €6bn Broadband Plan: Spread 100Mbps Far and Wide, Fill in the Rural Notspots* (Mar. 6, 2015), http://www.zdnet.com/article/italys-6bn-broadband-plan-spread-100mbps-far-and-wide-fill-in-the-rural-notspots/.

[326] Telecompaper, *Italian Cabinet Approves EUR 6 Bln National Broadband Plan* (Mar. 4, 2015), http://www.telecompaper.com/news/italian-cabinet-approves-eur-6-bln-national-broadband-plan--1068912.

[327] Telegeography Comms Update, *Italian Broadband Plan Hits Delays* (June 25, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/25/italian-broadband-plan-hits-delays/.

[328] Telegeography GlobalComms Database: *Italy* (2015) (last visited Sept. 9, 2015).

measures.[329] Italy also lags behind the rest of Europe in terms of broadband speed; as of July 2014, just over 18 percent of broadband lines in Italy offer speeds of 10 Mbps or more, compared to an EU average of 66 percent.[330] Telecom Italia is the broadband market leader with 47.7 percent of subscribers, followed by Wind Telecomunicazioni (15.3 percent), FastWeb (14.6 percent), Vodafone Italy (12.4 percent), Tiscali (3.2 percent), and other minor players (6.8 percent).[331] In contrast to its underdeveloped fixed broadband market, Italy has one of the region's most saturated wireless markets. Four incumbent operators compete for subscribers: Telecom Italia (TIM) (34.8 percent of market share), Vodafone Italy (29.1 percent), Wind Telecomunicazioni (24.7 percent), and 3 Italia (11.5 percent).[332] As of March 2014, all four operators have launched LTE networks. However, TIM has taken the lead in rolling out the most expansive network, with plans to achieve LTE coverage of 80 percent of the country by the end of 2016.[333] Additionally, in November 2014, TIM and Vodafone each launched LTE-A networks.[334]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[335]	23.6	0.9	0.0	21.4	1.3
Fixed broadband subs (Dec. 2014)[336]	14,373,844				
% of households with fixed broadband access (2014)[337]	71.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[338]	70.9				
Mobile wireless broadband subs (Dec. 2014)[339]	43,104,410				

22. Japan

Regulation: In June 2014, the Ministry of Internal Affairs and Communications (MIC) announced its Smart Japan ICT Strategy, an update of the Ministry's 2013 ICT Growth Strategy and its Initiatives for ICT International Competitiveness Enhancement and International Expansion.[340] The strategy includes a focus on programs that will serve as a platform for sustained development and growth of the ICT sector in

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[329] Eur. Comm'n, *Digital Agenda Scoreboard: Italy* (2015), https://ec.europa.eu/digital-agenda/en/scoreboard/italy (last visited Sept. 9, 2015).

[330] Telegeography GlobalComms Database: *Italy* (2015) (last visited Sept. 9, 2015).

[331] *Id*.

[332] *Id.*

[333] *Id.*

[334] *Id.*

[335] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[336] *Id.*

[337] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[338] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[339] *Id.*

[340] Press Release, MIC, Announcement of Smart Japan ICT Strategy (June 20, 2014), http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/Releases/Telecommunications/140620_01.html.

Japan. Programs include infrastructure improvements; creation of flexible and effective public-private partnership ecosystem; and ICT literacy.[341]

In June 2015, Japan and the EU announced an agreement to cooperate on 5G mobile technology research, and announced US$13.1 million of funding for 5G projects related to the Internet of Things, cloud technologies, and big data platforms.[342] In October 2014, MIC ordered that, beginning in May 2015, all smartphones and tablets must be sold with their SIM cards unlocked at no cost to consumers if consumers so request.[343]

Market and Competition: In August 2014, NTT DOCOMO and Huawei ran successful trials of LTE over unlicensed 5 GHz spectrum. In March 2015, DOCOMO announced its 5G trials were reaching speeds up to 4.5 Gbps. It carried out the trials in February in the 15 GHz band. DOCOMO has launched or plans to launch trials with Ericsson, Nokia, Huawei, Mitsubishi and others. DOCOMO hopes to have its 5G networks launched by the 2020 Olympic and Paralympic Games in Tokyo.[344]

NEC, a Japanese corporation, won a contract to build and operate a new Trans-Pacific submarine cable funded by a consortium of China Telecom, Global Transit, Google, KDDI, and Singtel investing a total of US$300 million. The system will be branded the FASTER cable and will land in Japan and the United States. In June 2015, NTT had the largest share of retail wireline broadband subscribers (39.4 percent), followed by UQ Communications (21.6 percent), Softbank BB (6.9 percent), KDDI (6.9 percent), J:COM (5.8 percent), and other smaller players (17.7 percent).[345]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[346]	28.5	20.7	4.7	3.1	0.0
Fixed broadband subs (Dec. 2014)[347]	36,261,653				
% of households with fixed broadband access (2012)[348]	75				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[349]	124.1				
Mobile wireless broadband subs (Dec. 2014)[350]	157,812,151				

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[341] MIC, *Smart Japan ICT Strategy*, http://www.soumu.go.jp/main_content/000296880.pdf (last visited Sept. 18, 2015).

[342] Press Release, Eur. Comm'n, EU and Japan Step up Cooperation on 5G Mobile Technology and Strengthen Research and Innovation Collaboration (May 29, 2015), http://europa.eu/rapid/press-release_IP-15-5069_en.htm.

[343] Teppei Kasai, *Japan's Wireless Carriers Told To Unlock Phones Starting Next Year* (Oct. 31, 2014), http://www.reuters.com/article/2014/10/31/us-japan-mobilephone-simcards-idUSKBN0IK0EU20141031.

[344] Press Release, NTT DOCOMO, DOCOMO's 5G Outdoor Trial Achieves 4.5Gbps Ultra-High-Speed Transmission (Mar. 2, 2015), https://www.nttdocomo.co.jp/english/info/media_center/pr/2015/0302_03.html.

[345] Telegeography GlobalComms Database: *Japan* (2015) (last visited Nov. 20, 2015).

[346] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[347] *Id.*

[348] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[349] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[350] *Id.*

23. Korea

Regulation: In May 2015, the Ministry of Science, ICT and Future Planning (MSIP) confirmed plans to license a fourth mobile operator within a year.[351] In June 2015, the government announced it would accept applications for the entrant in August 2015.[352] In March 2015, Korea announced plans for a 700 MHz spectrum auction by the end of 2015.[353]

In June 2014, South Korea and the EU signed an agreement to cooperate on 5G research and development.[354]

Market and Competition: In June 2014, SK Telecom introduced 225 Mbps LTE-A in South Korea.[355] In January 2015, Finland's Nokia Networks and South Korea's SK Telecom (SKT) announced plans to collaborate on 5G wireless technologies, including gigabit-level data transmission equipment and cloud-based virtual base stations, and announced aims to establish a 5G research and development facility in SKT's Corporate R&D Centre to develop and test centimeter- and millimeter-wave 5G technologies using 6 GHz or higher spectrum.[356] Also in January 2015, the two announced a partnership on an LTE-A technology called Enhanced Inter-Cell Interference Coordination (eICIC).[357] In February 2015, SKT selected Samsung as the sole vendor in a nationwide Network Functions Virtualization (NFV) deployment of SKT's dedicated mobile Internet of Things (IoT) network.[358]

In June 2015, KT announced GiGA LTE, a technology capable of gigabit download speeds by combining LTE and WiFi technologies. However, the service was only available to those of its 4G customers with Samsung Galaxy S6 and S6 Edge handsets after installation of a required firmware update. Also in June, KT and Ericsson signed a Memorandum of Understanding (MoU) for collaboration on Internet of Things research and development and LTE-MTC.[359] In May 2015, KT and Alcatel Lucent signed an MoU to collaborate on 5G research and development.[360]

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[351] Joseph Waring, *Korea to Award 4th Mobile License by End of Year* (May 29, 2015), http://www.mobileworldlive.com/asia/asia-news/korea-award-4th-mobile-licence-end-year/.

[352] Kim Yoo-chul, *Korea Plans Wireless Spectrum Auction* (Mar. 8, 2015), http://www.koreatimes.co.kr/www/news/tech/2015/03/133_174834.html.

[353] *Id.*

[354] Press Release, Eur. Comm'n, Landmark Agreement between the European Commission and South Korea on 5G Mobile Technology (June 16, 2014), http://europa.eu/rapid/press-release_IP-14-680_en.htm.

[355] Telegeography CommsUpdate, *SK Telecom Introducing 225 Mbps LTE-A This Week* (June 18, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/06/18/sk-telecom-introducing-225mbps-lte-a-this-week/.

[356] Business Korea, *SKT, Nokia Jointly Open R&D Center For 5G Tech* (June 30, 2015), http://www.businesskorea.co.kr/english/news/sciencetech/11215-joint-research-development-skt-nokia-jointly-open-rd-center-5g-tech.

[357] Press Release, SK Telecom, SK Telecom and Nokia Networks Announce World's First Commercialization of eICIC (Jan. 28, 2015), http://www.sktelecom.com/en/press/detail.do?idx=1100.

[358] Press Release, Samsung, Samsung's Virtualized Core Solution Chosen to Support SK Telecom's Nationwide IoT Network (Feb. 5, 2015), http://www.samsung.com/global/business/networks/insights/news/samsungs-virtualized-core-solution-chosen-to-support-sk-telecom.

[359] Press Release, GSMA, KT, The First to Commercialize 'Giga LTE' In the World, Advances Into 5G Era (June 17, 2015), http://www.gsma.com/membership/kt-the-first-to-commercialize-giga-lte-in-the-world-advances-into-5g-era/.

[360] Press Release, Alcatel-Lucent, Alcatel-Lucent and Korea's KT Sign Collaboration Agreement to Deliver 5G Mobile Networks of the Future (May 19, 2015), https://www.alcatel-lucent.com/press/2015/alcatel-lucent-and-koreas-kt-sign-collaboration-agreement-deliver-5g-mobile-networks-future-0.

As of June 2015, KT Corp had the most wired broadband subscribers in South Korea (44.1 percent of the market), followed by SK Broadband (24.3 percent), LG Uplus (15.2%), and other smaller players (16.4 percent).[361]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[362]	38.0	25.9	8.9	3.2	0.0
Fixed broadband subs (Dec. 2014)[363]	19,198,934				
% of households with broadband access (2014)[364]	98.5				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[365]	106.5				
Mobile wireless broadband subs (Dec. 2014)[366]	53,751,479				

24. Lithuania

Regulation: In October 2014, the Lithuanian government adopted an updated national broadband plan, the New Generation Network Access Plan for 2014-2020.[367] The EUR 46 million (US$50.6 million) plan aims to connect 100 percent of households to Internet speeds of at least 30 Mbps by 2020.[368] According to the plan, approximately 80 percent of households will rely on fixed fiber connections, while the remaining 20 percent of households located in sparsely populated or rural areas will have access via mobile broadband.[369]

Complementing the New Generation Network Access Plan, Lithuania's Information Society Development Programme for 2011-2019 also sets targets for extending broadband coverage and increasing the availability of high-speed connections. Among its goals, the program aims to increase the proportion of the population that regularly uses the Internet from 75 percent in 2015 to 85 percent by 2019; extend broadband network access coverage to 98 percent by 2015 and 100 percent by 2019; and

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[361] Telegeography GlobalComms Database: *South Korea* (2015) (last visited Nov. 21, 2015).

[362] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[363] *Id.*

[364] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015) Korea's data also includes mobile broadband.

[365] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[366] *Id.*

[367] The Lithuania Tribune, *Lithuanian Government Plans Broadband for Everyone* (Oct. 28, 2014), http://en.delfi.lt/lithuania/economy/lithuanian-government-plans-broadband-for-everyone.d?id=66242390.

[368] Eur. Comm'n, *Lithuania*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 195 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990.

[369] *Id.*

ensure that at least 70 percent of households are using a broadband connection by the end of 2015, increasing to 80 percent of households by 2019.[370]

Market and Competition: In the fixed broadband sector, incumbent TEO LT leads the market, with 49 percent of subscribers as of March 2015. The remaining half of the market remains fiercely competitive, with 107 active Internet service providers, a situation that has kept end-user prices low. In terms of technology, Lithuania has become a global leader in FTTH adoption. As of January 2015, Lithuania's FTTH network covered around 70 percent of households in more than 100 towns and cities.[371]

Three mobile network operators are active in Lithuania: Omnitel, Tele2 Lithuania, and Bite Lithuania. As of March 2015, Tele2 had 40.3 percent of mobile subscribers, followed by Omnitel (34.9 percent) and Bite Lithuania (24.8 percent). There are also four MVNOs, all operating on Bite's network, and six licensed resellers; nevertheless, the top three operators account for approximately 99 percent of all mobile subscribers.[372] With Lithuania's extremely high wireless penetration well above the regional average, competition between the three main operators remains strong; faced with a mature market, all three network operators have turned to more advanced data services in an attempt to gain a competitive edge. As of April 2015, Bite and Omnitel have both introduced LTE-A networks, with Tele2 expected to follow suit in August 2015.[373]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants (2013)[374]	22.01	n/a	n/a	n/a	n/a
Fixed broadband subs (2013)[375]	664,168				
% of households with fixed broadband access (2014)[376]	65				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[377]	58.56				
Mobile wireless broadband subs (Dec. 2014)[378]	1,762,000				

25. Luxembourg

Regulation: In October 2014, the EC sued Luxembourg's telecommunications regulator, the Institut Luxembourgeois de Regulation (ILR), for failing to conduct a review of market competition.[379] Under

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[370] Telegeography GlobalComms Database: *Lithuania* (2015) (last visited Sept. 8, 2015).

[371] *Id.*

[372] *Id.*

[373] *Id.*

[374] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[375] *Id.*

[376] Eurostat, Data Explorer (2015), http://ec.europa.eu/eurostat/data/database (last visited Dec. 17, 2015).

[377] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[378] *Id.*

[379] Press Release, Eur. Comm'n, Telecoms: Commission Refers Luxembourg to Court for Persistent Delays in Analysing Relevant Markets (Oct. 16, 2014), http://europa.eu/rapid/press-release_IP-14-1147_en.htm.

EU legislation, the ILR is required to perform a review of its competition policies, which it has not done since 2007.[380]

Market and Competition: In December 2014, broadband providers wrestled with a 2 percent increase in the Value-Added-Tax (VAT). Orange noted that it would not pass the cost on to its customers, while Tango will only pay for some of the increase.[381] In mid-December 2014, Tango announced plans to launch a 4G+ LTE-Advanced network during 2015, which will increase the current 4G download speeds from 150 Mbps to 225 Mbps.

In January 2015, Tango began offering a "FreeBorders" plan to German, French, and Belgian residents for EUR 35 (US$41) per month. The plan requires a one-year contract without a smartphone purchase and a two-year contract with a smartphone purchase.

The dominant mobile operator is state-backed Post Luxembourg, with 462, 000 subscribers and a 50.8 percent market share.[382] Tango follows with 286,000 subscribers and a 31.5 percent market share, while Orange Luxembourg serves 125,000 subscribers with a 13.8 percent market share, and Luxembourg Online carries the remaining 36,000 subscribers at a 4 percent market share.

In April 2015, Altice partnered with Cisco to deploy a next-generation converged cable access platform across several countries, including Luxembourg.[383] This long-term investment strategy will increase customer bandwidth to 10 Gbps.

By the end of 2014, 100 percent of households had access to ADSL, 90 percent to VDSL, 70 percent to cable, and 40 percent to FTTH. As of March 2015, the market is dominated by Post Luxembourg with a 68.8 percent market share.

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[384]	33.7	3.7	3.6	26.3	0.1
Fixed broadband subs (Dec. 2014)[385]	187,600				
% of households with fixed broadband access (2014)[386]	93.0				

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[380] To provide market players with legal certainty, EU law requires national regulatory authorities to conduct a market analysis on a regular basis: two years after the adoption of a Commission recommendation on relevant markets, or three years after the last analysis.

[381] Telegeography CommsUpdate, *Orange Luxembourg Customers Will Not Pay VAT Increase* (Dec. 1, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/12/01/orange-luxembourg-customers-will-not-pay-vat-increase/; Telegeography CommsUpdate, *It Takes 2% to Tango* (Dec. 4, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/12/04/it-takes-2-to-tango/.

[382] Telegeography GlobalComms Database: *Luxembourg* (2015) (last visited July 27, 2015).

[383] Joao Lima, *Cisco & Altice Speed up the Internet Taking IoE on Board* (Apr. 22, 2015), http://www.cbronline.com/news/telecoms/connectivity/cisco-altice-speed-up-the-internet-taking-ioe-on-board-4559579.

[384] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[385] *Id.*

[386] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[387]	84.4
Mobile wireless broadband subs (Dec. 2014)[388]	470,000

26. Mexico

Regulation: In July 2015, the Mexican regulator Federal Institute of Telecommunications (IFT) announced it would auction 2.5 GHz spectrum for 4G starting in 2016.[389] Mexico's constitutional reforms mandate that 90 megahertz of the 700 MHz band, which will be freed as a result of the DTV transition in 2015, is to be utilized for the installation and operation of a shared public wireless broadband network to be operated by an independent wholesaler. The government will consider public and private investments to fund construction of this wholesale "carrier of carriers" network to counter the market power of America Móvil. The "carrier of carrier" network is set to be operational by 2018.[390] The auction is expected to begin in the third quarter of 2015, with the bids being opened in the first half of 2016 and awards announced the second half of 2016.[391] In May 2015, the government cut the investment target for the open access network power from US$10 billion to US$7 billion after AT&T entered the Mexican market and the reduced market power of America Móvil.[392] The Secretariat of Communications and Transportation (SCT) reported in July 2015 that it had received 39 expressions of interest from domestic and foreign entities interested in rolling out and operating the shared wholesale 700 MHz broadband network.[393]

Pursuant to the National Digital Strategy launched in November 2013, the President's office is tracking updates on the 23 aspects of the telecommunications industry via an online document.[394] A few examples of the progress made by the end of 2014 towards the 2018 goals include: building 3,500 kilometers of fiber optic backbone of the promised 35,000 kilometers; providing consumers with an additional

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[387] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[388] *Id.*

[389] Telegeography CommsUpdate, *Ifetel Agrees to Release 2.5GHz Band for LTE Use* (July 7, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/07/07/ifetel-agrees-to-release-2-5ghz-band-for-lte-use/.

[390] Pacto por Mexico, *Reforma en material de telecomunicaciones* (Mar. 11, 2013), http://pactopormexico.org/reforma-telecomunicaciones/; Telegeography CommsUpdate, *Mexican Open-Access 700MHz Network to be Operational by 2018* (Oct. 13, 2014), https://www.telegeography.com/products/commsupdate/articles/2015/05/28/mexico-slashes-investment-target-for-700mhz-wholesale-network/.

[391] Secretariat of Commc'ns &Transp., *Red Compartida – Etapas del Processo*, http://www.sct.gob.mx/red-compartida/etapas-proceso.html (last visited July 27, 2015).

[392] Telegeography CommsUpdate, *Mexico Slashes Investment Target for 700MHz Wholesale Network* (May 28, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/28/mexico-slashes-investment-target-for-700mhz-wholesale-network/.

[393] Secretariat of Commc'ns &Transp., *Compendio de las Manifestaciones de Interés (MDI) Para la Red Compartida*, http://www.sct.gob.mx/red-compartida/descargaPDF/Analisis-manifestaciones-de-interes.pdf (last visited July 27, 2015).

[394] *See Avances de la Estrategia Digital Nacional,* http://www.presidencia.gob.mx/edn/indicadores/ (last visited July 27, 2015).

competitor in the mobile market through the creation of one of four MVNOs; and having 65,000 public sites connected to broadband Internet of the targeted 244,000.[395]

Market and Competition: In October 2014, IFT fined America Móvil's Telmex US$3.7 million for monopolistic practices and required it unbundle its local loop (in July 2015) to further open the Mexican telecommunications market.[396] In terms of fixed broadband, Telmex holds a 56.1 percent subscriber market share as of March 2015. Megacable, the country's largest cable broadband provider and second largest broadband ISP, has a 9.7 percent market share, followed by Cablemas (5.8 percent), Izzi Telecom (formerly Cablevision) (5.1 percent), and Axtel (3.2 percent).[397]

As of September 2014, Telcel led the mobile market with a 69 percent market share, followed by Telefónica Mexico (Movistar) (20.8percent), Unefon (4.9 percent), Iusacell (3.6 percent), and Nextel Mexico (1.8 percent).[398]

Nextel Mexico launched its LTE service in October 2014, joining Movistar and Telcel as operators of LTE networks. As of August 2014, Telcel had the most extensive 4G network, covering 39 cities.[399]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[400]	10.7	0.7	6.7	3.0	0.3
Fixed broadband subs (Dec. 2014)[401]	12,838,093				
% of households with fixed broadband access (2014)[402]	33.7				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[403]	42.5				
Mobile wireless broadband subs (Dec. 2014)[404]	50,913,677				

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[395] *Id.*

[396] Telegeography CommsUpdate, *Telmex Fined USD3.7m for Monopolistic Practices* (Oct. 1, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/10/01/telmex-fined-usd3-7m-for-monopolistic-practices/; Telegeography CommsUpdate, *Ifetel Hits Telmex with LLU Order; Telco Has 60 Days to Prepare Terms* (July 1, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/07/01/ifetel-hits-telmex-with-llu-order-telco-has-60-days-to-prepare-terms/.

[397] Telegeography GlobalComms Database: *Mexico* (2015) (last visited July 22, 2015).

[398] IFT, *Informe Estadístico 3 Trimestre 2014*, http://www.ift.org.mx/sites/default/files/contenidogeneral/comunicacion-y-medios/versioncompatible.pdf (last visited Aug. 20, 2015).

[399] *Id.*

[400] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[401] *Id.*

[402] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[403] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[404] *Id.*

27. Netherlands

Regulation: During 2014, Agentschap Telecom (AT), the Dutch agency responsible for the management of radio spectrum, issued 10 time division duplex (TDD) licenses of 40 megahertz each for the provision of local wireless broadband services in the 3.5 GHz band. AT also modified the National Frequency Plan to allow for mobile communications in part of the 3.6-3.8 GHz band.[405] AT intends to make the 700 MHz band available for wireless broadband as of 2020, with the auction of the band projected to take place during 2018 or 2019.[406]

Market and Competition: In the fixed broadband market, fiber connections continued to rise in popularity, increasing by 6.6 percent during the fourth quarter of 2014.[407] Forecasts predict that there will be more than 3 million fiber lines in service by 2017.[408] Incumbent KPN Telecom is working with joint venture partner Reggefiber to facilitate a phased nationwide rollout of FTTH services at a total cost of EUR 6 billion to EUR 7 billion (US$6.6 billion to US$7.7 billion) over the next several years.[409] The rollout of advanced technologies, particularly the increase in fiber connectivity, has positively affected Internet access speeds. According to the Dutch regulator, the Authority for Consumers and Markets (ACM), as of December 2014, around 16 percent of total broadband subscribers had a connection of at least 100 Mbps.[410]

Within the mobile market, three main network operators and over 65 MVNOs provide service. As of March 2015, KPN Mobile had 50.9 percent of mobile subscribers, followed by Vodafone (28 percent) and T-Mobile (20.8 percent).[411] In July 2014, KPN became the first operator to introduce LTE-A technology in select cities.[412] Subsequently, in March 2015, KPN trialed the Netherlands' first tri-band carrier aggregation (CA) solution, utilizing frequencies in the 800 MHz, 1800 MHz, and 2600 MHz bands.[413] As of May 2015, KPN's LTE-A networks covered seven major cities.[414] Vodafone launched its own LTE-A network in October 2014, and T-Mobile expects to introduce LTE-A by August 2016.[415]

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[405] Eur. Comm'n, *Netherlands*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 228 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990.

[406] *Id.*

[407] Broadband TV News, *Fibre Drives Dutch Broadband Market* (Mar. 3, 2015), http://www.broadbandtvnews.com/2015/03/03/fibre-drives-dutch-broadband-market/.

[408] Telegeography GlobalComms Database: *Netherlands* (2015) (last visited Sept. 8, 2015).

[409] *Id.*

[410] *Id.*

[411] *Id.*

[412] Telegeography Comms Update, *KPN Follows LTE0A Launch with VoLTE Trial* (July 28, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/07/28/kpn-follows-lte-a-launch-with-volte-trial/.

[413] Telegeography Comms Update, *KPN Claims Netherlands' First Tri-Band CA LTE Launch* (Mar. 2, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/03/02/kpn-claims-netherlands-first-tri-band-ca-lte-launch/.

[414] Telegeography Comms Update, *KPN Expands LTE Coverage to Seven Cities* (May 22, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/22/kpn-expands-lte-a-coverage-to-seven-cities/.

[415] Telegeography GlobalComms Database: *Netherlands* (2015) (last visited Sept. 8, 2015).

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[416]	40.6	4.0	19.3	17.3	0.0
Fixed broadband subs (Dec. 2014)[417]	6,851,000				
% of households with fixed broadband access (2014)[418]	95.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[419]	69.0				
Mobile wireless broadband subs (Dec. 2014)[420]	11,635,000				

28. New Zealand

Regulation: In July 2014, the Ministry of Business, Innovation & Employment (MBIE) announced a review of New Zealand's Radiocommunications Act 1989, particularly examining competition, licensing, and spectrum interference.[421]

In March 2015, the MBIE announced it would invest up to US$137 million to expand its Ultra Fast Broadband (UFB) program coverage from 75 to 80 percent of New Zealanders, invest US$65 million to expand the Rural Broadband Initiative (RBI), and invest US$21.3 million to improve mobile coverage in black spot areas along main highways and in popular tourist destinations.[422] As of June 2015, the UFB and RBI reached 96 percent of New Zealand schools.[423] By the end of June 2015, 54 percent of the UFB had been completed and 14.6 percent of the population within its reach subscribed to the network.[424]

Market and Competition: Telecom New Zealand rebranded itself as Spark in August 2014.[425] In August 2014, Spark launched its first 700 MHz LTE services via twelve sites. Though only two devices were compatible with the network at launch, ten were available to customers by the end of December 2014. By the end of December 2014, Spark's LTE network covered 70 towns and cities, or roughly two

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[416] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[417] *Id.*

[418] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[419] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[420] *Id.*

[421] MBIE, *Review of Radiocommunications Act 1989*, http://www.mbie.govt.nz/about/whats-happening/news/2014/review-of-radiocommunications-act-1989 (last visited Nov. 12, 2015).

[422] MBIE, *UFB, RBI, Blackspot Expansion*, http://www.mbie.govt.nz/about/whats-happening/news/2015/rois-for-ufb-rbi-mobile-black-spot-fund-expansion-programme-close-3-july (last visited Nov. 12, 2015); MBIE, *New Initiatives*, http://www.mbie.govt.nz/info-services/sectors-industries/technology-communications/fast-broadband/new-initiatives (last visited Nov. 12, 2015).

[423] MBIE, *Ultra Fast Broadband Deployment Map*, http://www.mbie.govt.nz/info-services/sectors-industries/technology-communications/fast-broadband/documents-image-library/JUN15%20YEAR%204%20Ultra-Fast%20Broadband%20Deployment%20MAP.pdf (last visited Nov. 13, 2015).

[424] MBIE, *Quarterly Broadband Deployment Update*, http://www.mbie.govt.nz/info-services/sectors-industries/technology-communications/fast-broadband/documents-image-library/quarterly-broadband-deployment-update-june-2015.pdf (last visited Nov. 12, 2015).

[425] Press Release, Spark, Spark Takes New Zealand into Digital Future (Aug. 8, 2014), http://www.sparknz.co.nz/news/sparklaunch/.

thirds of New Zealanders.[426] In June 2015, Spark announced plans to use its 700 MHz LTE for rural broadband with speeds up to ten times faster than the RBI.[427]

New Zealand internet service provider CallPlus acquired rival Orcon in July 2014, giving it a 15 percent market share and making it the third largest player in New Zealand.[428] In January 2015, Wireless Nation, a New Zealand ISP, doubled the maximum download speeds available via its satellite broadband service to 10 Mbps from 5 Mbps at no extra cost.[429]

As of June 30, 2015, New Zealanders with uncapped broadband mobile data plans had quadrupled over the last year, from 155,000 to 628,000.[430] In June 2015, Spark led the retail subscriber market with 48.5 percent of subscribers, followed by Vodafone (29.2 percent), CallPlus (7.9 percent), Orcon (5.0 percent), and other smaller players (9.4 percent).[431]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[432]	31.6	1.6	1.4	28.1	0.5
Fixed broadband subs (Dec. 2014)[433]	1,421,621				
% of households with fixed broadband access (2012)[434]	75.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[435]	98.8				
Mobile wireless broadband subs (Dec. 2014)[436]	4,440,948				

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[426] Telegeography CommsUpdate, *Bright Spark: NZ Telco Now Offers LTE in 70 Cities* (Dec. 19, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/12/19/bright-spark-nz-telco-now-offers-lte-in-70-cities/.

[427] Press Release, Spark, Spark New Zealand to Launch Fast Rural Wireless Broadband (June 2, 2015), http://www.sparknz.co.nz/news/ruralwirelessbroadband/.

[428] New Zealand Herald, Internet Shake-Up as CallPlus Buys Rival Orcon (June 20, 2014), http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11278357.

[429] Telegeography CommsUpdate, *New Zealand ISP Raise Satellite Broadband Speeds* (Jan. 15, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/01/15/new-zealand-isp-raises-satellite-broadband-speeds/.

[430] Statistics New Zealand, Internet Service Provider Survey (2015), http://www.stats.govt.nz/~/media/Statistics/Browse%20for%20stats/ISPSurvey/HOTP2015/ISPSurvey2015HOTP.pdf.

[431] Telegeography GlobalComms Database: *Netherlands* (2015) (last visited Nov. 22, 2015).

[432] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[433] *Id.*

[434] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[435] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[436] *Id.*

29. Norway

Regulation: In July 2014, the Norwegian Communications Authority (Nkom)[437] announced that in January 2015, it would auction three vacant blocks of spectrum in the 1800 MHz band that were not sold in the December 2013 auction.[438] The January 2015 auction was postponed after NetCom's July 2014 acquisition of Tele2 Norge and is scheduled to begin on November 9, 2015.[439] In June 2015, Nkom launched a public consultation on a proposed 900 MHz band auction. This auction would occur in summer 2016, and the spectrum would become available in January 2018.[440]

Market and Competition: Norway currently has close to 100 percent basic broadband coverage.[441] Fixed line incumbent Telenor remained the leading broadband provider with 42.5 percent of the market as of March 2015, followed by Altibox (19.9 percent), Get (12.8 percent), NextGenTel (6.8 percent), and Broadnet (3.4 percent).[442]

As of March 2015, the principal mobile operators were Telenor Norge (55.0 percent), Netcom (43.1 percent), and ice.net (formerly Nordisk Mobiltelefon) (1.9 percent). Multiple MVNOs and resellers also provide mobile services.[443] At the end of 2014, LTE was available to 83 percent of the population.[444]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[445]	38.7	11.3	11.9	14.6	0.8
Fixed broadband subs (Dec. 2014)[446]	1,985,997				
% of households with fixed broadband access (2014)[447]	88.0				

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[437] The Norwegian Post and Telecommunications Authority (NPT) was renamed the Norwegian Communications Authority (Nkom) in January 2015. *See* Nkom, Annual Report for the Norwegian Post and Telecommunications Authority (NPT) 2014 (Apr. 28, 2015), http://eng.nkom.no/topical-issues/news/annual-report-for-the-norwegian-post-and-telecommunications-authority-npt-2014.

[438] Telegeography CommsUpdate, *NPT to Re-Auction 1800 MHz Spectrum in January 2015* (July 3, 2014), http://www.telegeography.com/products/commsupdate/articles/2014/07/03/npt-to-re-auction-1800mhz-spectrum-in-january-2015/.

[439] Telegeography GlobalComms Database: *Tele2 Norge* (2015) (last visited July 20, 2015); Nkom, *Auction #23 (1800 MHz)* (July 2, 2014), http://eng.nkom.no/technical/frequency-auctions/auctions/planned-completed-auctions/auction-23-1800-mhz.

[440] Telegeography CommsUpdate, *Nkom Consults on 900MHz Draft Auction* (June 10, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/10/nkom-consults-on-900mhz-draft-auction/.

[441] Telegeography GlobalComms Database: *Norway* (2015) (last visited July 20, 2015).

[442] Telegeography GlobalComms Database: *Norway* (2015) (last visited July 20, 2015).

[443] *Id.*

[444] Eur. Comm'n, *Digital Agenda Scoreboard: Norway*, https://ec.europa.eu/digital-agenda/en/scoreboard/norway (last visited July 20, 2015).

[445] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[446] *Id.*

[447] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

Wireless	
Mobile wireless broadband subs per 100 inhabitants[448]	88.0
Mobile wireless broadband subs (Dec. 2014)[449]	4,520,385

30. Poland

Regulation: In October 2014, the Polish regulator, the Office of Electronic Communications (UKE), issued a decision deregulating wholesale broadband Internet access services in 76 municipalities across Poland after it found that there was sufficient competition in those markets and four conditions were met: (1) the dominant operator Orange's retail broadband market share was below 40 percent; (2) the area had at least three active broadband ISPs; (3) over 65 percent of premises had access to the infrastructure of at least three competing operators; and (4) more than 90 percent of premises had access to at least one broadband service.[450]

The UKE restarted the 800 MHz and 2.6 GHz auctions in March 2015 but paused them in April 2015 due to a technical glitch and again in May 2015 to consider a bid cap to speed up the sale process.[451] As of mid-July 2015, the auction process was still ongoing without a clear end date.[452]

Under the "Digital Poland" program, the government will oversee the deployment of a 45,000-kilometer fiber network for a new broadband service that would provide households with an Internet connection of at least 30 Mbps by 2020. This program, announced in December 2014 by the Ministry of Infrastructure and Development, is expected to cost US$2.56 billion with US$1.07 billion provided by the EU.[453] The operational phase of the program began in March 2015.[454]

Market and Competition: Poland's fixed broadband market is quite competitive, with several operators providing broadband Internet access via multiple technologies. [455] As of March 2015, incumbent Orange Poland (formerly Telekomunikacja Polska) had 35.7 percent of the country's broadband subscribers, followed by cable operator UPC Poland (16.3 percent), Netia (12.7 percent), Multimedia Polska (8.6

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[448] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[449] *Id.*

[450] UKE, *New Regulations Concerning Wholesale Broadband Internet Access Services in Poland* (Oct. 7, 2014), https://en.uke.gov.pl/new-regulations-concerning-wholesale-broadband-internet-access-services-in-poland-14775.

[451] Telegeography Comms Update, *Poland Pauses LTE Auction Again as it Considers Bid Cap* (May 26, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/26/poland-pauses-lte-auction-again-as-it-considers-bid-cap/.

[452] Telegeography, Comms Update, *MAC n Jeeze: No End in Sight for Poland's 4G Auction* (July 13, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/07/13/mac-n-jeeze-no-end-in-sight-for-polands-4g-auction/; Adrian Senecki, *Digital Poland Program to Provide 30 Mb/s Internet in Every Home* (Dec. 12, 2014), http://news.bitspiration.com/news/technology/digital-poland-program-to-provide-30-mbs-internet-in-every-home/.

[453] Telegeography CommsUpdate, *EU Pumps USD1.1bn into Poland's Broadband Rollout* (June 3, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/03/eu-pumps-usd1-1bn-into-polands-broadband-rollout/.

[454] Telegeography CommsUpdate, *Digital Poland Programme Gets Underway* (Mar. 18, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/03/18/digital-poland-programme-gets-underway/.

[455] Eur. Comm'n, *Digital Agenda Scoreboard: Poland*, https://ec.europa.eu/digital-agenda/en/scoreboard/poland (last visited July 21, 2015).

percent), and Vectra (8.1 percent). Other small operators collectively held the remaining 18.6 percent.[456]

As of early 2015, there are four major mobile operators, a few smaller network operators, and approximately 25 MVNOs in Poland. The major wireless providers are PTC, which operates as T-Mobile Poland, France Telecom's Orange Poland, Polkomtel and P4 (formerly Netia Mobile). As of March 2015, T-Mobile Poland was the leading mobile operator (27.1 percent of subscribers), followed by Orange Poland (26.6 percent), Polkomtel (23.1 percent), and P4 (21.7 percent).[457] The remaining 1.5 percent was split among other providers.

Privately owned operator Aero2, which primarily provides infrastructure services to other carriers, was the first operator to launch 4G LTE services.[458] As of June 2014, Aero2's LTE services covered about 66 percent of the population.[459] Polkomtel launched LTE services in October 2012, and covered 66 percent of the population by June 2014.[460] Polkomtel filed a complaint with UKE alleging discrimination by UKE in setting the LTE tender rules after failing to win spectrum in the 1800 MHz auction but is expecting to expand its LTE service using spectrum it anticipates winning in the ongoing 800 MHz and 2.6 GHz auction.[461]

Wired	**Total**	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[462]	18.0	0.8	6.0	7.4	3.7
Fixed broadband subs (Dec. 2014)[463]	6,922,890				
% of households with fixed broadband access (2014)[464]	71.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[465]	55.3				
Mobile wireless broadband subs (Dec. 2014)[466]	21,278,710				

31. Portugal

Regulation: As of June 2015, two and one half years since the implementation of Portugal's Digital Agenda, 89 percent of Portuguese homes have access to broadband speeds of over 30 Mbps, with 22 percent of homes having access to over 100 Mbps. Thirty percent of Portuguese citizens, however, had

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[456] Telegeography GlobalComms Database: *Poland* (2015) (last visited July 21, 2015).

[457] *Id*.

[458] *Id.*

[459] *Id.*

[460] *Id.*

[461] *Id.*

[462] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[463] *Id.*

[464] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[465] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[466] *Id.*

never used the Internet, only 39 percent of Portuguese Internet users had participated in ecommerce, and 43 percent of Portuguese Internet users had utilized public services online.[467]

In April 2015, the Digital Agenda goals were extended until 2020 in accordance with the objectives of the Europe 2020 growth strategy. The regulator, Anacom, will be responsible for coordinating and implementing the Digital Agenda goals related to broadband access and the digital market, increasing digital literacy, and increasing ICT use in the marketplace and in business.[468]

In April 2015, Anacom launched a public consultation on the availability and use of spectrum in the 3.4-3.8 GHz band, which it is considering releasing for mobile broadband services, including LTE services.[469]

Market and Competition: As of March 2015, the main fixed broadband providers were MEO (Portugal Telecom) (47.7 percent market share), Nos (created through the merger of Zon and Optimus) (35.4 percent), Vodafone Portugal (11.4 percent), and Cabovisão (5.0 percent).[470]

As of March 2015, Portugal Telecom's wireless subsidiary, MEO, was the wireless market leader with 47.1 percent of subscribers, followed by Vodafone Portugal (30.4 percent) and Nos (22.5 percent). By year end 2014, LTE was available to 94 percent of the population.[471] As of March 2015, MEO had the most extensive 4G network coverage reaching 93 percent of the population, while Nos and Vodafone both covered about 90 percent of the population.[472]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[473]	27.2	6.0	9.7	10.5	1.1
Fixed broadband subs (Dec. 2014)[474]	2,830,930				
% of households with fixed broadband access (2014)[475]	63.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[476]	45.8				
Mobile wireless broadband subs (Dec. 2014)[477]	4,755,599				

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[467] Eur. Comm'n, *Digital Agenda Scoreboard: Portugal*, https://ec.europa.eu/digital-agenda/en/scoreboard/portugal (last visited July 23, 2015).

[468] Anacom, *Agenda Portugal Digital até 2020* (Apr. 24, 2015), http://www.anacom.pt/render.jsp?contentId=1354358#.VdeJRZdvmDl.

[469] Anacom, *ANACOM quer ouvir o mercado sobre a utilização e a dar ao espectro disponível* (Apr. 28, 2015), http://www.anacom.pt/render.jsp?contentId=1354566#.VdeON5dvmDk.

[470] Telegeography GlobalComms Database: *Portugal* (2015) (last visited July 21, 2015).

[471] Eur. Comm'n, *Digital Agenda Scoreboard: Portugal*, https://ec.europa.eu/digital-agenda/en/scoreboard/portugal (last visited July 23, 2015).

[472] Telegeography GlobalComms Database: *Portugal* (2015) (last visited July 21, 2015).

[473] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[474] *Id.*

[475] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[476] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[477] *Id.*

32. Singapore

Regulation: In December 2014, the Infocomm Development Authority (IDA), the telecommunications regulator of Singapore, issued a decision permitting the deployment of 4G and IMT-Advanced systems and services using 3G bands in Singapore (1904.9-1920 MHz and 1920-1979.7 MHz paired with 2110.3-2169.7 MHz).[478] In December 2014, IDA opened a review of its spectrum allocation and regulatory frameworks. The review includes an examination of spectrum pricing, shared use of spectrum, and improving the consistency of spectrum regulations while also reducing regulations as needed.[479]

In February 2015, Singapore announced plans to build a public sector only telecommunications network as part of its Smart Nation initiative.[480] The government opened requests for proposals from the private sector for the building and deployment of the network.

In April 2015, IDA closed a public consultation called "Internet Protocol Transit and Peering Landscape in Singapore" and said it would announce its decision "when it is ready." The consultation sought comment on current market conditions, including competition, choice, cost, and whether there are possible areas that would require regulatory intervention.[481]

Market and Competition: In July 2014, SingTel launched a 300 Mbps 4G service with a Huawei mobile MiFi device compatible with LTE-A networks.[482] In August 2014, responding to consumer demand, Singtel's mobile division began offering more mobile plans which offer high speed Wi-Fi service to supplement its 4G services.[483] Also that August, Starhub announced a dual broadband package which would pair 1 Gbps via fiber and 100 Mbps via cable. As part of a limited launch promotion, Starhub gave dual-band gigabit Wi-Fi routers to customers.[484] In May 2015, MyRepublic launched a claimed first in Singapore -- 1 Gbps no-contract fiber broadband plan.[485]

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[478] IDA, Deployment of Fourth Generation ("4G") and International Mobile Telecommunication ("IMT")-Advanced Systems and Services Using Existing 3G Spectrum Rights (Dec. 12, 2014), https://www.ida.gov.sg/~/media/Files/PCDG/Consultations/20140422_ProposedAllocationSpectrumIMT/Deployment_4G_IMT_Advanced_Sys_and_Svsusing_3G_SpectrumRights.pdf.

[479] IDA, *Proposed Amendments to the Telecommunications (Radio-Communication) Regulations,* https://www.ida.gov.sg/Policies-and-Regulations/Consultation-Papers-and-Decisions/Store/Proposed-Amendments-to-the-Telecommunications-Radio-Communication-Regulations (last visited Nov. 12, 2015).

[480] Irene Tham, *Government to Get Own Telecoms Network in Smart Nation Push* (Feb. 2, 2015), http://www.straitstimes.com/singapore/government-to-get-own-telecoms-network-in-smart-nation-push.

[481] IDA, *The Internet Protocol Transit and Peering Landscape in Singapore* (Apr. 15, 2015), https://www.ida.gov.sg/Policies-and-Regulations/Consultation-Papers-and-Decisions/Store/The-Internet-Protocol-Transit-and-Peering-Landscape-in-Singapore.

[482] Telegeography Comms Update, *SingTel Launches Commercial 300Mbps 4G Service with Huawei Mobile MiFi Device* (July 24, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/07/24/singtel-launches-commercial-300mbps-4g-service-with-huawei-mobile-mifi-device/.

[483] Press Release, Singtel, Singtel Meets Customer Demand for More Data with Asia's First WiFi-Integrated Mobile Plans (Aug. 12, 2014), http://info.singtel.com/about-us/news-releases/singtel-meets-customer-demand-more-data-asias-first-wifi-integrated-mobile-pl.

[484] Press Release, Starhub, Starhub Speeds Ahead with New 1Gbps Dual Network Plan (Nov. 18, 2014), http://www.starhub.com/about-us/newsroom/2014/november/starhub-speeds-ahead-with-new-1gbps-dual-network-plan.html.

[485] Jolene Hee, *MyRepublic Launches Singapore's First 1Gbps No Contract Plan (For the Commitment-Phobes)*, https://vulcanpost.com/240331/myrepublic-launches-singapore-1gbps-no-contract-plan/ (last visited Nov. 12, 2015).

As of June 2015, Singtel had the most wired broadband subscribers (40.2 percent of the market), followed by Starhub (32.3 percent), M1 Limited (7.8 percent), MyRepublic (2.2 percent). The remaining market share (17.5 percent) is held by a series of small players.[486]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants (2013)[487]	26.03	n/a	n/a	n/a	n/a
Fixed broadband subs (2013)[488]	1,409,000				
% of households with fixed broadband access (2014)[489]	87.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[490]	156.15				
Mobile wireless broadband subs (Jan. 2014)[491]	8,615,000				

33. Slovak Republic

Regulation: In December 2013, the Slovak Republic's Parliament passed a law merging the Telecommunications Regulatory Authority with the Postal Regulatory Authority, creating a new Regulatory Office for Electronic Communications and Postal Services (RU), which began operations in January 2014.[492] The Ministry of Transport, Construction and Regional Development of the Slovak Republic has the primary responsibility for the national broadband strategy and policies.[493]

One of the goals of the National Strategy for Broadband Access, adopted in March 2011, is to provide all households in the Slovak Republic access to a high-speed Internet connection of at least 30 Mbps by the end of 2020. As of June 2015, only 63 percent of homes had a connection of at least 30 Mbps.[494] Currently there is an applicable state aid measure until the end of 2015 to achieve the construction of a national backhaul network. Further measures are planned for after 2015 in order to meet the goal of providing broadband coverage at speeds above 30 Mbps to the entire population of the Slovak Republic by 2020.[495]

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[486] Telegeography GlobalComms Database: *Singapore* (2015) (last visited Nov. 20, 2015).

[487] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[488] *Id.*

[489] IDA, *Facts & Figures: Infocomm Usage – Households and Individuals*, https://www.ida.gov.sg/Tech-Scene-News/Facts-and-Figures/Infocomm-Usage-Households-and-Individuals#2b (last visited Dec. 17, 2015).

[490] ITU, World Telecommunication/ICT Indicators Database (2015) (last visited Dec. 17, 2015).

[491] *Id.*

[492] Telegeography GlobalComms Database: *Slovakia* (2015) (last visited Aug. 20, 2015).

[493] *Id.*

[494] Eur. Comm'n, *Digital Agenda Scoreboard: Slovakia,* https://ec.europa.eu/digital-agenda/en/scoreboard/slovakia (last visited Aug. 20, 2015).

[495] *Id.*

Market and Competition: As of March 2015, Slovak Telecom remained the dominant fixed broadband provider, with a market share of 37.8 percent, followed by Orange Slovensko (11.4 percent) and UPC (9.9 percent).[496]

The Slovak Republic's mobile market is divided among three major mobile operators. As of March 2015, Orange Slovensko had a 42.2 percent market share by subscribers, followed by Slovak Telecom's mobile arm (32.5 percent), and Spanish-owned O2 Slovakia (25.3 percent).[497] At the end of 2014, 4G LTE was available to 52 percent of the population.[498]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[499]	22.0	5.7	2.8	8.5	5.0
Fixed broadband subs (Dec. 2014)[500]	1,191,216				
% of households with fixed broadband access (2014)[501]	76.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[502]	59.9				
Mobile wireless broadband subs (Dec. 2014)[503]	3,246,305				

34. Slovenia

Regulation: Slovenia's current national broadband plan, adopted in 2008, aims to ensure 90 percent broadband population coverage by 2020 (no speed specified), with a preference for the deployment of FTTH infrastructure.[504] In August 2014, the Information Society Directorate of the Ministry of Education, Science and Sport, Slovenia's telecommunications policymaker, launched a public consultation on updating the national broadband plan, particularly by including a 100 Mbps target. Operators contested the draft plan, pointing to the need for clarification as to the scope of the target and calling for a closer look at the role of mobile broadband in the overall strategy. In March 2015, after taking into account the operators' objections, the government began an ongoing inter-ministerial consultation on a revised broadband plan, which envisions an estimated EUR 766 million (US$843 million) in broadband investment.[505]

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[496] *Id.*

[497] *Id.*

[498] *Id.*

[499] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[500] *Id.*

[501] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[502] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[503] *Id.*

[504] Gov't of the Rep. of Slovn., Broadband Network Development Strategy in the Republic of Slovenia at 41 (July 2008), https://ec.europa.eu/digital-agenda/en/news/broadband-network-development-strategy-republic-slovenia.

[505] Eur. Comm'n, *Slovenia*, Commission Staff Working Document: Implementation of the EU Regulatory Framework for Electronic Communication – 2015, Doc. No. SWD(2015) 126, at 279 (June 19, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990 [hereinafter *EC Slovenia Report*].

In April 2015, the Slovenian regulator, the Agency for Communications Networks & Services (AKOS), launched a public consultation on the award of wireless broadband spectrum licenses in the 700 MHz band, as well as available frequencies in the 1400 MHz, 2300 MHz, 3500 MHz, and 3700 MHz bands. AKOS plans to hold the multi-band auction in 2016.[506]

In December 2012, Slovenia became the second country in Europe (after the Netherlands) to adopt net neutrality legislation.[507] In January 2015, AKOS found that Slovenia's two largest wireless operators, Telekom Slovenije and Si.mobil, had violated the net neutrality law by engaging in positive price discrimination, also known as zero-rating.[508] AKOS gave the companies 60 days to ensure that all data services were priced equally.[509] In February 2015, AKOS gave the same warning to two additional operators, Amis and Tusmobil.[510]

Market and Competition: DSL remains the most popular access technology in Slovenia, but cable and fiber have gained traction in recent years. Fiber-based subscriptions significantly exceed the EU average of 7 percent. As of June 2015, next generation access (NGA) technologies accounted for 39 percent of all fixed broadband subscriptions, well above the EU average of 27 percent. Nevertheless, Slovenia's overall broadband speeds remain low, with speeds of 30 Mbps or above reaching only 1.8 percent of subscriptions, well below the EU average of 6.9 percent. [511] Former monopoly Telekom Slovenije controls the largest share of the market, with 35.4 percent of subscribers as of March 2015.[512] Alternative operators have steadily increased their cumulative market share, however, from 62 to 65 percent from July 2013 to July 2014.[513]

Telekom Slovenije also leads the mobile market, with 54.1 percent of subscribers as of March 2015, followed by principal competitors Si.mobil (30 percent) and Tusmobil (13.1 percent).[514] In May 2015, Tusmobil became the last of these three main wireless operators to launch LTE services.[515] Also in May 2015, Telekom Slovenije announced plans to use its 4G LTE wireless infrastructure to begin offering

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[506] Telegeography CommsUpdate, *Slovenian Regulator to Hold Multi-Band Wireless Auction in 2016* (Apr. 23, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/04/23/slovenian-regulator-to-hold-multi-band-wireless-auction-in-2016/.

[507] Article 203(1) of the Electronic Communications Act directs the Slovenian government to promote an "open and neutral" Internet and affirms that consumers should have the opportunity to make their own choices about their Internet access and use. Article 203(3) prohibits ISPs from throttling Internet traffic. Finally, Article 203(5) prevents the anticompetitive use of data caps. For an English translation of the relevant provisions of the law, see *Slovenia Net Neutrality Law 2012*, http://www.scribd.com/doc/144614369/Slovenia-Net-Neutrality-law-2012 (last visited July 24, 2015). *See also Slovenia Reinforces Net Neutrality Principles* (Jan. 3, 2013), http://radiobruxelleslibera.wordpress.com/2013/01/03/slovenia-reinforces-net-neutrality-principles/.

[508] Telegeography CommsUpdate, *Slovenian Operators Told to Halt Zero Rating* (Jan. 27, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/01/27/slovenian-operators-told-to-halt-zero-rating/.

[509] *Id.*

[510] Telegeography CommsUpdate, *Two More Operators Found to Be Breaching Net Neutrality Laws* (Feb. 25, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/02/25/two-more-operators-found-to-be-breaching-net-neutrality-laws/.

[511] *EC Slovenia Report*, *supra* note 507, at 276.

[512] Telegeography GlobalComms Database: *Slovenia* (2015) (last visited July 24, 2015).

[513] *EC Slovenia Report*, *supra* note 507, at 275.

[514] Telegeography GlobalComms Database: *Slovenia* (2015) (last visited July 24, 2015).

[515] Telegeography CommsUpdate, *Tusmobil Begins LTE Rollout* (May 21, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/21/tusmobil-begins-lte-rollout/.

triple-play services to customers in areas not served by fixed broadband networks.[516] Following the April 2014 multi-band auction of 4G-suitable spectrum, mobile broadband is expected to play a greater role in providing basic Internet access and supplementing the development of fixed broadband infrastructure, especially in rural areas.[517]

Telekom Slovenije, currently 72 percent state-owned, has been undergoing a privatization process since May 2013. In the latest development, Slovenia is negotiating a deal to sell its shares to UK-based private equity company Cinven.[518]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[519]	26.7	5.9	8.4	12.0	0.4
Fixed broadband subs (Dec. 2014)[520]	551,062				
% of households with fixed broadband access (2014)[521]	75.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[522]	47.0				
Mobile wireless broadband subs (Dec. 2014)[523]	968,383				

35. Spain

Regulation: In 2013, the Spanish government adopted the Digital Agenda for Spain, setting out a comprehensive national ICT strategy for 2013-2015. In May 2014, the main legislative measure provided for in this agenda was completed with the adoption of the "Telecommunications Law (9/2014)." Under this law, Spain committed to rolling out 10 Mbps broadband to the entire population by 2017. By 2020, Spain expects to have universal access to 30 Mbps speeds with 50 percent of the population having access to 100 Mbps download. All schools, universities, libraries, and health centers will have 30 Mbps access by 2016 and 100 Mbps by 2020. In March 2015, Spain completed the digital terrestrial television (DTV) transition in the 800 MHz band.[524]

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[516] Telegeography CommsUpdate, *Telekom Slovenije to Use LTE as Fixed Broadband Alternative* (May 26, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/26/telekom-slovenije-to-use-lte-as-fixed-broadband-alternative/.

[517] *EC Slovenia Report*, *supra* note 507, at 276.

[518] Telegeography CommsUpdate, *Telekom Slovenije Sale Still Not Settled* (June 15, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/06/15/telekom-slovenije-sale-not-yet-settled; Telegeography GlobalComms Database: *Telekom Slovenije (incl. Mobitel)* (2015) (last visited July 24, 2015).

[519] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[520] *Id.*

[521] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[522] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[523] *Id.*

[524] Press Release, Ministry of Indus., Energy & Tourism, The Release of Digital Dividend Will Be Completed Today in Spain, In Compliance with the European Mandate for the Opening Up of the 800 MHz Band (Mar. 31,

In October 2014, the EC recommended redefining two broadband markets to loosen restrictions on competitive access and investment. In December 2014, Spain's telecommunication regulatory authority, the Comision Nacional de los Mercados y la Competencia (CNMC), launched a public consultation over a new regulation for the wholesale broadband market that would require Movistar to lease its fiber network at regulated prices.[525]

Market and Competition: In July 2014, the EC approved Vodafone's merger with Grupo Corporativo ONO, as their telecommunications services were largely complimentary.[526] Vodafone paid EUR 7.2 billion (US$7.9 billion) for the acquisition. In December 2014, the EC investigated Orange's plans to purchase Jazztel for EUR 3.4 billion (US$3.7 billion), as it would reduce the number of nationwide operators from four to three.

In July 2014, the European Court of Justice upheld a fine on Telefonica Espana for anticompetitive behavior for charging wholesale rates close to retail ones.[527] Nevertheless, in May 2015, the EC approved Orange's acquisition of Jazztel, provided that Orange divest an FTTH network covering over 700,000 premises. The operator that acquires the network will have wholesale access to Jazztel's ADSL for eight years and Orange's cellular network, including 4G.[528] By June 2015, the deal was approved by the Spanish regulator and accepted by a majority of Jazztel's shareholders.

Currently, Telefonica Espana leads the market with 5.9 million subscribers and a 45.4 percent market share.[529] After the acquisition of Jazztel, Orange will serve 3.6 million subscribers with a 27.5 percent market share. The final nationwide operator, Vodafone-ONO, will have a 21.5 percent market share and 2.8 million subscribers once the merger is complete.

In November 2014, the CNMC announced that mobile broadband revenue of EUR 889 million (US$978 million) surpassed fixed broadband revenue of EUR882 million (US$970 million) for the first time.[530] By December 2014, all four mobile operators offered 4G LTE services to over 50 percent of the population.[531] LTE-A coverage will be built out after the 800 MHz band from the DTV transition is auctioned off.

2015), http://www.minetur.gob.es/en-US/GabinetePrensa/NotasPrensa/2015/Paginas/20150313-dividendo-digital.aspx.

[525] Press Release, CNMC, La CNMC lanza una consulta pública sobre la regulación mayorista de los mercados de banda ancha (Dec. 19, 2014), http://www.cnmc.es/CNMC/Prensa/TabId/254/ArtMID/6629/ArticleID/1044/La-CNMC-lanza-una-consulta-p250blica-sobre-la-regulaci243n-mayorista-de-los-mercados-de-banda-ancha.aspx.

[526] Telegeography CommsUpdate, *EC Approves Vodafone-ONO Merger; Closure This Month* (July 3, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/07/03/ec-approves-vodafone-ono-merger-closure-this-month/.

[527] Telegeography CommsUpdate, *ECJ Upholds Fine on Telefonica Espana's For Anticompetitive Broadband Activity* (July 11, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/07/11/ecj-upholds-fine-on-telefonica-espanas-for-anticompetitive-broadband-activity/.

[528] Press Release, Eur. Comm'n, Mergers: Commission Clears Acquisition of Jazztel by Orange, Subject To Conditions (May 19, 2015), http://europa.eu/rapid/press-release_IP-15-4997_en.htm.

[529] Telegeography GlobalComms Database: *Spain* (2015) (last visited July 27, 2015).

[530] Christina Ramon, *La banda ancha móvil supera por primera vez a la fija en ingresos* (Nov. 5, 2014), http://cnmcblog.es/2014/11/05/la-banda-ancha-movil-supera-por-primera-vez-a-la-fija-en-ingresos/.

[531] *Id.*

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[532]	27.6	3.4	4.7	19.3	0.2
Fixed broadband subs (Dec. 2014)[533]	12,834,049				
% of households with fixed broadband access (2014)[534]	73.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[535]	78.1				
Mobile wireless broadband subs (Dec. 2014)[536]	36,267,330				

36. Sweden

Regulation: In March 2015, the Swedish regulator, the Post and Telecom Authority (PTS), announced that broadcasters must relinquish the 700 MHz band by the end of March 2017, so that the spectrum can be used to supplement 4G coverage in sparsely populated areas. However, broadcasters will not have to give up the 470MHz-694MHz spectrum until the end of March 2020.[537] Requirements to expand mobile coverage have not always been met: in April 2014, PTS issued a directive to Tele2/Telenor to fulfill the commitment to increase coverage in sparsely-populated areas that was a condition of its 800 MHz license; in a later order, PTS established incremental deadlines for compliance in June, September, and November 2015.[538]

Formal regional broadband plans were in place in 17 of 21 Swedish counties by the end of 2014, in time for the transfer of authority over financing rural development from the national government to county governments at the beginning of 2015.[539] Sweden's national rural broadband plan was approved by the EC five months later (in May 2015), and by October 2015, the implementing rules will be in place and the first round of projects approved.[540] In February 2015, the PTS responded to new competition and to EC recommendations by finalizing its October 2014 draft orders that relaxed regulations for wholesale broadband markets.[541]

Market and Competition: TeliaSonera Sweden is the market leader for both fixed broadband access and mobile services.[542] On the fixed side, TeliaSonera (39.2 percent) competes with Telenor Sweden (19.3 percent), Com Hern (19.3 percent), Tele2 Sweden (2.3 percent), and several other smaller

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[532] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[533] *Id.*

[534] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[535] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[536] *Id.*

[537] Telegeography GlobalComms Database: *Sweden* (2015) (last visited Oct. 30, 2015).

[538] *Id.*

[539] *Id.*

[540] *Id.*

[541] *Id.*

[542] *Id.*

providers.[543] By the end of 2014, fiber had overtaken DSL as the most popular broadband technology, and is expected to keep increasing.[544]

In the mobile sector, there has been a rapid expansion in access to mobile broadband in Sweden.[545] TeliaSonera leads the market (43.3 percent), followed by Tele2 (25.6 percent), Telenor (17.5 percent), Hi3G Access Sweden (13.1 percent), and Net 1 Sweden (0.6 percent).[546] As of March 2015, Telia announced 4G coverage of over 99 percent of the Swedish population.[547] Working together, TeliaSonera and Tele2 were also able to achieve 4G coverage of over 99 percent by March 2015, while Hi3G obtained 80 percent coverage by mid-2015.[548]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[549]	33.8	14.8	6.2	12.7	0.2
Fixed broadband subs (Dec. 2014)[550]	3,281,000				
% of households with fixed broadband access (2014)[551]	87.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[552]	115.6				
Mobile wireless broadband subs (Dec. 2014)[553]	11,204,000				

37. Switzerland

Regulation: In November 2014, the Federal Council published a report identifying issues that had arisen during the efforts to update Switzerland's national communications law to reflect advances in technology, such as fiber deployment.[554] This review was a response to a March 2012 evaluation conducted by the

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[543] *Id.*

[544] *Id.*

[545] Press Release, PTS, Rapid Expansion of Mobile Broadband according to PTS Survey (Mar. 2, 2015), https://www.pts.se/en-GB/News/Press-releases/2015/Rapid-expansion-of-mobile-broadband-according-to-PTS-survey/.

[546] Telegeography GlobalComms Database: *Sweden* (2015) (last visited Oct. 30, 2015).

[547] *Id.*

[548] *Id.*

[549] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[550] *Id.*

[551] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[552] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[553] *Id.*

[554] *See generally* Fed. Office of Commc'ns, Telecommunications Report 2014 (Nov. 2014), http://www.bakom.admin.ch/dokumentation/gesetzgebung/00512/03498/index.html?lang=en.

Federal Council.[555] A bill to resolve these policy issues is to be drafted by the end of 2015, with any unresolved matters left to a future revision of the legislation.[556]

Market and Competition: Incumbent Swisscom is the market leader for both fixed broadband access and mobile services.[557] On the fixed side, Swisscom (54.3 percent) competes with Cablecom (21.3 percent), Sunrise (9.4 percent), and several other smaller providers.[558] DSL and cable connections remain the most prevalent broadband technologies, although fiber has continued to increase its share.[559]

In the mobile sector, Swisscom leads the market (57.8 percent), followed by Sunrise (22.0 percent) and Salt (20.2 percent), which was formerly Orange Switzerland.[560] In addition to the three mobile network operators, Switzerland boasts a large number of MVNOs delivering specialized services to niche markets, though many of these MVNOs are now owned by one of the three networks.[561] The handover of licenses from Switzerland's February 2012 800 MHz auction was conducted from July 21 to August 16, 2014.[562] Additional spectrum will be released to licensees in 2016.[563]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[564]	48.9	5.7	14.8	27.7	0.7
Fixed broadband subs (Dec. 2014)[565]	3,990,200				
% of households with fixed broadband access (2014)[566]	86.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[567]	83.1				
Mobile wireless broadband subs (Dec. 2014)[568]	6,780,000				

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[555] *See* Fed. Office of Commc'ns, Evolution of the Swiss Telecommunications Market: Supplementary Report (Mar. 2012), http://www.bakom.admin.ch/dokumentation/gesetzgebung/00512/03498/index.html?lang=en.

[556] Telegeography GlobalComms Database: *Switzerland* (2015) (last visited Oct. 30, 2015).

[557] *Id.*

[558] *Id.*

[559] *Id.*

[560] *Id.*

[561] *Id.*

[562] *Id.*

[563] *Id.*

[564] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[565] *Id.*

[566] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[567] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[568] *Id.*

38. Turkey

Regulation: In March 2015, the Ministry of Transport and Communications announced that Turkey planned to hold a multi-band spectrum auction in May, with the goal of extending 4G coverage to 90 percent of the population within six years. According to the Ministry, the government planned to auction frequencies in the 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, and 2600 MHz bands and reserve a block of spectrum in the 2600 MHz band for a new market entrant.[569] Turkey's regulator, the Information and Communication Technologies Authority (ICTA), specified that it would offer 20 spectrum lots across the five bands, with 390.4 megahertz total available for bidding. ICTA set the combined floor price for the licenses on offer at EUR 2.3 billion (US$2.5 billion), with winning bidders permitted to purchase the frequencies outright or in four six-month installment payments.[570]

In April 2015, President Recap Tayyip Erdogan made headlines by proposing that Turkey should not "lose time" with 4G and instead should jump directly from 3G to 5G within the next two years.[571] Subsequently, in May 2015, the Ministry of Transport and Communications postponed the multi-band auction until August, citing the need for additional financial and technical preparations.[572] The effect of President Erdogan's comments on the decision to postpone the auction remains unclear.[573]

Market and Competition: According to ICTA, there were 331 ISPs officially licensed to provide services in Turkey in September 2014, up from 237 one year earlier and 175 in September 2012. Despite an influx of competitors, incumbent fixed-line operator Turk Telecom (TT) leads the market, with 71.2 percent of subscribers as of March 2015, followed by Turkcell Superonline (14.1 percent) and Turksat (5.7 percent).[574]

Mobile broadband has surpassed DSL as the most popular Internet access technology since 2012.[575] In contrast to the fixed broadband market, Turkey's mobile market is characterized by strong competition among three well-established operators: Turkcell (47.9 percent of subscribers as of March 2015), Vodafone Turkey (formerly Telsim) (29 percent), and Avea (23.2 percent). Throughout 2014, competition in the market increased as the operators began to more aggressively target the mobile data sector, offering competitive pricing and new bundled plans.[576] All three operators have conducted 4G trials and planned to introduce commercial launches by December 2015, pending the spectrum auction and the allocation of licenses.[577]

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[569] Telegeography CommsUpdate, *Turkey Staging 4G Tender in May; 2600MHz Licence to Be Offered to 4th Player* (Mar. 5, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/03/05/turkey-staging-4g-tender-in-may-2600mhz-licence-to-be-offered-to-4th-player/.

[570] Telegeography GlobalComms Database: *Turkey* (2015) (last visited July 27, 2015).

[571] *See, e.g.*, Daren Butler, *Erdogan Says Turkey Should Not "Lose Time" with 4G Telecoms* (Apr. 22, 2015), http://www.reuters.com/article/2015/04/22/turkey-telecomunications-idUSL5N0XJ0CO20150422.

[572] Telegeography CommsUpdate, *Turkey Postpones 4G Auction Until 26 August 2015* (May 18, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/05/18/turkey-postpones-4g-auction-until-26-august-2015/.

[573] *Compare id.* (noting that "it is not clear as to whether Erdogen's words impacted on the watchdog's decision to delay the auction") *with* Ece Toksabay, *Turkey Minister Says Might Cancel 4G Tender, Switch to 5G: Newspaper*, (Apr. 28, 2015), http://www.reuters.com/article/2015/04/28/us-turkey-tech-4g-idUSKBN0NJ0MB20150428 (interpreting the President's remarks as "instructions" for postponing or possible canceling the auction).

[574] Telegeography GlobalComms Database: *Turkey* (2015) (last visited July 27, 2015).

[575] Kylie Wansink, *Turkey – Telecoms, Mobile and Broadband* (Sept. 2014), http://www.budde.com.au/Research/Turkey-Telecoms-Mobile-and-Broadband.html.

[576] *Id.*

[577] Telegeography GlobalComms Database: *Turkey* (2015) (last visited July 27, 2015).

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[578]	11.6	1.9	0.7	8.9	0.1
Fixed broadband subs (Dec. 2014)[579]	8,866,361				
% of households with fixed broadband access (2014)[580]	57.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[581]	42.2				
Mobile wireless broadband subs (Dec. 2014)[582]	32,360,661				

39. United Kingdom (UK)

Regulation: In March 2015, Ofcom, the UK's telecommunications regulatory authority, announced its "Strategic Review of Digital Communications," a comprehensive ten-year examination of competition, investment, innovation, and product availability in the broadband, mobile, and fixed line markets.[583] Ofcom plans to focus its review on three topics: ensuring the right incentives for private-sector investment in order to deliver availability and quality of service; maintaining strong competition and tackling bottlenecks; and identifying opportunities for deregulation. Ofcom plans to release the initial results of its review by the end of 2015.[584]

Also in March 2015, to complement Ofcom's review, the UK government released "The Digital Communications Infrastructure Strategy," a policy paper published alongside the national budget. The policy paper announced the government's ambition to make broadband speeds of 100 Mbps or more available to 95 percent of premises by 2017.[585] To effectuate this goal, the policy paper proposed the introduction of a universal service obligation for broadband Internet access, thereby establishing broadband as a basic legal right.[586] The accompanying budget echoed the need for a future national minimum broadband speed of 100 Mbps, and allocated GBP 600 million (US$885 million) to help clear

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[578] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[579] *Id.*

[580] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[581] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[582] *Id.*

[583] Press Release, Ofcom, Ofcom Announces Strategic Review of Digital Communications (Mar. 12, 2015), http://media.ofcom.org.uk/news/2015/digital-comms-review/.

[584] *Id*.

[585] Dep't for Culture, Media & Sport, *The Digital Communications Infrastructure Strategy* (Mar. 18, 2015), https://www.gov.uk/government/publications/the-digital-communications-infrastructure-strategy/the-digital-communications-infrastructure-strategy.

[586] Telegeography CommsUpdate, *Policy Sets Broadband as a Basic Legal Right* (Mar. 19, 2015), https://www.telegeography.com/products/commsupdate/articles/2015/03/19/policy-sets-broadband-as-basic-legal-right/.

new spectrum for mobile Internet, fund WiFi in public libraries, and install satellite broadband in remote rural areas.[587]

In November 2014, Ofcom introduced a proposal to auction 190 total megahertz of spectrum in the 2.3 GHz and 3.4 GHz bands in late 2015 or early 2016. Ofcom intends to offer the frequencies in 38 lots of 5 megahertz each, with bidders able to request a minimum bid of four lots per band.[588] That same month, Ofcom also revealed plans to release spectrum in the 700 MHz band, currently used for digital terrestrial television, for mobile broadband use by 2022, and possibly up to two years earlier.[589] By making available additional spectrum through both of these actions, Ofcom expects consumers to benefit from cheaper and faster mobile data services.[590]

Market and Competition: The UK broadband market is evolving at a rapid pace.[591] Rather than a focus on price-led competition, the market has looked to speeds as the differentiating factor between competing providers.[592] As a result, as of June 2015, next-generation access (NGA) coverage in the UK stood at 89 percent of households, well above the EU average of 68 percent. 32 percent of total fixed broadband subscribers take service with speeds of at least 30 Mbps (up from 26 percent in June 2014),[593] while more than 80 percent subscribe to speeds of at least 24 Mbps.[594] Fixed line incumbent BT remains the UK's largest broadband provider, with 32.7 percent of subscribers as of March 2015.[595] Other notable players include Sky (23 percent), Virgin Media (19.5 percent), and TalkTalk (18.2 percent).[596]

The UK has a competitive mobile market, with four main wireless operators: EE (34.2 percent of subscribers), O2 UK (33 percent), Vodafone UK (21 percent), and Hutchison 3G UK (11.8 percent). Given the UK's saturated market, operators have sought to drive growth and revenues through the deployment of new technologies, particularly LTE. All four operators launched commercial LTE networks by August 2014, and Vodafone and HG3 UK expect to achieve 98 percent population coverage by the end of 2015.[597]

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[587] *Id. See also* Juliette Garside, *Broadband to Be Basic Legal Right, Says George Osborne* (Mar. 18, 2015), http://www.theguardian.com/technology/2015/mar/18/broadband-to-be-basic-legal-right-says-george-osborne.

[588] Telegeography CommsUpdate, *Ofcom Outlines Plans for 2.3GHz/3.4GHz Auction* (Nov. 10, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/11/10/ofcom-outlines-plans-for-2-3ghz3-4ghz-auction/.

[589] Telegeography CommsUpdate, *Ofcom Aims to Release 700MHz Spectrum for Mobile Broadband Use by 2022* (Nov. 24, 2014), https://www.telegeography.com/products/commsupdate/articles/2014/11/20/ofcom-aims-to-release-700mhz-spectrum-for-mobile-broadband-use-by-2022/.

[590] *Id.*

[591] Dep't for Culture, Media & Sport, *The Digital Communications Infrastructure Strategy* (Mar. 18, 2015), https://www.gov.uk/government/publications/the-digital-communications-infrastructure-strategy/the-digital-communications-infrastructure-strategy.

[592] Telegeography GlobalComms Database: *United Kingdom* (2015) (last visited Sept. 9, 2015).

[593] Eur. Comm'n, *Digital Agenda Scoreboard: United Kingdom* (2015), https://ec.europa.eu/digital-agenda/en/scoreboard/united-kingdom (last visited Sept. 9, 2015).

[594] Dep't for Culture, Media & Sport, *The Digital Communications Infrastructure Strategy* (Mar. 18, 2015), https://www.gov.uk/government/publications/the-digital-communications-infrastructure-strategy/the-digital-communications-infrastructure-strategy

[595] Telegeography GlobalComms Database: *United Kingdom* (2015) (last visited Sept. 9, 2015).

[596] *Id.*

[597] *Id.*

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[598]	36.8	0.0	7.0	29.7	0.0
Fixed broadband subs (Dec. 2014)[599]	23,729,800				
% of households with fixed broadband access (2014)[600]	88.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[601]	84.8				
Mobile wireless broadband subs (Dec. 2014)[602]	54,718,423				

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[598] OECD Broadband Portal, Table 1.2.1 (Dec. 2014) (last visited Dec. 10, 2015).

[599] *Id.*

[600] OECD Stat Extracts, http://stats.oecd.org/ (last visited Dec. 16, 2015).

[601] OECD Broadband Portal, Table 1.2.2 (Dec. 2014) (last visited Dec. 10, 2015).

[602] *Id.*

APPENDIX F

A. Comparing International Fixed Broadband Speeds

Broadband speeds are often illustrated using three metrics: the advertised speed, the actual speed, and the divergence between the advertised and actual speed. Advertised speeds for a given consumer can generally be obtained either from the ISP serving that consumer or directly from the consumer. The latter approach may create some error (when consumers are not certain of the speed tier that they have subscribed to). Actual speed is measured primarily by two methods: (i) by installing special hardware on an end user's device that enables the hardware to measure actual download and upload speeds, and (ii) software-based tests.[1]

The most widely collected speed data for international (non-U.S.) cities are based primarily on software-based tests conducted by Ookla using speedtest.net. These data can be useful in providing an international comparison, but certain caveats should be noted. For instance, the physical distance of the end user to the server may influence the results of software-based speed measurement tests. Another point worth noting is that the actual speeds that are observed in each country reflect a combination of availability and usage. For example, a low average download speed for a country could be a reflection of either more people subscribing to low-speed broadband or poor performance and availability of high-speed broadband. Despite these shortcomings, the Ookla speed dataset helps in constructing international comparisons because of its large geographic scope and vast number of speed tests.[2] Additionally, the data provide other metrics of network quality that may be used to evaluate broadband performance across countries.

We are aware that other international broadband speed surveys are available. For example, Akamai released its "State of the Internet" report for the third quarter of 2015 in December 2015. According to this report, the United States has an average connection speed of 12.6 Mbps (ranking 16th in the world).[3] This measurement, however, cannot be readily compared to the analysis of the Ookla data

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[1] Installing special hardware on an end user's device is usually preferred as the speed measurement is not biased by the subscriber's device configuration, the type of connection between the end user and the Internet service provider's (ISP) network, and the physical distance of the end user from the testing server. For example, SamKnows (a company that measures broadband performance and provides related analytics) conducts such hardware based tests for the United States and the United Kingdom. *See* https://www.samknows.com/#. For the United States, the Commission partnered with SamKnows to measure advertised and actual speeds, and the results are summarized in FCC's "Measuring Broadband America" reports, available at http://www.fcc.gov/measuring-broadband-america. The FCC releases these reports on a regular basis, most recently in December 2015. *See* FCC's Office of Engineering and Technology and Consumer and Governmental Affairs Bureau, 2015 Measuring Broadband America Fixed Broadband Report: A Report on Consumer Fixed Broadband Performance in the United States, rel. Dec. 30, 2015, https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-broadband-america-2015 ("2015 MBA Report"). Raw data for the 2015 report is available at https://www.fcc.gov/measuring-broadband-america/2015/raw-data-2014#node-80197 and the validated data is available at https://www.fcc.gov/reports-research/reports/measuring-broadband-america/validated-data-measuring-broadband-america-2015. For information about the U.K. speed testing, see http://infrastructure.ofcom.org.uk/. However for broad-based international data, software-based tests such as Ookla's speedtest.net are the best readily available data source.

[2] Since January 2008, Ookla has collected data on over 8.1 billion speed tests. *See* https://www.ookla.com/ (last checked January 22, 2016). In this report, we use data for 2013 and 2014. The 2013 data covers January 1 to December 31, including 40 countries with 5.9 million observations for 16,294 cities. For 2014, the data include 6.3 million observations for 17,917 cities from the same 40 countries from January 1 to December 15. The end date of the collection period for 2014 corresponds to the date the data were downloaded from Ookla.

[3] Akamai's State of the Internet, Q3 2015 Report at 24 (December 2015), https://www.stateoftheinternet.com/resources-connectivity-2015-q3-state-of-the-internet-report.html. South Korea holds the number one position in the Akamai rankings, with an average download speed of 20.5 Mbps. *Id.* at 12.

presented in this appendix. Akamai calculates its average speeds based on a user request for a specific file, taking into account the file size and the time required to complete delivery of the file.[4] Ookla measures maximum sustainable throughput between the user's computer and the nearest server selecting a file size based on a bit test estimate of connection speed. This method measures the speed of the broadband connection when multiple computers or programs are using it.[5] Essentially, more data are used to test the faster connections than slower ones, ensuring the speed data reflect the actual speed experienced by the typical consumer.[6] In addition, Akamai excludes slower connections, *i.e.*, users with a connection speed slower than 4 Mbps. Because the Ookla dataset is aggregated at the city level on a daily basis, we cannot identify individual connection speeds. Thus, the following analysis includes all connection speeds above 256 Kbps.

1. Aggregate Country Rankings Based on Ookla Data

Figure 1a shows the 2013 and 2014 rankings based on average download speed (Mbps) for 40 countries. The countries included are identical to those included in the *Fourth IBDR*. These rankings are based on weighted average speed, *i.e.*, the average speed obtained by averaging across cities using the sample size in each city as weights.

Average download speeds in both years increased for the majority of countries in the sample. The data are shown in Figure 1a.[7] Luxembourg was first in the 2013 rankings, but it saw the largest decrease in average download speed, a drop of 6.39 Mbps to 36.58 Mbps in 2014, putting it in 11th place in the 2014 rankings. However, the median download speed in Luxembourg has increased each of the past four years.[8] Japan was the only other country to observe a slowdown on average speeds from 2013 to 2014. Singapore held the top spot in the 2014 rankings; its average download speeds increased by 27.95 Mbps, from 41.06 Mbps in 2013 to 69.01 Mbps in 2014.

The United States ranked 26th of the 40 countries included in our sample in 2014, the same ranking as 2013. With an average download speed of 26.68 Mbps, the United States increased download speeds by 8.01 Mbps from 2013. From 2013 to 2014, the United Kingdom moved from 19th to 22nd even though the average download speed increased from 23.29 Mbps to 29.41 Mbps. In 2014, the bottom five countries did not change rankings, with India remaining last with an average download speed of 5.11 Mbps.

By comparison, Akamai ranks the District of Columbia the fastest state/district in the United States with an average speed of 19.5 Mbps. *Id.* at 18.

[4] Akamai's methodology for determining connection speed is explained in further detail at https://blogs.akamai.com/2011/11/the-future-internet.html and https://blogs.akamai.com/2013/04/clarifying-state-of-the-internet-report-metrics.html.

[5] This is done by using multiple threads (simultaneous transfers of data) and carefully sizing the transferred payload to "fill the pipe." For more information, see http://blog.ookla.com/2010/05/14/testing-speed-tests/.

[6] According to Professors Bauer, Clark and Lehr of MIT, "the Ookla/Speedtest approach – which typically results in greater measured data rates than the other approaches reviewed – was the best of the currently available data sources for assessing the speed of ISP's broadband access service. One of the key differences that accounts for this is that the Ookla/Speedtest tools utilize multiple TCP connections to collect the measurement data which is key to avoiding the receive window limitation. These tests are also much more likely to be conducted to a server that is relatively close to the client running the test." Steve Bauer, David Clark, William Lehr, Massachusetts Institute of Technology, "Understanding Broadband Speed Measurements," at 3 (2010), http://mitas.csail.mit.edu/papers/Bauer_Clark_Lehr_Broadband_Speed_Measurements.pdf.

[7] Throughout this Appendix F, references to "figures" signify charts or diagrams within this narrative. References to "tables" refer to the detailed data tables that are collected at the end of this Appendix.

[8] Data for 2011 through 2013 can be found in the *Fourth IBDR*. Because the data are aggregated at the city level and do not have individual speed test records, we cannot compute a true median. Here, median refers to the median of the aggregated (average) daily city speed tests weighted by sample size.

Figure 1a
Country Average Weighted Speed Rankings
(2013-2014): All Available Data
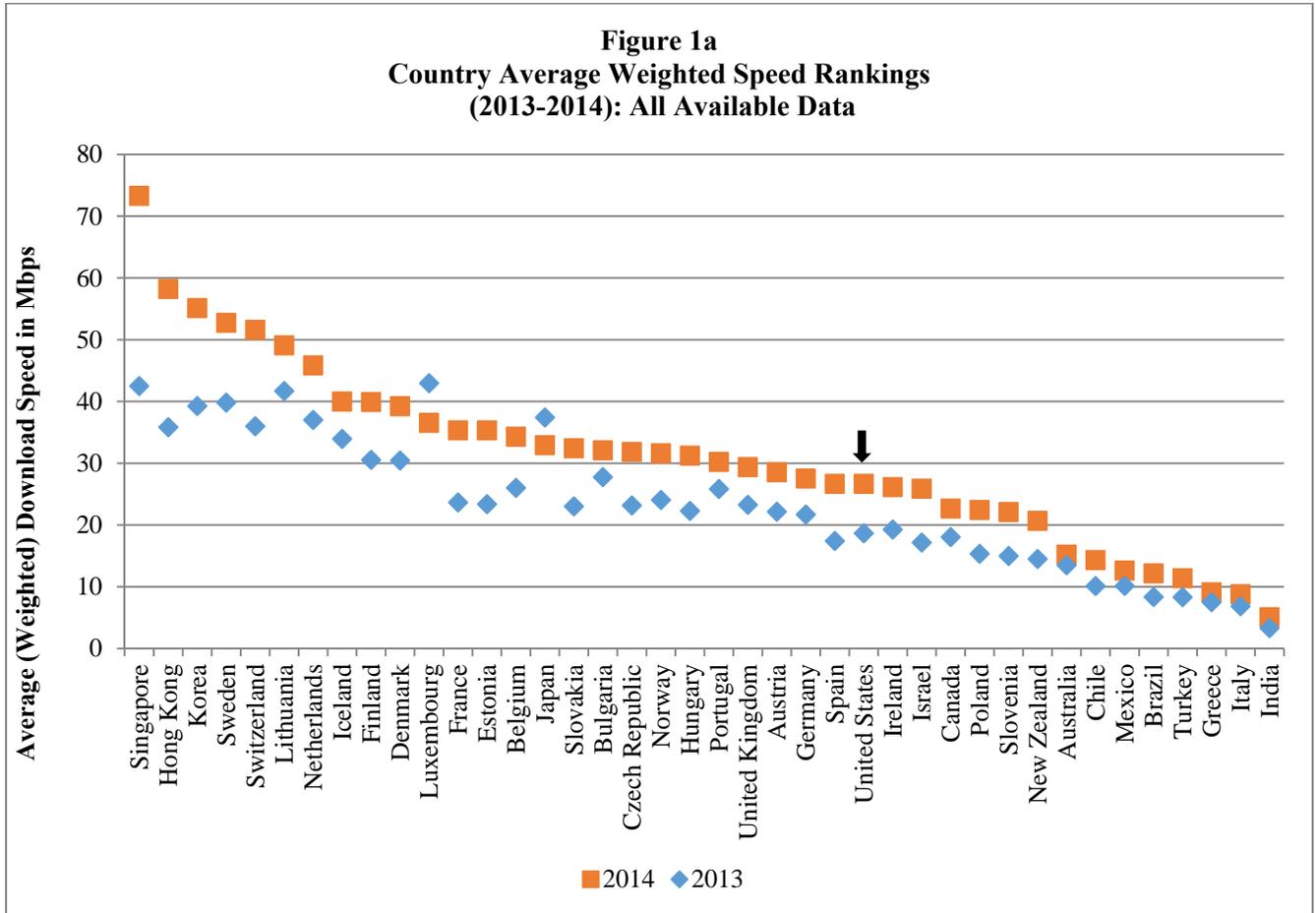
Source: Actual Download Speeds from Net Index by Ookla, weighted by total number of tests. (Data were drawn on Dec. 15, 2014.)

In 2014, the median weighted download speed for the United States increased to 24.63 Mbps from 18.43 Mbps in 2013, but its ranking fell one spot to 27th of 40 countries. Similar to the United States, most countries have means and medians that are fairly close together, in both the 2013 and 2014 data. Hong Kong continues to be an exception, as its median download speed in 2014 was 6.69 Mbps slower than its average download speed. In 2013, Luxembourg and Hong Kong had average download speeds exceeding their 2013 median download speeds by 8.20 Mbps and 7.34 Mbps, respectively.[9] This discrepancy between the mean and median largely disappeared for Luxembourg in the 2014 data. Median speeds are also shown in Appendix F Table 1a.

Figure 1b includes 95 percent confidence interval bands for the percent change in average weighted download speeds between 2013 and 2014. The confidence interval bands measure the margin of error associated with the calculated percent change at a 95 percent confidence level (*i.e*., that 95 percent of the intervals would include the percent change parameter). Countries where the bounds are

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[9] A high average relative to the median indicates that a small number of cities posted speeds much higher than the typical city in the country (which increased the overall country average). With the exception of 2013, the mean and median values for Luxembourg since 2011 have been relatively close (within 0.6 Mbps). In Hong Kong, however, the average and median were similar in 2011 and then the median grew rapidly in 2012, outpacing the average. In both 2013 and 2014, the median was at least 5 Mbps lower than the average. These discrepancies between mean and median speeds are more likely to occur in smaller places like Hong Kong and Luxembourg, where there are not many cities.

close to the estimated percent change have smaller variation in the change from the previous year and smaller overall variance in the average download speeds.

In 2014, the average download speed increase in the United States of 28.3 percent had a lower bound of 27.9 percent and an upper bound of 28.8 percent. All countries had a positive percent increase except for Luxembourg and Japan. Singapore, New Zealand, Iceland, and Estonia have the widest confidence interval bands, indicating larger variation in the percent change from 2013 to 2014. All percent change data are presented in Appendix F Table 1c.
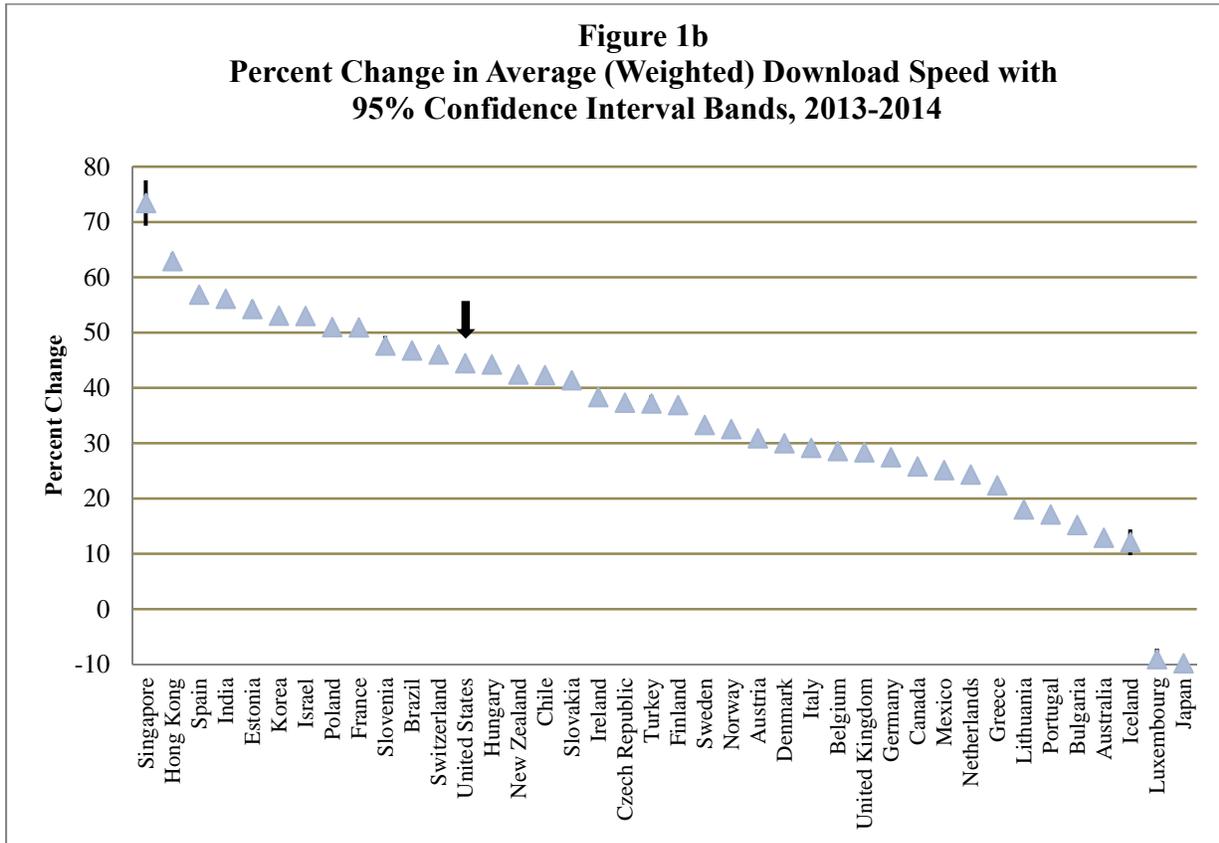
Figure 1b
Percent Change in Average (Weighted) Download Speed with
95% Confidence Interval Bands, 2013-2014

Source: Actual Download Speeds from Net Index by Ookla, weighted by sample size. (Data were drawn on Dec. 15, 2014.)

Figure 1c shows the percentage of tests with actual download speeds exceeding 10 Mbps. By 2013, 99 percent or more of tests were above 10 Mbps for 19 countries. The United States nearly reached that threshold in 2014, with 98.2 percent of tests over 10 Mbps. Italy quadrupled the percentage of tests above 10 Mbps between 2013 and 2014, going from 8.56 percent to 35.93 percent. Only 0.07 percent of 2014 tests in India were over 10 Mbps.

Figure 1c
Percentage of Tests Reporting Greater than 10 Mbps of Download
Speed, 2013-2014
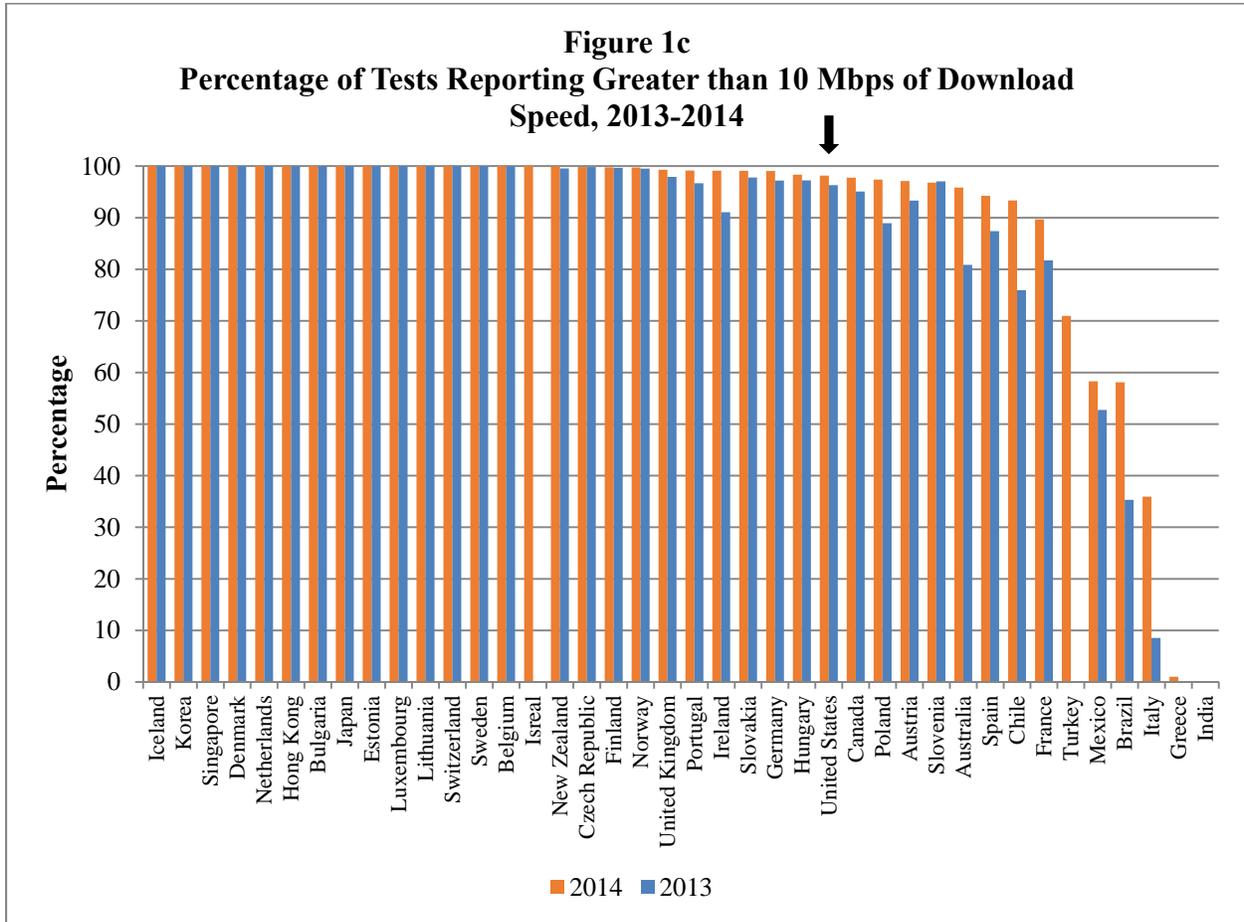
Source: Actual Download Speeds from Net Index by Ookla. (Data were drawn on Dec. 15, 2014.) There were no 2013 data from Israel.

Figure 1d shows the percentage of tests with actual download speeds exceeding 25 Mbps. Download speed tests reporting 25 Mbps or greater increased dramatically for nearly every country in the sample. The United States increased in the percentage of tests over 25 Mbps from 0.75 percent in 2013 to 58.89 percent in 2014. Several countries, including Bulgaria, Luxembourg, and the Netherlands had large increases in this speed tier from 2013 to 2014.[10] Many European countries experienced tremendous growth in this speed tier from 2013 to 2014; Austria, Denmark, Finland, Iceland, Norway, and the United Kingdom all improved at least 20 times their 2013 mark and were among the most improved countries in this regard.

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[10] Note that this metric is a reflection of the number of *tests* exceeding 25 Mbps, and does not necessarily reflect the number of consumers who actually subscribe to service with at least 25 Mbps download service. *See* Section 4 for more detail concerning comparison of actual and advertised speeds.

Figure 1d
Percentage of Tests Reporting Greater than 25 Mbps Download Speed,
2013-2014
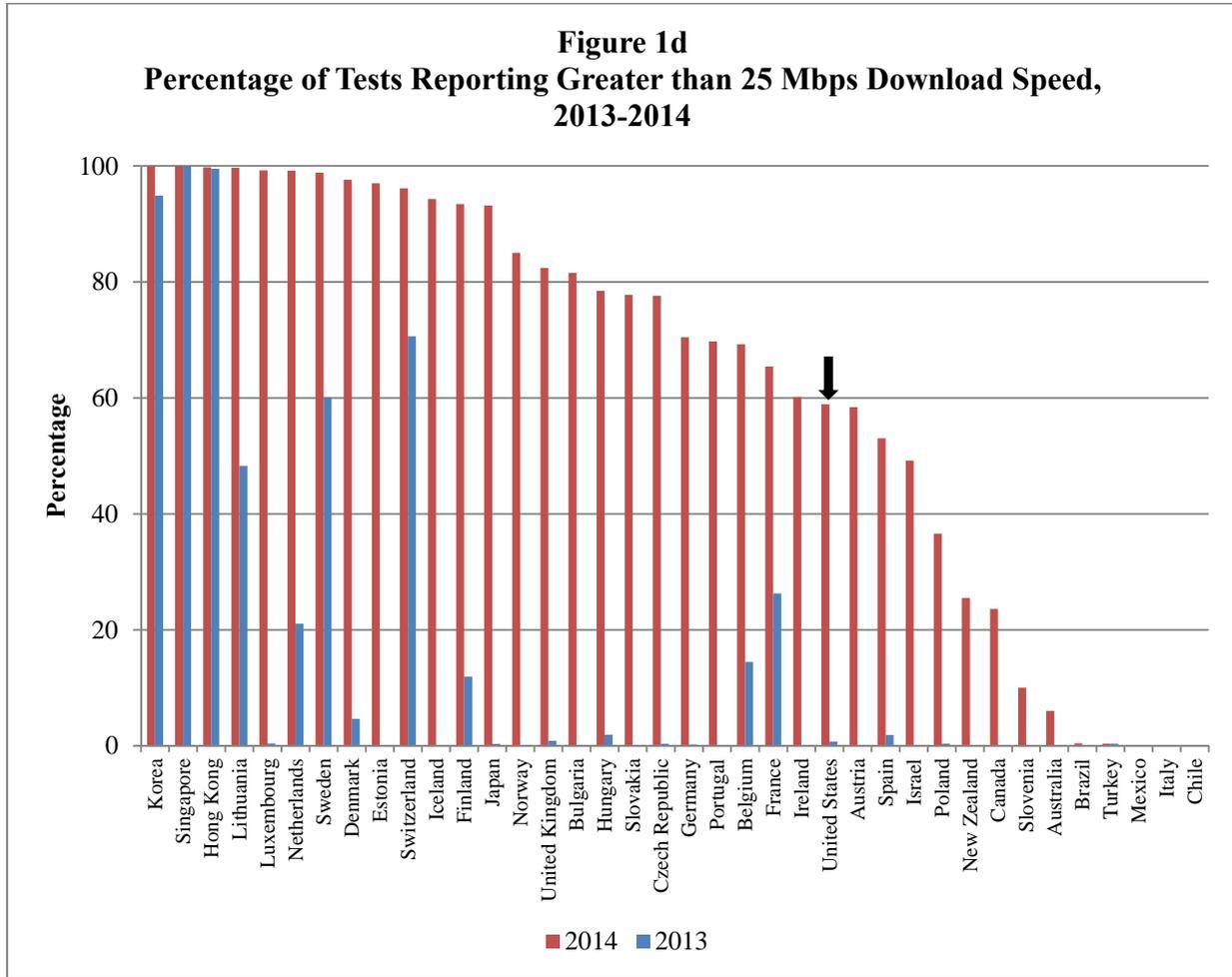
Source: Actual Download Speeds from Net Index by Ookla. (Data were drawn on Dec. 15, 2014.) India and Greece did not have any tests over 25 Mbps.

2.   Speed Comparisons at the City Level

The following analysis compares the capital cities of all 40 countries, including Washington, D.C., as well as all U.S. state capitals. Figure 2 shows the ranking of capital cities for the top and bottom quartiles of the mean download speed distribution (weighted by sample size). The rankings of all capital cities can be found in Appendix F Table 2.

In 2014, Olympia fell out of the top quartile, bringing the number of U.S. cities in the top quartile to three. Two thirds of the bottom quartile is comprised of 16 U.S. cities, and in 2014 five new U.S. cities dropped into the bottom quartile.
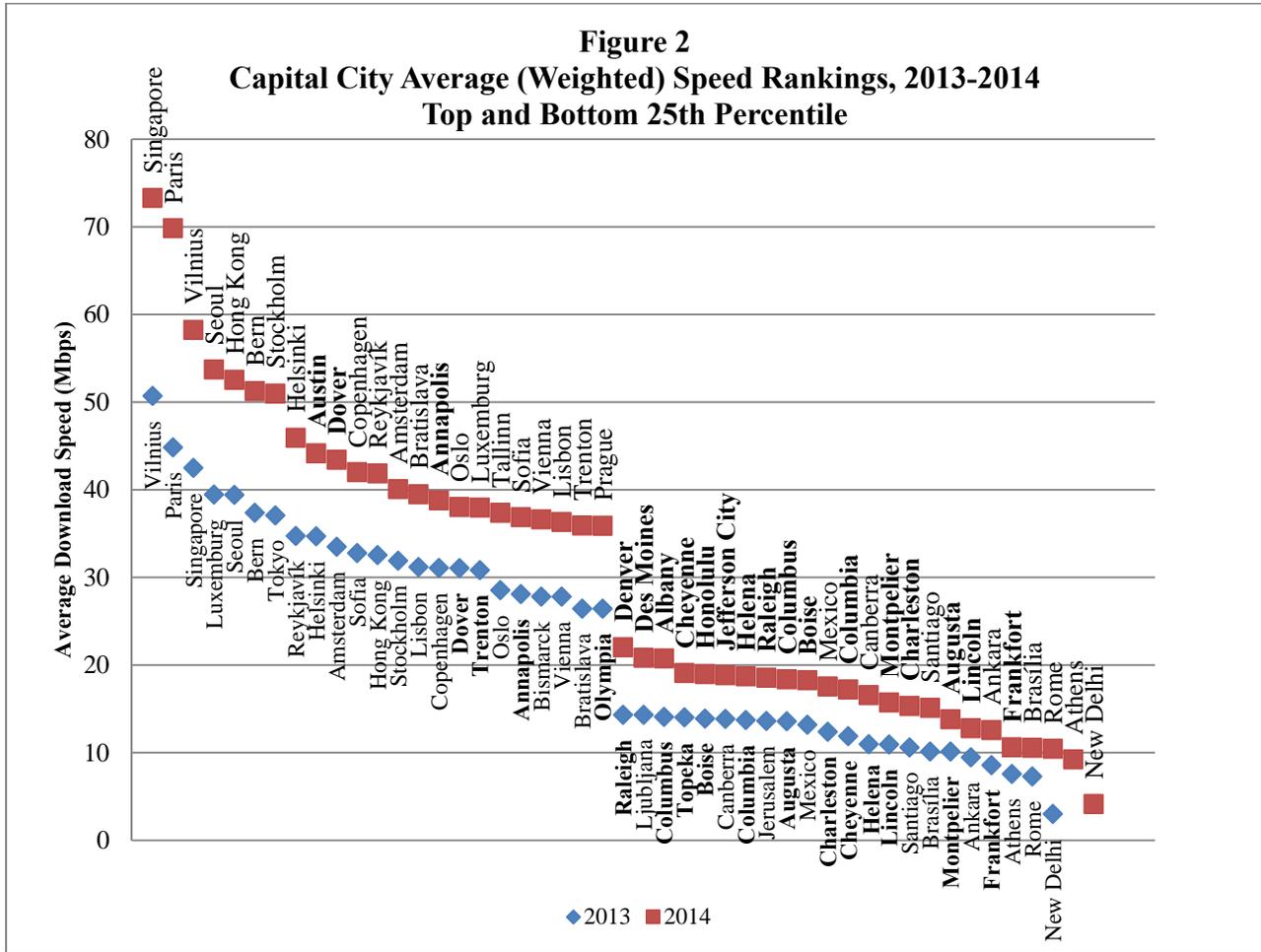
Figure 2
Capital City Average (Weighted) Speed Rankings, 2013-2014
Top and Bottom 25th Percentile

Source: Actual Download Speeds from Net Index by Ookla, weighted by sample size. (Data were drawn on Dec. 15, 2014.) Capital cities consist of 40 country capitals (including Washington, D.C.) and the 50 state capitals for the United States.

3.   Speed Comparisons Using a Stratified Sampling Technique

We chose to keep the cities in the stratified sample identical to those selected in the *Third IBDR* because it allows for cleaner comparison between the four years of data—2011-2014. The stratified sample was drawn using 2011 data. We do not redraw the sample for following years; we keep data for the cities that match those selected in 2011.

We added cities in Brazil and India to our comparison analysis in the 2012 and 2013 data. To add them, we generated the proportions of cities for the stratified sample from the Ookla data rather than the population because of the discrepancy between the availability of Ookla data (primarily large cities) and population distribution. Population was used to identify the strata city size indicators for Brazil and India. The stratified sample cities for Brazil and India remained unchanged in the 2014 update. Other than the modifications noted, we followed the stratified sampling methodology outlined in the *Third IBDR*.[11] Appendix F Tables 3a and 3b, respectively, present the population proportions for each stratum of non-U.S. and U.S. cities.

Figure 3a shows the country speed ranks based on the cities in the sample. In 2014, the U.S dropped one spot to 26th, matching the 26th place ranking the United States holds in the non-stratified

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[11] The report can be downloaded from http://www.fcc.gov/reports/international-broadband-data-report-third. See Appendix F, Section 5 for explanation of the stratified sampling methodology.

speed rankings. While speeds may have increased in absolute value (moving from 19.55 Mbps in 2013 to 27.47 Mbps in 2014), speeds in the U.S. cities in the sample increased more slowly than speeds in other cities in the sample. For example, Singapore ranked first both in 2013 with an average speed (based on stratified sampling) of 42.52 Mbps and in 2014 with an average speed (based on stratified sampling) of 73.32 Mbps.[12] ,Of the 39 countries that reported data (there is no data on Greece), 37 experienced an increase in their average download speed. Luxembourg posted a 13 Mbps slowdown.[13] Data for all states and countries can be found in Appendix F Table 3d.

Figure 3a
Average (Weighted) Speed Rankings by Country, 2013-2014
(Based on stratified sampling using 2011 cities)
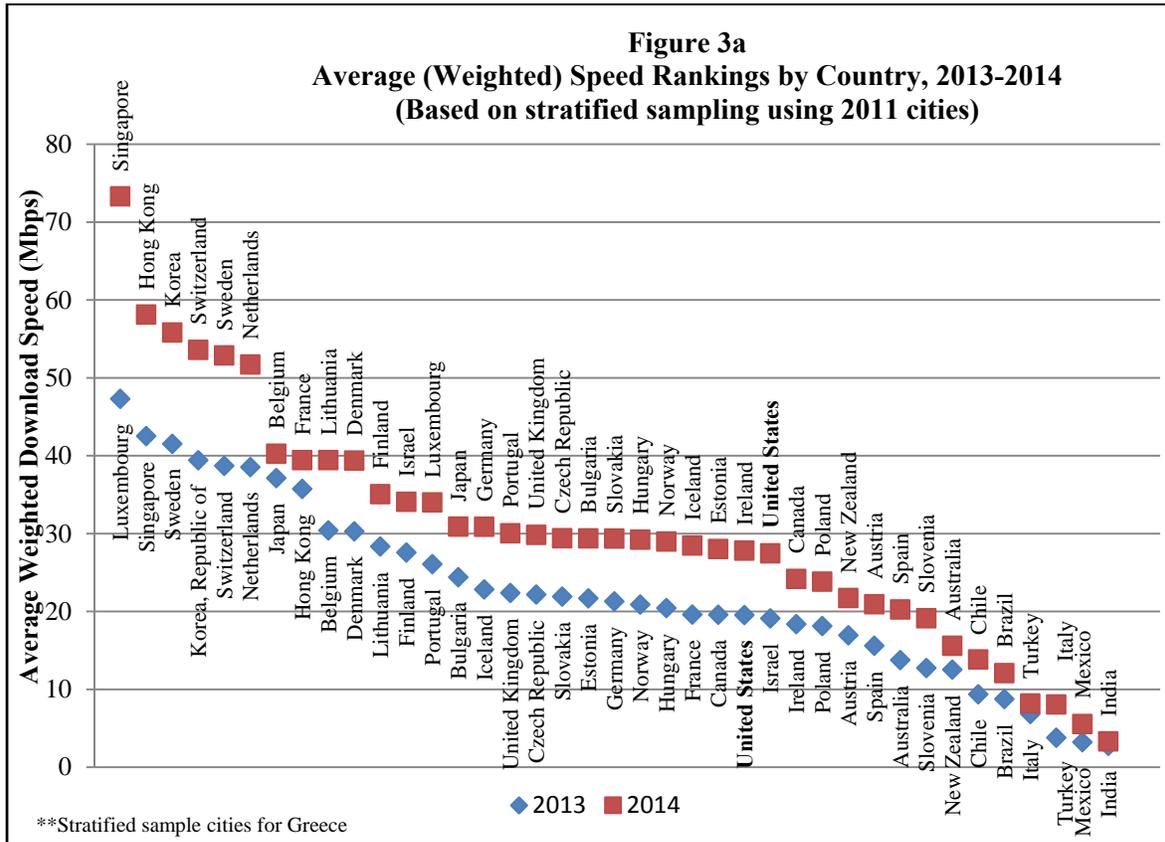
Source: Actual Download Speeds from Net Index by Ookla, weighted by sample size (Data drawn on Dec. 15, 2014). Cities use to construct the sample are identical to those used in the *Third IBDR*, based on 2011 data, with the addition of Brazil and India.

Figure 3b compares the United States at the state level with the other countries in our sample in 2013 and 2014. The top and bottom quartiles show that considerable variation in download speed exists within the United States, when measured by stratified sample. Nine U.S. states appeared in the top quartile in 2014, an increase of two from 2013. The number of states in the bottom quartile decreased to twelve from thirteen, though there were many states new to it. Utah improved its average download speed by 13.63 Mbps (from 22.91 Mbps in 2013 to 36.54 Mbps in 2014), which helped the state jump from 21st to 11th place and become the highest ranked U.S. state.[14] Every U.S. state increased its average download speed as estimated by the stratified sampling technique. Data for all states and countries can be found in Appendix F Table 3d.

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[12] *See* Appendix F, Table 3c.

[13] *Id*.

[14] *See* Appendix F, Table 3d.
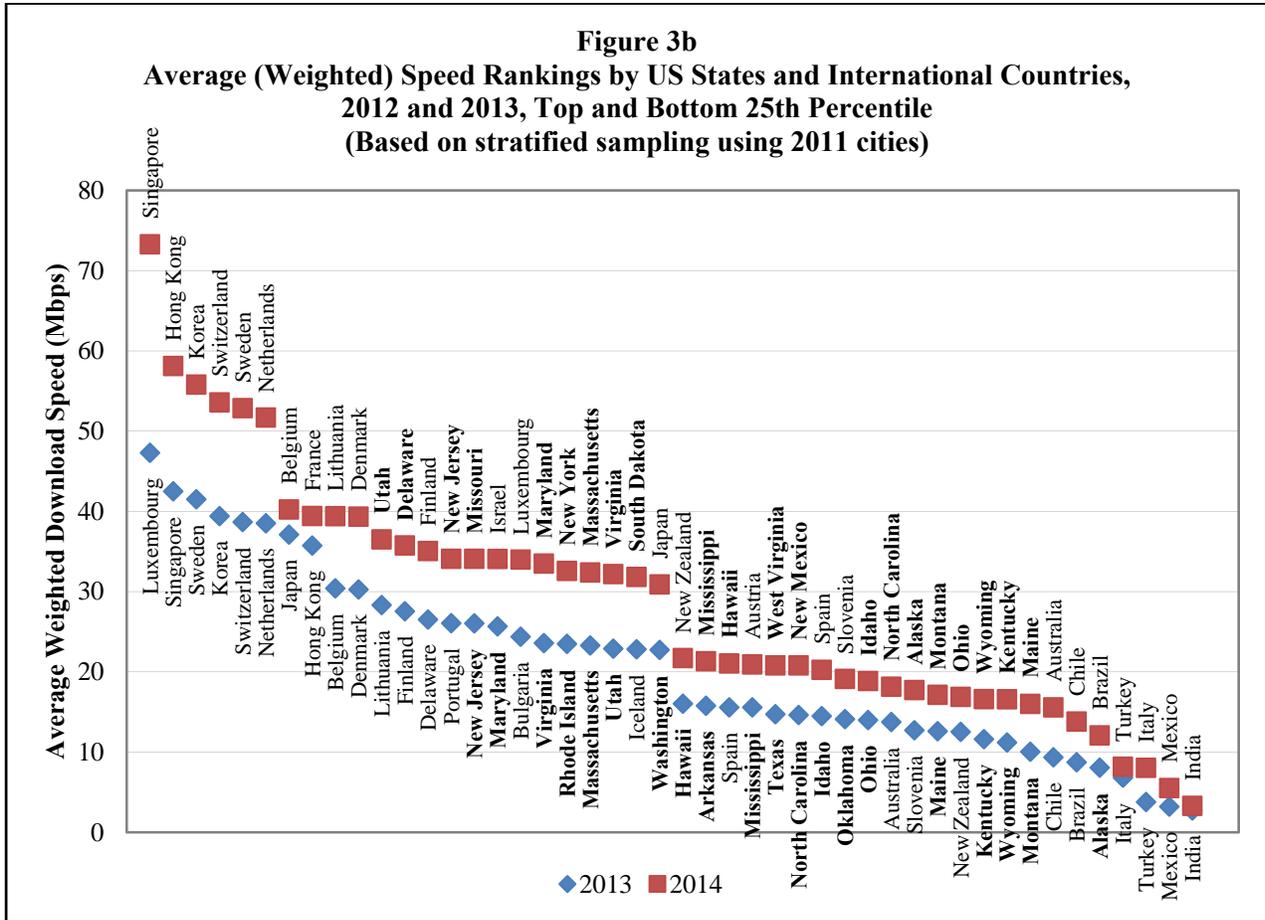
Figure 3b
Average (Weighted) Speed Rankings by US States and International Countries,
2012 and 2013, Top and Bottom 25th Percentile
(Based on stratified sampling using 2011 cities)

Source: Actual Download Speeds from Net Index by Ookla, weighted by sample size. (Data were drawn on Dec. 15, 2014.) Cities used to construct the sample are identical to those used in the *Third IBDR*, based on 2011 data, with the addition of Brazil and India.

In addition to analyzing the overall speed ranks based on the sampling approach, we also show how each country ranks within each stratum. Appendix F Tables 4a-4d present these results. As in past years, there is variation across the United States. While some states appear in the upper quartile, the majority of U.S. states are concentrated in the lower half of the distribution across all strata.

4. Advertised versus Actual Speed

Figure 4 presents the shortfall index – *i.e.*, the percent difference between advertised and actual speeds[15] – for 2013 and 2014. Exactly half of the countries experienced a decrease in their shortfall index from 2013 to 2014, meaning that providers in those countries are more likely to deliver promised speeds in 2014 than in previous years. New Zealand and Singapore saw the greatest reduction in shortfall at nearly ten percentage points, while Portugal experienced growth in excess of five percentage points. The shortfall index for the United States decreased to 6.2 in 2014 from 7.2 in 2013, moving the United States down one spot in the rankings (from 13th to 14th).[16] Thus, even though the shortfall index improved for

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[15] Ookla also referred to this as the Promise Index -- an index that ranks the value of the median ratio of actual download speed to the download speed subscribed to (the "promised speed"). The promise index is the median ratio of actual download speed to the advertised download speed subscribed to by the consumer. The shortfall index is: 1 – (Actual Speed/Advertised Speed). Ookla has discontinued the publication of this dataset.

[16] *See* Appendix F Table 5.

the United States, the U.S. ranking for this metric went down because other countries had greater improvement (*e.g.*, Singapore, which had a shortfall index of 14.28 in 2013 and 5.23 in 2014).[17]

Figure 4
Shortfall Index in 2013-2014
(% Difference Between Advertised and Actual Speed)
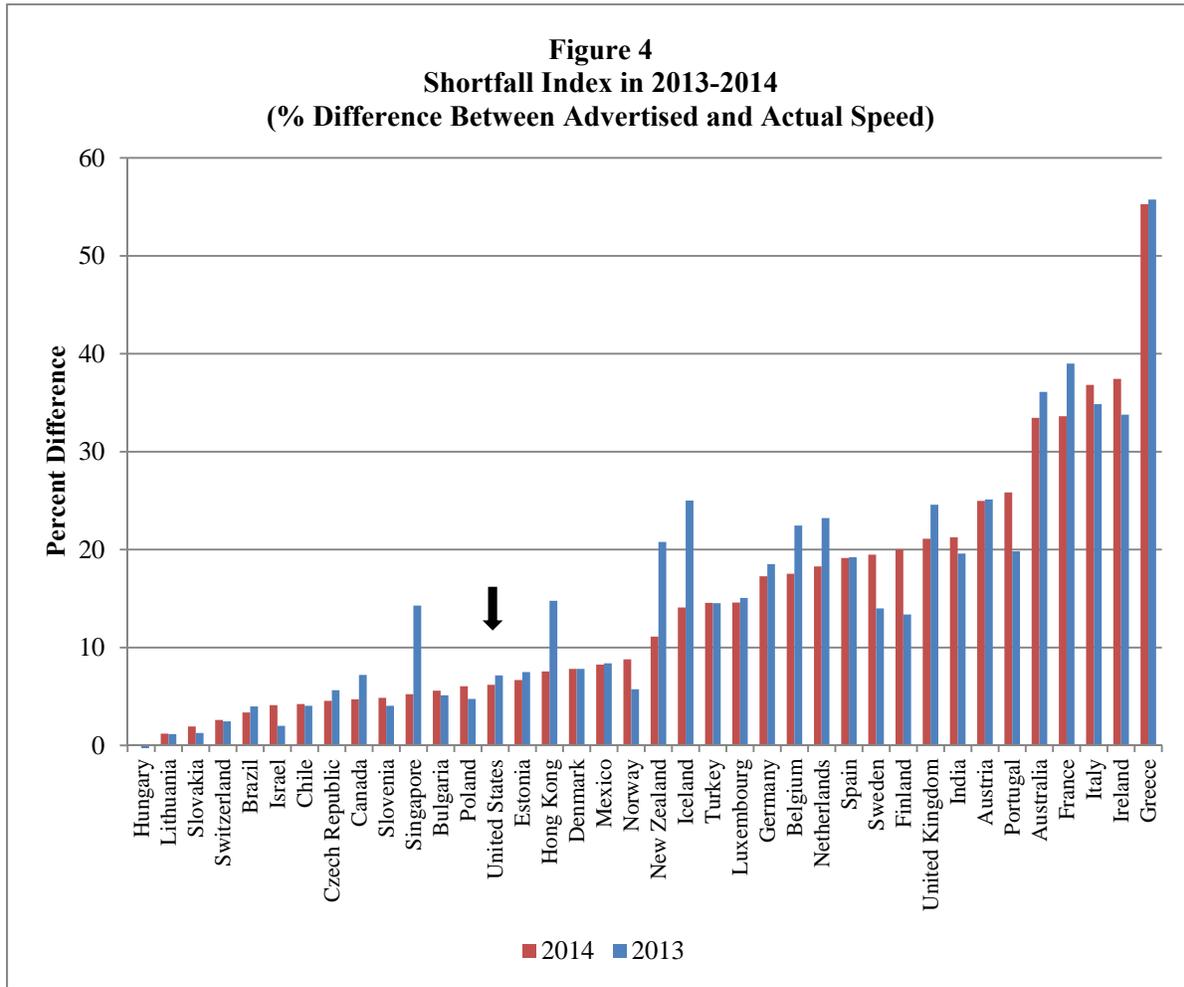
Source: Promise Index from Net Index by Ookla. (Data were drawn on Dec. 15, 2014.)

The shortfall index may not be entirely representative of broadband carriers' ability to deliver advertised speeds. In order to generate the Promise Index, Ookla requires consumers that submit test results to fill out a survey that asks for the advertised speed to which they are subscribed. This means that the Promise Index is created from a smaller subset of test results than the Net Index and assumes that the test subjects know the promised speed of the plan to which they have subscribed. Also, the potential exists that consumers unhappy with their speed are more likely to run tests for the Promise Index, thereby creating a bias in the data.

The Ookla Promise Index, though imperfect, does provide a means for comparing the ability of broadband carriers to deliver advertised speeds. In addition to constructing a shortfall index, we present the average and advertised download speeds from the Ookla data. Figure 5 shows the actual download speeds from each country, and to what extent that matches what survey respondents reported they were promised. The United States was ranked 23rd of 38 countries for its average advertised speed of 25.35 Mbps in 2014, the same ranking that its 2013 advertised speed of 19.3 Mbps earned.[18] Data for both 2013 and 2014 are presented in Appendix F Table 6.

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[17] *Id.*

[18] Japan and South Korea do not have actual download speeds reported in this dataset.

Figure 5
Shortfall Index 2013-2014
(Mbps)
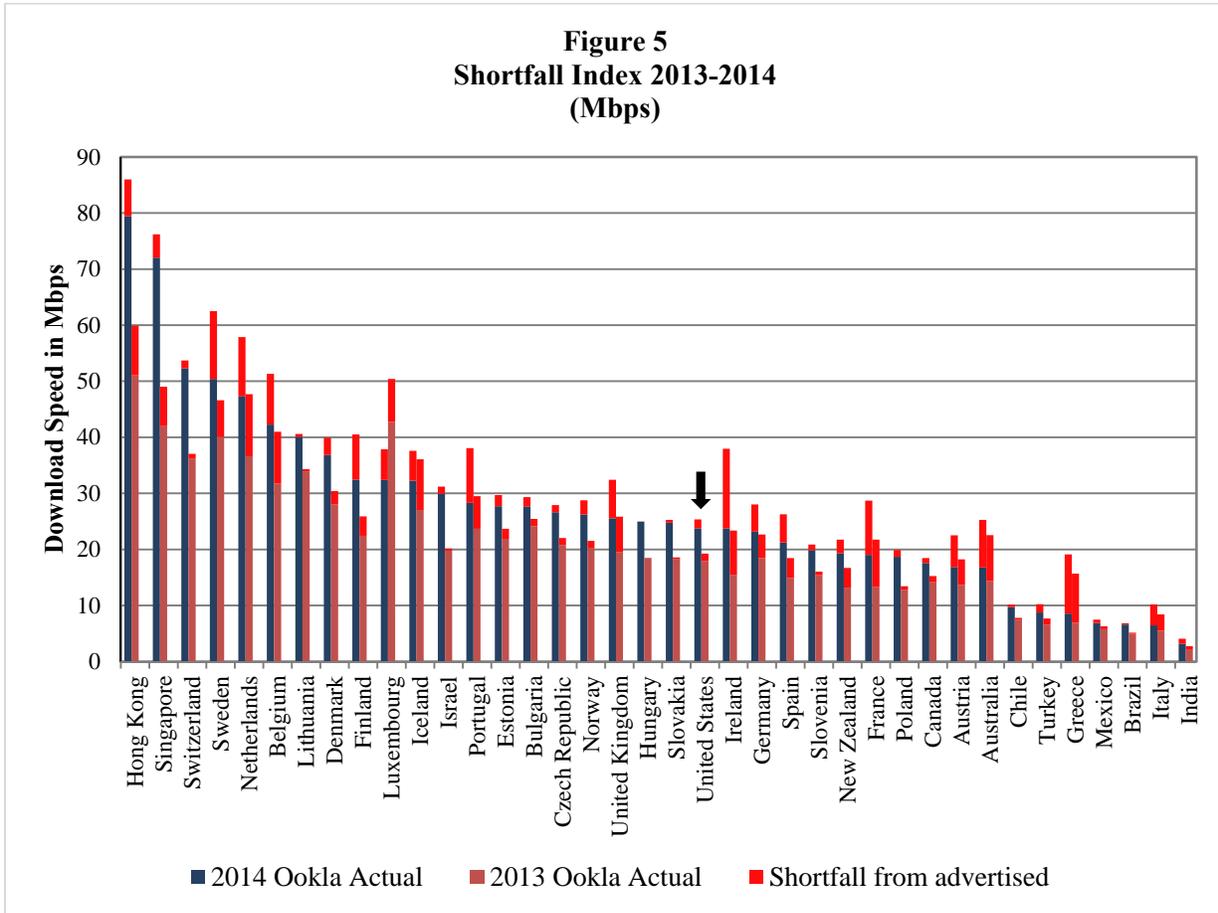
Source: Promise Index from Net Index by Ookla. (Data were drawn on Dec. 15, 2014.)

     We believe that the Commission's Measuring Broadband America (MBA) program, an ongoing, rigorous, nationwide study of residential broadband performance in the United States, provides a more accurate picture of U.S. broadband providers' ability to deliver advertised speeds. The most recent MBA study (released on December 30, 2015), like those conducted before, involves actual performance tests for thousands of subscribers of ISPs serving well over 80 percent of the residential market.[19] Previous reports (for 2012 and 2013 data) found that at least five ISPs routinely delivered nearly 100 percent or greater of the download speed advertised to the consumer, even during time periods when bandwidth demand was at its peak.[20] The 2015 MBA Report shows a continuation of this trend. The ratio in September 2014 of the actual download speeds to advertised download speeds, averaged across all panelists, was 105.6 percent, an increase from the 101.6 percent reported last year for September 2013.[21]

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[19] *See* 2015 MBA Report.

[20] *See* 2014 Measuring Broadband America: Fixed Broadband Report - A Report on Consumer Wireline Broadband Performance in the U.S., FCC's Office of Engineering and Technology and Consumer and Governmental Affairs Bureau, http://data.fcc.gov/download/measuring-broadband-america/2014/2014-Fixed-Measuring-Broadband-America-Report.pdf, (*2014 MBA Report*); 2013 Measuring Broadband America: February Report - A Report on Consumer Wireline Broadband Performance in the U.S., FCC's Office of Engineering and Technology and Consumer and Governmental Affairs Bureau, at 4, http://transition.fcc.gov/cgb/measuringbroadbandreport/2013/Measuring-Broadband-America-feb-2013.pdf.

[21] 2015 MBA Report at 13.

The Measuring Broadband America program relies on measurements by hardware and software deployed in the homes of thousands of volunteer consumers by Commission contractor SamKnows. The SamKnows "Whitebox" devices and their software conduct automated, direct measurements of broadband performance throughout the year, though for reporting purposes, the Commission focuses on test results during a specific time period (September and October 2014, in the case of the December 2015 report).[22] The study examines service offerings from 13 of the largest broadband providers (focusing on four ISP delivery technologies—DSL, cable, fiber, and satellite), which collectively account for well over 80 percent of all U.S. residential broadband connections. Hardware approaches involve placing a device inside the user's home, and it is physically connected to the consumer's Internet connection, and periodically running tests to remote targets on the Internet.

Several countries have undertaken detailed broadband studies similar to our own,[23] the largest being a European Commission-organized study of actual broadband speeds in 30 countries across Europe, also using SamKnows.[24] In the last IBDR, we compared the European Union and MBA actual speed data, finding such comparison warranted due to similarities in methodologies and the time of data collection. We compare the U.S. and European data in this report for the same reason. The data show a continuation of the trend we saw in the last IBDR: the United States still does better than Europe when comparing actual performance to advertised speeds.[25] The European study is based on data SamKnows gathered

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[22] *Id*. at 22.

[23] The United Kingdom is a notable example. Ofcom, the United Kingdom's telecommunications regulator, has also partnered with SamKnows to conduct regular broadband speed tests. *See e.g*., U.K. fixed-line broadband performance, Ofcom, November 2014, http://stakeholders.ofcom.org.uk/market-data-research/other/telecoms-research/broadband-speeds/broadband-speeds-november2014/. Singapore's Infocomm Development Authority has also partnered with SamKnows to provide broadband speed test results for Singapore's consumers. *See* http://www.ida.gov.sg/applications/rbs/chart.html. Anatel, the Brazilian regulator, working with SamKnows, has provided meter devices to volunteers to measure broadband speeds. First quarter 2014 test results are available at http://www.anatel.gov.br/Portal/exibirPortalNoticias.do?acao=carregaNoticia&codigo=33476. Germany's telecommunications regulator, Bundesnetzagentur (BNetza), released the results of its 2012 and 2013 studies of actual broadband speeds experienced by German broadband subscribers (*see* http://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Breitband/Dienstequalitaet/qualitaetsstudie/qualitaetsstudie-node.html). BNetza's method of testing is similar to Ookla's, in that the test was software-based and conducted via a consumer's web browser (*see* http://www.initiative-netzqualitaet.de/startseite/. Those taking the test were required to fill out a survey identifying, among other factors, the name of their broadband provider and the speed tier (maximum "up to" speed) to which they subscribe. Germany's test results reveal that 15.7 percent of fixed broadband customers and 21 percent using mobile broadband devices achieved the advertised maximum speeds. *See* "Internet Speeds Fail to Meet Promises in Germany, Study Shows," *New York Times* (Apr. 11, 2013), http://www.nytimes.com/2013/04/12/technology/internet-speeds-fail-to-meet-promises-in-germany-study-shows.html. BNetza now offers an app for mobile devices so that consumers can measure their mobile broadband speeds. *See* https://breitbandmessung.de/mobil-testen. According to the SamKnows website, the Canadian Radio-television and Telecommunications Commission is in the early stages of planning a broadband measurement study with SamKnows. *See* https://www.samknows.com/regulators.

[24] "Quality of Broadband Services in the EU, October 2014," Final Report prepared for the European Commission, (Oct. 22, 2015), https://ec.europa.eu/digital-agenda/en/news/quality-broadband-services-eu. (*2014 EU Broadband Report*). For this study, the EC recruited 10,000 consumers across these 30 countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom (*i.e*., the 28 EU member countries plus Iceland and Norway). The study examined speeds on xDSL, cable, and fiber networks of the top two or three ISPs (by subscriber number) in their national markets.

[25] This observation should be considered when looking at pricing data (section III.C. *infra*) which is collected with only advertised speeds. Based on the data presented here, it appears that U.S. broadband consumers get more of what they pay for, compared to European consumers.

from Whiteboxes in October 2014 and the latest MBA study is based on Whitebox data gathered in September 2014 and October 2014. The charts below show the peak (7:00 pm-11:00 pm) and non-peak (*i.e.*, 24 hour period) average advertised and actual broadband speed for both the United States and Europe for DSL, cable, fiber, and (for the United States) satellite ISPs. The speeds below are averages for all observations of a given technology. For the United States, the reported figure is the average for all consumer observations using the indicated technology. For Europe, the reported figure is the average for all observations in the 30 country survey. These high-level averages do not account for variations in actual/advertised speeds at various speed tiers.[26]

Technology	U.S. advertised speed (Mbps)	Europe advertised speed (Mbps)	U.S. actual speed (Mbps) (24 hour)	Europe actual speed (Mbps) (24 hour	U.S. actual/ Advertised (%)[27]	Europe actual/ Advertised (%)
xDSL	10.16	14.04	10.28	8.5	97	65.07
Cable	40.23	79.8	43.89	70.04	114	90.16
fiber	44.17	64.92	48.34	54.65	112	85.45
Satellite	9.86	NA	16.37	NA	201	NA

Technology	U.S. advertised speed (Mbps)	Europe advertised speed (Mbps)	U.S. actual speed (Mbps) (peak)	Europe actual speed (Mbps) (peak)	U.S. actual/ Advertised (%)	Europe actual/ Advertised (%)
xDSL	10.16	14.04	9.85	8.27	93	63.32
Cable	40.27	79.8	42.14	66.57	110	86.51
fiber	44.33	64.92	47.11	53.09	110	83.14
Satellite	9.78	NA	15.00	NA	183	NA

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[26] The U.S.-based MBA testing data does not include all speed tiers for the tested 13 providers for all regions. Thus, we cannot say that all consumers in the United States for a specific technology experience a specific speed on average. The MBA selects sample sets of Whiteboxes from: (1) selected speed tiers; (2) from selected areas/regions; and (3) selected ISPs at a minimum. The MBA does not measure and report on all speed tiers for all regions for all ISPs. Therefore, the reported data is a specific and limited characterization of the actual consumer services and performance. For the 6,000-7,000 Whiteboxes tested at some speed tiers for the largest 13 providers in some regions of the United States, the average speeds were what we show in the tables below. The averages provide a useful tool for comparing huge volumes of data, but they reflect only the experiences of those consumers participating in the SamKnows studies (both in Europe and the United States), and do not necessarily represent a true "average" American or "average" European experience.

[27] The European report computed these percentages on per-panelist basis and averaged them to form an overall figure (in other words, they did not obtain the percentages simply by dividing average actual speed by average advertised speed for each technology). *2014 EU Broadband Report* at 60. We computed the ratio of actual to advertised speed the same way for the MBA data.

Just as we reported in the last IBDR, the data suggest that although advertised and actual speeds are often higher in Europe than in the United States, U.S. broadband providers are more effective than European providers in delivering promised speeds to consumers. In this report, we look at speeds measured during both peak and non-peak hours, and in both cases, U.S. providers' (that is, those providers in the MBA sample) actual speeds exceed advertised speeds for all platforms except DSL, whereas European providers (again, only those providers that participate in the study) do not exceed advertised speeds for any technology. Further, for DSL, although European providers advertised faster speeds than U.S. providers, the U.S. providers, on average, delivered actual speeds that were faster than actual speeds of the European providers, at both peak and non-peak hours.[28]

5.   Other Quality Measures for Fixed Broadband Connections

The focus of our discussion so far has centered on the speed of broadband connection, which measures the average rate at which information packets travel from a source to a destination. There are, however, other metrics of network quality that may provide insight about comparative broadband performance across countries. Three common measures of connection quality are latency, jitter (*i.e.*, the variance in latency), and packet loss. Ookla collects data on these broadband quality measures through user-based tests at pingtest.net.[29]

a.   Latency

Latency (also known as ping) refers to several types of delays typically incurred during network data processing, and is typically measured in milliseconds (ms). One common measure is round-trip latency, which measures the amount of time it takes a data packet to travel from a source to a destination and back. More precisely, it is measured as the sum of time from the start of packet transmission by a source to the start of packet reception by a destination plus the time that it takes for the packet to travel back from the receiving destination to the source. Latency is often affected by factors such as the properties of the physical medium through which the network packets are transmitted or processing delays which may occur when the packets need to pass through proxy servers.

Figure 6a shows the weighted latency rankings for our 40 sample countries for 2013-2014. The dataset provided 2014 data for 32 countries. From 2013 to 2014, latency in the United States decreased from 80.33 ms to 77.66 ms and the U.S. ranking improved from 27th (of 40 countries) to 15th (of 32 countries).[30] Fourteen countries experienced increases in latency in 2014, with the largest growth seen in the Czech Republic from 50.45 ms in 2013 to 101.4 ms in 2014. The United Kingdom has seen increases in latency each of the past three years. Data are shown in Appendix F Table 7a.

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[28] The U.S. data are publicly available at https://www.fcc.gov/reports-research/reports/measuring-broadband-america/validated-data-measuring-broadband-america-2015.

[29] These data are included with the full NetIndex download.

[30] The only country missing 2014 data that had a better 2013 ranking than the United States was Hong Kong, meaning the jump in rankings was not mainly due to incomplete 2014 data.
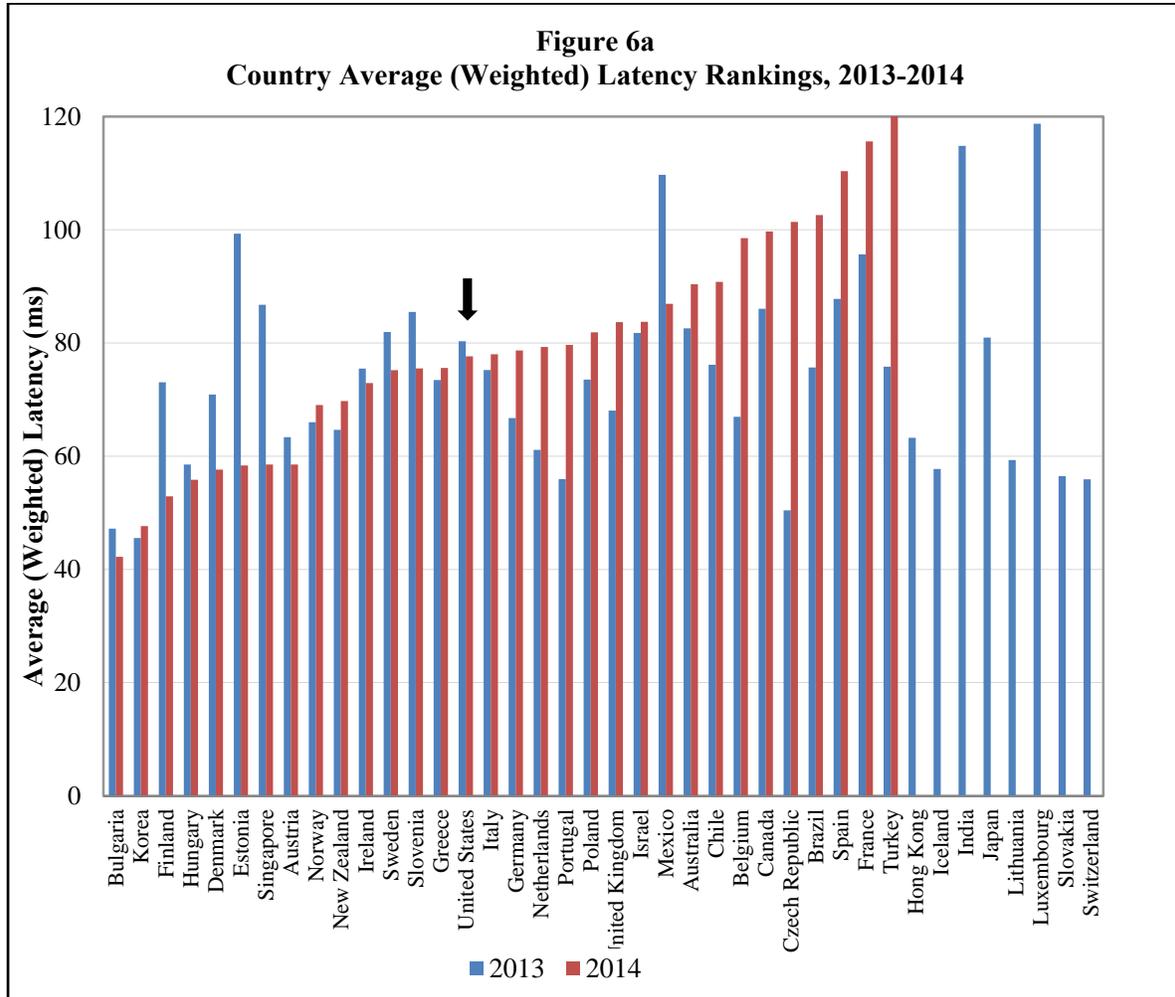
Figure 6a
Country Average (Weighted) Latency Rankings, 2013-2014

Note: incomplete quality data from Hong Kong, Iceland, India, Japan, Lithuania, Luxembourg, Slovakia, and Switzerland. (Data were drawn on Dec. 15, 2014.)

In Figure 6b, we plot the top and bottom quartiles of average (weighted) percent packet loss for the other countries in our sample and most U.S. states (including District of Columbia) for 2013 and 2014. In 2014, the number of U.S. states in the top quartile increased by two, for a total of seven, and the number of states in the bottom quartile decreased from nine to five. Only 27 states are represented in the 2014 data (as compared to 30 states in 2013), which may partially account for the decrease. Michigan jumped from next to last in the 2013 rankings to first in the 2014 rankings by improving latency from 159.45 ms to 34.04 ms. Kentucky and Wisconsin both saw increases in latency of over 20 ms from 2013 to 2014. Data for other countries and the U.S. states which reported data are presented in Appendix F Table 7b.
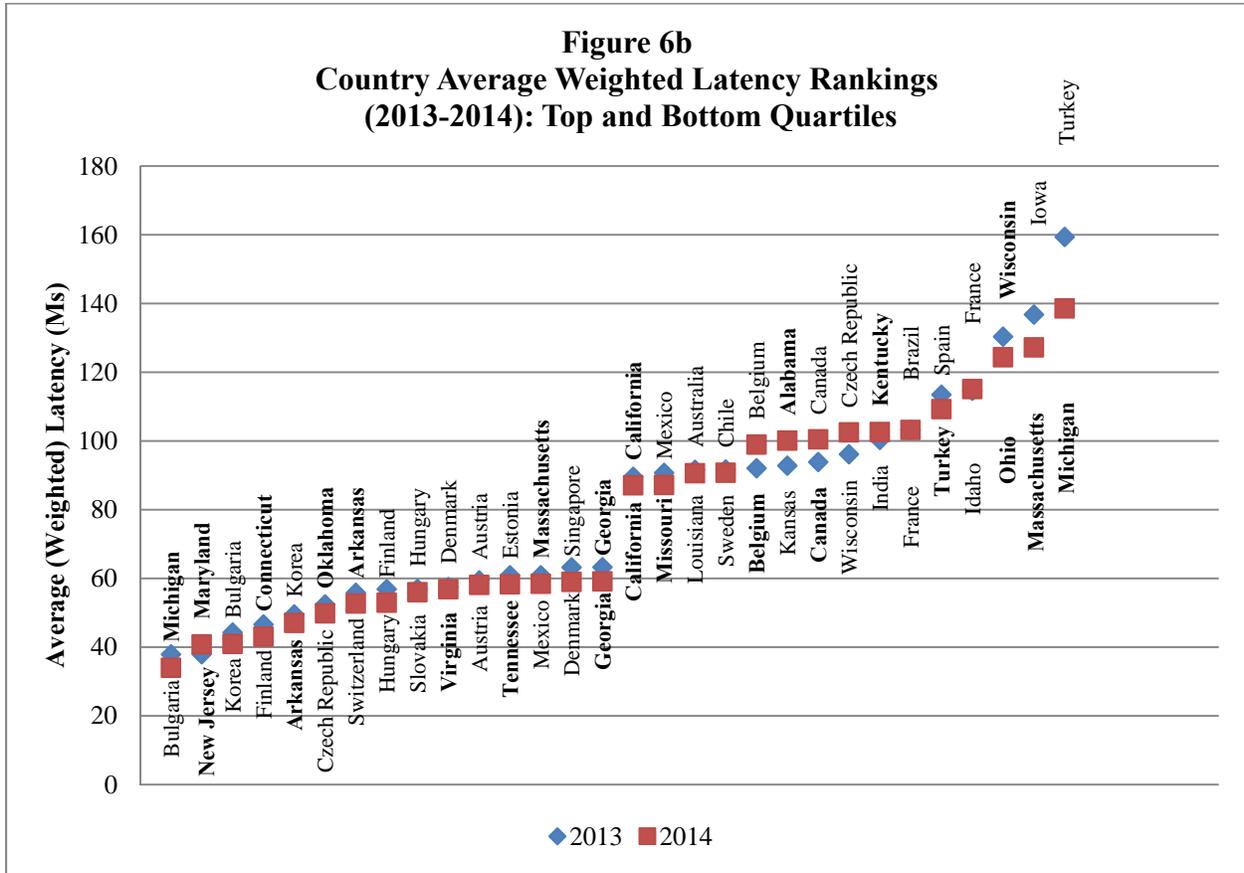
Figure 6b
Country Average Weighted Latency Rankings
**(2013-2014): Top and Bottom Quartiles**

Note: incomplete quality data from Alaska, Arizona, Delaware, Hong Kong, Iceland, Idaho, India, Japan, Kansas, Lithuania, Louisiana, Luxembourg, Maine, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, North Dakota, Rhode Island, Slovakia, South Carolina, South Dakota, Switzerland, Tennessee, Utah, Vermont, West Virginia, and Wyoming. (Data were drawn on Dec. 15, 2014.)

      b.   **Jitter**

      Jitter (also known as packet delay variation) refers to the variance of latency over time, and is measured by the average deviation from the mean latency of the network. More generally, jitter measures the consistency of the broadband connection.

      Figure 7a shows the average jitter rankings for 32 countries in our sample with complete data. All but four countries saw increases in jitter between 2013 and 2014. The United States ranked 24th (of 32 countries) in 2014, compared to 35th (of 40 countries) in 2013. Five countries from the top 20 in 2013 did not report 2014 data. The Czech Republic and Belgium nearly doubled their average jitter levels in 2014, while Mexico and Lithuania both improved their rankings. Estonia posted the largest decrease in jitter, decreasing by 13.88 ms from 39.55 ms in 2013 to 25.67 in 2014. Complete data can be found in Appendix F Table 8a.
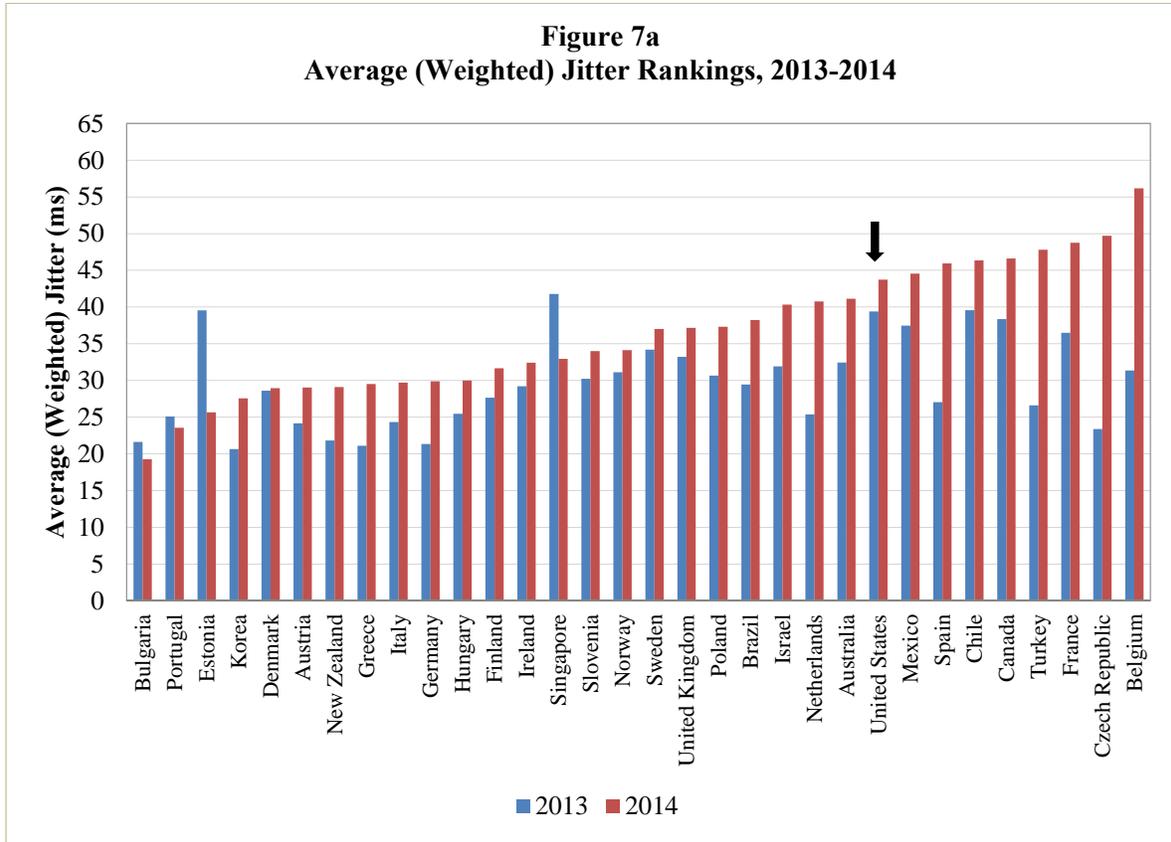
Figure 7a
Average (Weighted) Jitter Rankings, 2013-2014

Note: incomplete quality data from Hong Kong, Iceland, India, Japan, Lithuania, Luxembourg, Slovakia, and Switzerland. (Data were drawn on Dec. 15, 2014.)

Figure 7b compares U.S. states with the other countries in our sample; the top and bottom quartiles from 2013 and 2014 are displayed. In 2014, seven states appeared in the top quartile, compared to three states in 2013. The number of states in the bottom quartile decreased from ten to eight in 2014, and half of these states were new to the bottom quartile. Data for other countries and all U.S. states for which Ookla collected data are presented in Appendix F Table 8b.

Figure 7b
Country Average Weighted Jitter Rankings
(2013 and 2014): All Available Data

Note: incomplete quality data from Alaska, Arizona, Delaware, Hong Kong, Iceland, Idaho, India, Japan, Kansas, Lithuania, Louisiana, Luxembourg, Maine, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, North Dakota, Rhode Island, Slovakia, South Carolina, South Dakota, Switzerland, Tennessee, Utah, Vermont, West Virginia, and Wyoming. (Data were drawn on Dec. 15, 2014.)

        c.   **Packet Loss**

When packets of data traveling across the network fail to reach their destination, the phenomenon is termed packet loss. Packet loss can occur because of network congestion, signal degradation, faulty network drivers or networking hardware, and the distance between the origin of the transmitted data and the destination. When packet loss occurs due to these reasons, it can be used as a quality loss metric. In some cases, however, packet loss may be intentional, and intended to slow down specific services. Therefore, packet loss statistics, while still useful in measuring connection reliability, are imperfect.

Figure 8a shows the average weighted percent packet loss from 2013-2014 for 32 countries. Packet loss decreased for most countries in 2014, including the United States. In 2014, packet loss in the United States was 1.32 percent, down from 1.39 percent in 2013.[31] The countries with the greatest improvement (fewer packets lost) in 2014 were Greece and Ireland, while Israel saw the largest increase in percent packet loss. The United States saw its ranking decrease from fifth in 2013 (of 40 countries) to thirteenth in 2014 (of 32 countries), even though fewer countries reported data. Complete data can be found in Appendix F Table 9a.

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[31] *See* Appendix F, Table 9a.

Figure 8a
Country Average (Weighted) Packet Loss Rankings, 2011 and 2012

Note: incomplete quality data from Hong Kong, Iceland, India, Japan, Lithuania, Luxembourg, Slovakia, and Switzerland. (Data were drawn on Dec. 15, 2014.)

In Figure 8b, we plot the top and bottom quartiles of average (weighted) percent packet loss for countries and U.S. states for 2013 and 2014. Idaho saw substantial improvement in 2012 with fewer packet losses and joined six other states in the top quartile, one more than the previous year. The number of U.S. states in the bottom quartile increased as well, rising from five to six in 2012. The number of states in the top quartile remained at seven in 2013, while the number of states in the bottom quartile returned to five. Of the U.S. states, Alabama made the greatest improvement in 2013, moving from 5.45 percent packet loss to 0.20 percent packet loss. Data for other countries and all U.S. states which reported data are presented in Appendix F Table 9b.
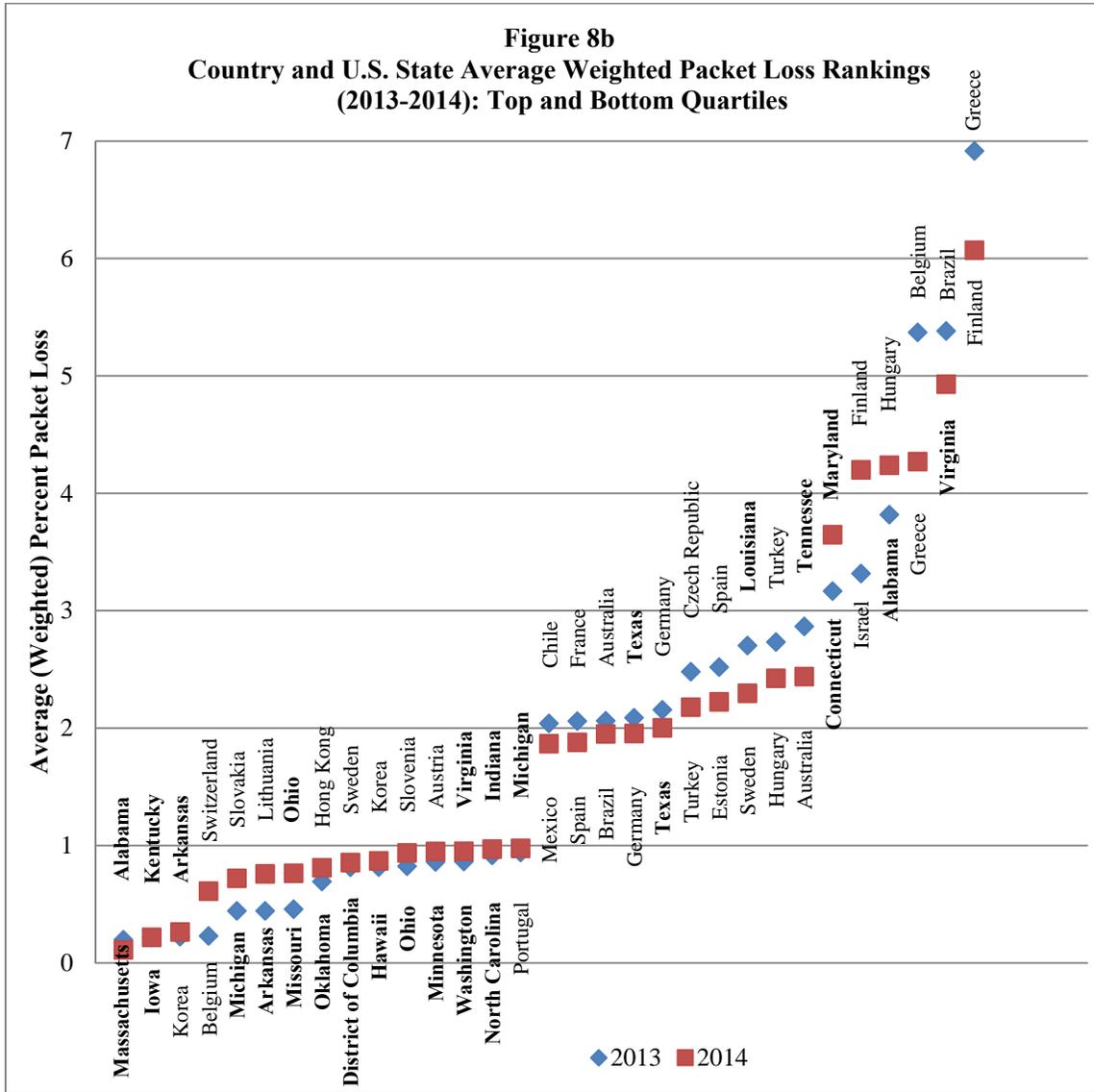
Figure 8b
Country and U.S. State Average Weighted Packet Loss Rankings
(2013-2014): Top and Bottom Quartiles

Note: incomplete quality data from Alaska, Arizona, Delaware, Hong Kong, Iceland, Idaho, India, Japan, Kansas, Lithuania, Louisiana, Luxembourg, Maine, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, North Dakota, Rhode Island, Slovakia, South Carolina, South Dakota, Switzerland, Tennessee, Utah, Vermont, West Virginia, and Wyoming. (Data were drawn on Dec. 15, 2014.)

Table 1a
Average (Weighted) Actual Download Speeds (2012-2014): All Available Data

2014 Data			2013 Data		
Rank	**Country**	**Mbps**	**Rank**	**Country**	**Mbps**
1	Singapore	73.32	1	Luxembourg	42.97
2	Hong Kong	58.24	2	Singapore	42.52
3	Korea	55.15	3	Lithuania	41.72
4	Sweden	52.75	4	Sweden	39.85
5	Switzerland	51.63	5	Korea	39.28
6	Lithuania	49.12	6	Japan	37.42
7	Netherlands	45.88	7	Netherlands	37.02
8	Iceland	40.01	8	Switzerland	36.01
9	Finland	39.93	9	Hong Kong	35.85
10	Denmark	39.25	10	Iceland	33.97
11	Luxembourg	36.58	11	Finland	30.56
12	France	35.35	12	Denmark	30.45
13	Estonia	35.35	13	Bulgaria	27.78
14	Belgium	34.31	14	Belgium	26.04
15	Japan	32.94	15	Portugal	25.86
16	Slovakia	32.44	16	Norway	24.08
17	Bulgaria	32.11	17	France	23.66
18	Czech Republic	31.87	18	Estonia	23.40
19	Norway	31.63	19	United Kingdom	23.29
20	Hungary	31.25	20	Czech Republic	23.18
21	Portugal	30.24	21	Slovakia	23.05
22	United Kingdom	29.41	22	Hungary	22.32
23	Austria	28.55	23	Austria	22.19
24	Germany	27.56	24	Germany	21.73
25	Spain	26.69	25	Ireland	19.28
26	**United States**	**26.68**	**26**	**United States**	**18.67**
27	Ireland	26.15	27	Canada	18.06
28	Israel	25.90	28	Spain	17.43
29	Canada	22.68	29	Israel	17.19
30	Poland	22.46	30	Poland	15.35
31	Slovenia	22.11	31	Slovenia	15.00
32	New Zealand	20.71	32	New Zealand	14.53
33	Australia	15.22	33	Australia	13.51
34	Chile	14.34	34	Mexico	10.16
35	Mexico	12.66	35	Chile	10.13
36	Brazil	12.19	36	Brazil	8.35
37	Turkey	11.40	37	Turkey	8.34
38	Greece	9.12	38	Greece	7.53
39	Italy	8.83	39	Italy	6.87
40	India	5.11	40	India	3.33

Table 1b

Median (Weighted) Download Speed (2014): All Available Data

Country	2014 Median Download Speed (Mbps)	2014 Rank	Country	2013 Median Download Speed (Mbps)	2013 Rank
Singapore	69.01	1	Singapore	41.06	1
Korea	54.64	2	Korea	35.30	8
Sweden	52.03	3	Sweden	35.46	7
Hong Kong	51.55	4	Hong Kong	28.52	13
Switzerland	50.26	5	Switzerland	38.63	2
Lithuania	49.10	6	Lithuania	36.34	5
Netherlands	45.35	7	Netherlands	36.93	4
Iceland	43.01	8	Iceland	34.77	9
Finland	41.73	9	Finland	35.56	6
Luxembourg	37.71	10	Luxembourg	34.77	10
Denmark	37.69	11	Denmark	29.89	11
Austria	35.92	12	Austria	25.53	16
Czech Republic	35.04	13	Czech Republic	21.61	23
Slovakia	34.23	14	Slovakia	24.74	17
Estonia	34.10	15	Estonia	19.56	25
Bulgaria	33.36	16	Bulgaria	29.61	12
Hungary	32.74	17	Hungary	22.45	19
France	32.71	18	France	20.69	24
Norway	31.76	19	Norway	23.98	18
Belgium	31.24	20	Belgium	25.92	15
Portugal	31.06	21	Portugal	28.04	14
Ireland	30.07	22	Ireland	22.24	21
United Kingdom	28.90	23	United	22.35	20
Japan	28.53	24	Japan	37.57	3
Germany	26.41	25	Germany	21.85	22
Spain	26.34	26	Spain	16.06	29
United States	24.63	27	United States	18.43	26
Israel	23.21	28	Israel	15.76	30
Poland	22.97	29	Poland	16.51	28
Canada	22.94	30	Canada	18.34	27
Slovenia	21.21	31	Slovenia	14.02	31
New Zealand	17.74	32	New Zealand	12.97	32
Chile	15.25	33	Chile	10.09	35
Australia	13.88	34	Australia	11.19	34
Turkey	12.60	35	Turkey	9.28	36
Mexico	12.37	36	Mexico	11.79	33
Brazil	10.32	37	Brazil	8.50	37
Greece	9.20	38	Greece	7.49	38
Italy	8.12	39	Italy	6.17	39

Country	2014 Median Download Speed (Mbps)	2014 Rank	Country	2013 Median Download Speed (Mbps)	2013 Rank
India	4.51	40	India	2.90	40

Table 1c

Percent Change in Average (Weighted) Download Speed, 2013-2014
95% confidence interval bounds

Country	Percent Change	Upper Bound	Lower Bound	Rank
Singapore	73.4	69.3	77.5	1
Hong Kong	62.9	61.5	64.3	2
Spain	56.9	56.1	57.6	3
India	56.1	55.3	56.9	4
Estonia	54.3	52.9	55.6	5
Korea	53.1	51.8	54.3	6
Israel	53.0	52.1	53.8	7
Poland	51.0	50.2	51.7	8
France	50.9	50.6	51.3	9
Slovenia	47.7	45.9	49.4	10
Brazil	46.8	46.5	47.1	11
Switzerland	46.0	45.4	46.7	12
United States	44.5	44.3	44.6	13
Hungary	44.2	43.5	44.9	14
New Zealand	42.4	41.1	43.7	15
Chile	42.3	41.0	43.6	16
Slovakia	41.4	40.4	42.3	17
Ireland	38.3	37.0	39.6	18
Czech Republic	37.3	36.5	38.1	19
Turkey	37.2	35.7	38.7	20
Finland	36.9	36.0	37.8	21
Sweden	33.3	32.5	34.1	22
Norway	32.5	32.1	33.0	23
Austria	30.9	30.3	31.4	24
Denmark	30.0	29.3	30.6	25
Italy	29.2	29.0	29.3	26
Belgium	28.6	28.1	29.0	27
United Kingdom	28.4	28.1	28.6	28
Germany	27.4	27.2	27.7	29
Canada	25.8	25.5	26.1	30
Mexico	25.1	24.7	25.5	31
Netherlands	24.3	24.1	24.5	32
Greece	22.4	21.8	23.0	33
Lithuania	18.0	17.2	18.8	34
Portugal	17.1	16.6	17.6	35

Country	Percent Change	Upper Bound	Lower Bound	Rank
Bulgaria	15.2	14.7	15.6	36
Australia	12.9	12.5	13.3	37
Iceland	12.1	9.7	14.4	38
Luxembourg	-9.0	-10.9	-7.1	39
Japan	-9.8	-10.4	-9.2	40

Table 1d

Percent Tests Reporting At Least 10 Mbps Download Speed, 2013-2014

Rank	Country	2014	2013
1	Iceland	100	100
2	Korea	100	100
3	Singapore	100	100
4	Denmark	100	100
5	Netherlands	100	100
6	Hong Kong	100	100
7	Bulgaria	100	100
8	Japan	100	100
9	Estonia	100	100
10	Luxembourg	100	100
11	Lithuania	100	100
12	Switzerland	100	100
13	Sweden	100	100
14	Belgium	100	100
15	Israel	100	
16	New Zealand	99.95	99.56
17	Czech Republic	99.82	99.84
18	Finland	99.76	99.68
19	Norway	99.75	99.52
20	United Kingdom	99.30	97.93
21	Portugal	99.16	96.70
22	Ireland	99.12	91.06
23	Slovakia	99.08	97.80
24	Germany	99.06	97.20
25	Hungary	98.36	97.25
26	United States	98.18	96.30
27	Canada	97.77	95.09
28	Poland	97.38	88.95
29	Austria	97.12	93.32
30	Slovenia	96.81	97.05
31	Australia	95.84	80.88
32	Spain	94.24	87.39
33	Chile	93.35	75.97
34	France	89.68	81.74
35	Turkey	70.95	0.14
36	Mexico	58.29	52.73
37	Brazil	58.11	35.33
38	Italy	35.93	8.56
39	Greece	1.03	0.00
40	India	0.07	0.02

Table 1e

Percent Tests Reporting Greater Than Benchmark Speed, 2014

Rank	Country	>25 Mbps	>50 Mbps	>75 Mbps
1	Korea	100	94.90	0.23
2	Singapore	100	100	0.00
3	Hong Kong	99.77	99.53	16.22
4	Lithuania	99.69	48.26	0.00
5	Luxembourg	99.24	0.41	0.00
6	Netherlands	99.19	21.07	1.35
7	Sweden	98.87	60.13	4.35
8	Denmark	97.64	4.67	0.64
9	Estonia	97.02	0.00	0.00
10	Switzerland	96.14	70.62	1.07
11	Iceland	94.32	0.00	0.00
12	Finland	93.43	11.92	0.00
13	Japan	93.18	0.34	0.17
14	Norway	85.02	0.12	0.00
15	United Kingdom	82.42	0.90	0.00
16	Bulgaria	81.56	0.00	0.00
17	Hungary	78.47	1.92	0.06
18	Slovakia	77.79	0.00	0.00
19	Czech Republic	77.62	0.38	0.00
20	Germany	70.48	0.24	0.00
21	Portugal	69.76	0.05	0.00
22	Belgium	69.27	14.48	0.05
23	France	65.43	26.30	0.57
24	Ireland	60.16	0.00	0.00
25	United States	58.89	0.75	0.17
26	Austria	58.42	0.00	0.00
27	Spain	53.04	1.87	0.29
28	Israel	49.20	0.00	0.00
29	Poland	36.60	0.41	0.39
30	New Zealand	25.48	0.00	0.00
31	Canada	23.60	0.00	0.00
32	Slovenia	10.03	0.00	0.00
33	Australia	6.03	0.00	0.00
34	Brazil	0.45	0.00	0.00
35	Turkey	0.39	0.39	0.39
36	Mexico	0.13	0.00	0.00
37	Italy	0.03	0.00	0.00
38	Chile	0.00	0.00	0.00

Table 2

**Average (Weighted) Download Speeds (2013-2014):
Non-US Capital Cities & US State Capitals and Washington, D.C.**

Country	City	2014 Rank	2014 Speed	2013 Rank	2013 Speed
Singapore	Singapore	1	73.32	3	42.65
France	Paris	2	69.87	2	44.87
Lithuania	Vilnius	3	58.25	1	50.76
Korea	Seoul	4	53.75	4	39.51
Hong Kong	Hong Kong	5	52.58	12	32.42
Switzerland	Bern	6	51.27	6	37.38
Sweden	Stockholm	7	50.99	13	32.00
Finland	Helsinki	8	45.96	9	34.69
United States	**Austin**	9	44.18	60	15.56
United States	**Dover**	10	43.44	15	31.16
Denmark	Copenhagen	11	42.04	16	31.13
Iceland	Reykjavík	12	41.90	8	34.81
Netherlands	Amsterdam	13	40.11	10	33.50
Slovakia	Bratislava	14	39.51	22	26.51
United States	**Annapolis**	15	38.81	19	28.13
Norway	Oslo	16	38.06	18	28.57
Luxembourg	Luxemburg	17	37.99	5	39.20
Estonia	Tallinn	18	37.39	28	23.11
Bulgaria	Sofia	19	36.89	11	32.78
Austria	Vienna	20	36.65	20	27.84
Portugal	Lisbon	21	36.35	14	31.20
United States	**Trenton**	22	35.95	17	30.79
Czech Republic	Prague	23	35.92	24	24.31
United States	**Bismarck**	24	34.52	21	27.83
Hungary	Budapest	25	34.31	25	24.30
Japan	Tokyo	26	34.05	7	37.11
United States	**Concord**	27	33.83	38	21.27
Spain	Madrid	28	32.72	30	22.68
United States	**Richmond**	29	31.72	27	23.82
United States	**Harrisburg**	30	31.66	26	23.83
Ireland	Dublin	31	30.58	31	22.46
United States	**Olympia**	32	28.94	23	26.39
United States	**DC**	33	28.82	50	17.75
United States	**Montgomery**	34	28.20	46	18.83
United States	**Boston**	35	28.04	56	16.32
United States	**Providence**	36	27.90	37	21.29
United States	**Phoenix**	37	27.66	35	21.45

Country	City	2014 Rank	2014 Speed	2013 Rank	2013 Speed
United States	**Atlanta**	38	27.64	45	19.04
United States	**Oklahoma City**	39	27.57	65	14.99
United States	**Nashville**	40	27.52	41	19.88
United States	**Pierre**	41	27.45	49	17.88
United States	**Salem**	42	27.14	29	22.78
United States	**Madison**	43	26.47	43	19.76
New Zealand	Wellington	44	26.24	51	17.59
Canada	Ottawa	45	25.75	36	21.34
United Kingdom	London	46	25.49	34	21.69
Poland	Warsaw	47	25.17	55	16.75
Germany	Berlin	48	25.07	33	22.13
United States	**Sacramento**	49	24.59	63	15.29
United States	**Salt Lake City**	50	24.59	47	18.31
United States	**Springfield**	51	24.54	53	17.00
United States	**Baton Rouge**	52	24.43	44	19.24
United States	**Lansing**	53	24.35	57	16.03
United States	**Santa Fe**	54	24.04	42	19.76
Belgium	Brussels	55	23.98	61	15.35
United States	**Jackson**	56	23.41	59	15.87
United States	**Topeka**	57	23.28	71	14.02
United States	**Tallahassee**	58	23.19	39	20.68
United States	**Saint Paul**	59	23.05	40	20.33
United States	**Carson City**	60	22.91	32	22.17
Israel	Jerusalem	61	22.77	75	13.60
United States	**Indianapolis**	62	22.68	62	15.34
United States	**Hartford**	63	22.67	54	16.99
United States	**Juneau**	64	22.35		
Slovenia	Ljubljana	65	22.20	69	14.29
United States	**Little Rock**	66	22.12	64	15.14
United States	**Denver**	67	22.04	48	18.21
United States	**Des Moines**	68	20.84	66	14.67
United States	**Albany**	69	20.78	58	15.92
United States	**Cheyenne**	70	19.11	79	11.90
United States	**Honolulu**	71	18.99	67	14.46
United States	**Jefferson City**	72	18.86	52	17.15
United States	**Helena**	73	18.74	80	10.97
United States	**Raleigh**	74	18.59	68	14.35
United States	**Columbus**	75	18.39	70	14.13
United States	**Boise**	76	18.29	73	13.91
Mexico	Mexico City	77	17.57	77	13.21
United States	**Columbia**	78	17.24	74	13.74

Country	City	2014 Rank	2014 Speed	2013 Rank	2013 Speed
Australia	Canberra	79	16.59	72	13.91
United States	**Montpelier**	80	15.75	83	10.23
United States	**Charleston**	81	15.36	78	12.38
Chile	Santiago	82	15.15	82	10.66
United States	**Augusta**	83	13.84	76	13.52
United States	**Lincoln**	84	12.82	81	10.95
Turkey	Ankara	85	12.61	85	9.50
United States	**Frankfort**	86	10.64	86	8.60
Brazil	Brasília	87	10.58	84	10.15
Italy	Rome	88	10.47	88	7.30
Greece	Athens	90	9.26	87	7.60
India	New Delhi	91	4.15	90	3.02

Table 3a

Population Strata for Non-US Cities (2011-2014)
(Based on City Population and Ookla Data)

Strata	No. of Cities in Stratum	Proportion (%)
Very Small Cities Less than 25,000 inhabitants	9,700	57.3%
Small Cities Greater than or equal to 25,000, but less than 50,000 inhabitants	2,704	16.0%
Medium Cities Greater than or equal to 50,000, but less than 100,000 inhabitants	3,441	20.3%
Large Cities Greater than 100,000 inhabitants	1,085	6.4%
Total	16,930	

Table 3b

Population Strata for US Cities (2011-2014)
(Based on City Population and Ookla Data)

Strata	No. of Cities in Stratum	Proportion (%)
Very Small Cities Less than 25,000 inhabitants	911	34.9%
Small Cities Greater than or equal to 25,000, but less than 50,000 inhabitants	916	35.1%
Medium Cities Greater than or equal to 50,000, but less than 100,000 inhabitants	500	19.2%
Large Cities Greater than 100,000 inhabitants	283	10.8%
Total	2,610	

Table 3c

Average (Weighted) Download Speeds by Country: 2013-2014
Based on stratified sampling using 2011 cities

Country	2014 Average (Weighted) Download Speed (Mbps)	2014 Rank	2013 Average (Weighted) Download Speed (Mbps)	2013 Rank
Singapore	73.32	1	42.52	2
Hong Kong	58.14	2	35.75	8
Korea	55.83	3	39.43	4
Switzerland	53.61	4	38.70	5
Sweden	52.89	5	41.53	3
Netherlands	51.72	6	38.54	6
Belgium	40.25	7	30.42	9
France	39.44	8	19.60	23
Lithuania	39.44	9	28.35	11
Denmark	39.37	10	30.29	10
Finland	35.08	11	27.57	12
Israel	34.09	12	19.11	26
Luxembourg	34.02	13	47.32	1
Japan	30.91	14	37.13	7
Germany	30.89	15	21.30	20
Portugal	30.05	16	26.08	13
United Kingdom	29.84	17	22.39	16
Czech Republic	29.41	18	22.18	17
Bulgaria	29.38	19	24.40	14
Slovakia	29.36	20	21.91	18
Hungary	29.23	21	20.44	22
Norway	28.99	22	20.89	21

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Country	2014 Average (Weighted) Download Speed (Mbps)	2014 Rank	2013 Average (Weighted) Download Speed (Mbps)	2013 Rank
Iceland	28.47	23	22.83	15
Estonia	28.02	24	21.70	19
Ireland	27.82	25	18.37	27
United States	27.47	26	19.55	25
Canada	24.19	27	19.58	24
Poland	23.84	28	18.14	28
New Zealand	21.74	29	12.53	33
Austria	20.94	30	16.95	29
Spain	20.26	31	15.59	30
Slovenia	19.14	32	12.74	32
Australia	15.59	33	13.77	31
Chile	13.83	34	9.36	34
Brazil	12.09	35	8.76	35
Turkey	8.19	36	3.80	37
Italy	8.05	37	6.83	36
Mexico	5.54	38	3.22	38
India	3.32	39	2.74	39

Table 3d

Average (Weighted) Download Speed by US State and International Country: 2013-2014, Based on stratified sampling using 2011 cities

Country	2014 Average Weighted Download Speed (Mbps)	2014 Rank	2013 Average Weighted Download Speed (Mbps)	2013 Rank
Singapore	73.32	1	42.52	2
Hong Kong	58.14	2	35.75	8
Korea	55.83	3	39.43	4
Switzerland	53.61	4	38.70	5
Sweden	52.89	5	41.53	3
Netherlands	51.72	6	38.54	6
Belgium	40.25	7	30.42	9
France	39.44	8	19.60	43
Lithuania	39.44	9	28.35	11
Denmark	39.37	10	30.29	10
Utah	36.54	11	22.91	21
Delaware	35.77	12	26.54	13
Finland	35.08	13	27.57	12
New Jersey	34.12	14	26.06	15
Missouri	34.12	15	16.67	64
Israel	34.09	16	19.11	47
Luxembourg	34.02	17	47.32	1
Maryland	33.51	18	25.68	16

Country	2014 Average Weighted Download Speed (Mbps)	2014 Rank	2013 Average Weighted Download Speed (Mbps)	2013 Rank
New York	32.60	19	21.41	31
Massachusetts	32.42	20	23.31	20
Virginia	32.21	21	23.60	18
South Dakota	31.86	22	20.61	38
Japan	30.91	23	37.13	7
Germany	30.89	24	21.30	32
North Dakota	30.58	25	19.20	46
Arizona	30.40	26	22.16	26
New Hampshire	30.36	27	21.12	34
Portugal	30.05	28	26.08	14
Texas	29.94	29	14.74	70
United Kingdom	29.84	30	22.39	24
Rhode Island	29.69	31	23.50	19
Kansas	29.66	32	20.81	36
Czech Republic	29.41	33	22.18	25
Bulgaria	29.38	34	24.40	17
Slovakia	29.36	35	21.91	27
Hungary	29.23	36	20.44	39
Norway	28.99	37	20.89	35
Nevada	28.98	38	21.54	30
Connecticut	28.60	39	20.37	40
Iceland	28.47	40	22.83	22
Florida	28.17	41	21.88	28
Pennsylvania	28.07	42	20.04	41
Estonia	28.02	43	21.70	29
Washington	27.92	44	22.75	23
Ireland	27.82	45	18.37	50
California	27.48	46	18.03	54
Illinois	26.35	47	18.73	49
Vermont	26.19	48	17.70	55
Tennessee	25.49	49	19.08	48
Michigan	25.40	50	19.52	45
Oklahoma	25.10	51	14.12	73
Georgia	24.84	52	17.46	56
Oregon	24.84	53	20.73	37
Indiana	24.82	54	18.16	51
Colorado	24.79	55	19.77	42
Minnesota	24.67	56	21.25	33
Nebraska	24.64	57	18.07	53
Canada	24.19	58	19.58	44
Alabama	23.85	59	16.70	63
Poland	23.84	60	18.14	52
Iowa	23.76	61	16.63	65
Arkansas	23.35	62	15.78	67

Country	2014 Average Weighted Download Speed (Mbps)	2014 Rank	2013 Average Weighted Download Speed (Mbps)	2013 Rank
Louisiana	22.81	63	17.24	58
Wisconsin	22.44	64	16.96	59
South Carolina	22.10	65	16.81	61
New Zealand	21.74	66	12.53	78
Mississippi	21.34	67	15.59	69
Hawaii	21.07	68	16.04	66
Austria	20.94	69	16.95	60
West Virginia	20.83	70	16.74	62
New Mexico	20.82	71	17.37	57
Spain	20.26	72	15.59	68
Slovenia	19.14	73	12.74	76
Idaho	18.89	74	14.50	72
North Carolina	18.16	75	14.65	71
Alaska	17.75	76	8.07	84
Montana	17.16	77	10.07	81
Ohio	16.90	78	14.00	74
Wyoming	16.62	79	11.21	80
Kentucky	16.61	80	11.63	79
Maine	16.03	81	12.62	77
Australia	15.59	82	13.77	75
Chile	13.83	83	9.36	82
Brazil	12.09	84	8.76	83
Turkey	8.19	85	3.80	86
Italy	8.05	86	6.83	85
Mexico	5.54	87	3.22	87
India	3.32	88	2.74	88

Table 4a

Average Download Speed (2013-2014) in Very Small Cities for a Country/State
(Based on stratified sampling using 2011 cities)

Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)	Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)
Hong Kong	54.7	34.0	Georgia	26.0	18.3
Switzerland	52.9	37.1	New York	25.9	19.3
Korea	52.3	33.7	Hungary	25.8	17.1
Sweden	51.6	39.8	Tennessee	25.7	19.2
Netherlands	49.5	37.0	Minnesota	25.6	20.2
Denmark	39.8	30.3	Oklahoma	25.3	15.3
Belgium	39.4	29.5	Washington	25.2	21.0
Texas	37.7	14.8	Vermont	25.0	16.8
Delaware	37.5	30.1	Louisiana	24.8	19.4
Finland	37.4	24.6	Indiana	24.8	17.9
Maryland	37.1	28.9	Alabama	24.7	18.8

Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)	Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)
Arizona	37.0	24.1	South	24.6	18.3
France	36.2	20.2	Spain	24.5	15.4
Lithuania	35.9	31.6	Canada	24.4	20.0
Israel	34.1	19.1	Michigan	24.2	17.2
Luxembourg	34.0	47.3	Slovakia	23.1	18.7
New Jersey	33.6	27.9	Turkey	22.2	3.0
Massachusetts	33.5	25.8	Ireland	22.0	10.9
Virginia	33.3	25.0	Iowa	21.9	12.4
Nevada	31.9	21.3	Mississippi	21.5	15.3
Germany	31.5	21.0	Kansas	21.5	17.2
Japan	30.9	37.7	Hawaii	21.0	16.9
New Mexico	30.6	N/A	Austria	20.9	16.9
Nebraska	30.4	21.4	Colorado	20.7	15.1
Bulgaria	30.1	25.7	Wisconsin	20.6	16.6
Portugal	30.0	26.0	Slovenia	19.1	14.3
Utah	29.2	21.9	West Virginia	19.0	14.1
Pennsylvania	29.2	22.4	North	18.8	15.1
Florida	29.2	22.8	North Dakota	18.8	11.5
Illinois	29.1	19.7	Kentucky	16.6	12.8
Czech Republic	29.0	22.0	Maine	16.4	14.0
Missouri	28.6	17.8	Ohio	16.2	13.4
Connecticut	28.2	19.7	Arkansas	16.1	11.0
Estonia	28.0	21.7	Australia	15.6	13.7
California	27.7	17.7	Montana	15.3	10.3
Norway	27.6	20.2	Idaho	14.2	17.4
New Hampshire	27.5	20.3	Chile	13.9	9.9
Iceland	27.3	20.9	Alaska	13.3	5.9
Rhode Island	27.2	20.6	Wyoming	12.1	8.9
South Dakota	27.1	17.5	Brazil	12.1	8.8
Oregon	26.8	21.5	Mexico	3.9	3.2
Poland	26.2	20.2	India	3.3	2.8

Table 4b

**Average Download Speed (2013-2014) in Small Cities for a Country/State
(Based on stratified sampling using 2011 cities)**

Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)	Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)
Netherlands	57.9	40.8	**New York**	26.2	22.3
Switzerland	53.8	42.3	**Pennsylvania**	26.2	18.8
Lithuania	48.2	44.5	**Minnesota**	26.1	20.2
Mexico	47.5	N/A	**Indiana**	26.1	18.3
Belgium	46.9	38.8	**Iowa**	26.1	18.0
Sweden	46.7	38.9	**Arizona**	26.0	20.2
Delaware	38.8	29.0	Bulgaria	24.9	20.5
Denmark	35.7	27.5	**Wisconsin**	24.2	18.8
Ireland	35.6	27.2	**Georgia**	23.5	17.4
New Jersey	35.1	26.7	**South**	23.2	16.3
South Dakota	34.1	26.0	**Arkansas**	22.3	15.7
Slovakia	33.6	22.9	Finland	22.0	21.9
Massachusetts	33.1	24.9	**Mississippi**	21.8	16.7
North Dakota	32.8	23.6	**Louisiana**	21.6	16.1
Virginia	32.6	23.7	**Hawaii**	21.2	15.2
Texas	31.7	14.4	**Missouri**	20.7	15.8
Rhode Island	31.5	26.3	**Oklahoma**	20.1	12.3
Maryland	31.5	24.3	**Kansas**	19.9	16.7
Portugal	31.2	27.3	Poland	19.5	15.6
New	30.8	21.5	**Alabama**	19.1	14.6
Connecticut	30.4	23.5	Spain	18.7	15.0
Iceland	30.3	25.5	**North**	18.3	14.6
Germany	29.1	20.5	**Idaho**	18.3	13.0
Michigan	29.1	20.2	**Kentucky**	17.5	13.0
Utah	28.7	22.5	**Wyoming**	17.1	11.8
Oregon	28.3	21.1	**Ohio**	16.9	13.6
Hungary	28.1	22.4	**Montana**	16.8	9.5
West Virginia	27.2	18.8	**New Mexico**	16.5	12.6
Czech Republic	27.1	21.3	**Maine**	15.4	11.2
Vermont	27.1	16.9	**Nebraska**	14.1	12.1
Florida	27.1	19.7	**Alaska**	13.6	5.6
Illinois	26.8	18.3	France	10.0	8.3
Colorado	26.8	18.9	**Australia**	9.5	6.3
Washington	26.7	23.4	**Nevada**	5.5	4.3
California	26.3	18.2	Turkey	4.7	3.8
Tennessee	26.3	20.0	Chile	3.6	2.2

Table 4c

Average Download Speed (2013-2014) in Medium Cities for a Country/State
(Based on stratified sampling using 2011 cities)

Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)	Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)
Hong Kong	101.7	59.1	**Missouri**	26.2	16.5
Switzerland	64.6	36.2	**Indiana**	26.0	18.5
Sweden	54.5	48.5	**Oklahoma**	25.9	13.9
Netherlands	50.9	43.1	**Georgia**	25.3	17.2
Germany	47.5	34.4	**Washington**	25.3	22.2
North Dakota	41.0	26.5	**Nevada**	24.9	15.9
Portugal	37.1	29.8	**Alabama**	24.9	19.6
Hungary	37.0	27.4	**Iowa**	24.2	16.3
Maryland	35.2	26.4	Finland	24.1	24.6
New Jersey	33.5	25.4	**Minnesota**	24.1	21.3
Slovakia	33.3	27.1	**Illinois**	23.9	18.0
New Hampshire	33.0	23.2	**Oregon**	23.8	20.8
Massachusetts	32.1	24.8	**Kansas**	23.5	17.2
Texas	31.3	15.1	**Michigan**	23.3	17.2
Delaware	31.3	23.7	Spain	21.8	17.5
Japan	30.8	23.1	New Zealand	21.7	12.5
Rhode Island	30.4	22.9	**Mississippi**	21.5	14.3
Bulgaria	30.2	25.1	**Louisiana**	21.4	16.7
United Kingdom	29.8	23.1	**New Mexico**	21.0	16.6
Utah	29.6	23.1	**Idaho**	19.7	15.4
California	29.1	17.1	Poland	19.2	14.0
Florida	28.6	22.1	**Wyoming**	18.5	10.9
Connecticut	28.5	20.5	**South**	18.5	14.7
Virginia	28.4	19.4	**Wisconsin**	18.4	14.6
Arizona	28.4	22.7	**Montana**	17.6	11.0
Arkansas	27.7	18.1	**North**	17.6	15.0
Tennessee	27.2	19.0	**Ohio**	17.2	14.5
Colorado	27.1	22.3	**Maine**	17.1	12.8
Czech Republic	26.9	20.1	**Kentucky**	12.9	8.1
Pennsylvania	26.8	18.5	France	9.7	7.3
South Dakota	26.4	20.6	Italy	8.1	6.8
New York	26.4	22.3	Turkey	5.4	4.2

   *Vermont Not Included

Table 4d

Average Download Speed (2013-2014) in Large Cities for a Country/State
(Based on stratified sampling using 2011 cities)

Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)	Country	2014 Download Speed (Mbps)	2013 Download Speed (Mbps)
Utah	104.6	26.2	**Michigan**	27.6	20.1
Hong Kong	79.5	47.8	Portugal	27.0	23.2
Switzerland	61.1	32.2	**North** Dakota	26.5	15.7
Sweden	59.9	42.3	**Georgia**	25.4	18.1
Korea	57.4	39.6	**Tennessee**	25.4	18.7
Finland	51.1	36.1	**Illinois**	25.2	17.8
France	50.3	34.0	**Vermont**	25.0	12.5
Denmark	38.6	30.6	**Colorado**	24.3	20.1
Lithuania	38.2	34.6	Germany	24.3	20.7
Missouri	38.0	16.3	**New Hampshire**	24.2	15.1
South Dakota	37.5	21.7	**Alabama**	23.9	16.8
New York	37.5	19.9	**Louisiana**	23.4	16.2
Czech Republic	35.4	26.0	**Iowa**	22.7	15.1
Maryland	35.3	28.6	**Indiana**	21.8	14.6
Hungary	34.7	26.0	**New Mexico**	21.7	18.7
Kansas	34.5	22.8	Canada	21.6	15.8
Norway	33.2	23.8	**Oregon**	21.0	18.7
Bulgaria	33.2	25.3	**South Carolina**	19.6	15.3
Virginia	32.7	24.5	**Alaska**	18.9	8.7
Nebraska	32.2	22.2	**Texas**	17.9	13.6
Arizona	31.8	22.5	Spain	17.6	14.4
New Jersey	31.6	23.8	**Rhode Island**	17.5	11.2
Massachusetts	31.4	21.0	**North Carolina**	17.3	13.9
Japan	30.9	38.8	**Montana**	17.3	9.2
Florida	30.2	24.1	**Ohio**	17.2	13.5
Washington	30.1	22.9	**Wisconsin**	16.9	12.7
Nevada	29.6	22.1	**West Virginia**	15.0	11.9
Poland	29.1	21.0	Chile	13.9	8.2
Connecticut	28.3	19.5	**Kentucky**	12.1	9.2
Pennsylvania	28.3	19.6	**Arkansas**	6.7	3.7
Oklahoma	28.3	14.5	India	2.0	1.8
California	27.6	18.9			

Table 5

Shortfall Index (%), 2013-2014

2014 Rank	Country	Median Shortfall 2014	Median Shortfall 2013	2013 Rank
1	Hungary	0.14	-0.99	1
2	Lithuania	1.21	1.15	2
3	Slovakia	1.94	1.28	3
4	Switzerland	2.60	2.46	5
5	Brazil	3.37	3.98	6
6	Israel	4.12	2.00	4
7	Chile	4.23	4.05	7
8	Czech Republic	4.56	5.64	11
9	Canada	4.72	7.20	14
10	Slovenia	4.86	4.05	8
11	Singapore	5.23	14.28	20
12	Bulgaria	5.59	5.12	10
13	Poland	6.05	4.75	9
14	United States	6.20	7.15	13
15	Estonia	6.69	7.50	15
16	Hong Kong	7.57	14.77	22
17	Denmark	7.82	7.82	16
18	Mexico	8.26	8.38	17
19	Norway	8.79	5.74	12
20	New Zealand	11.11	20.79	28
21	Iceland	14.10	25.02	32
22	Turkey	14.56	14.52	21
23	Luxembourg	14.60	15.06	23
24	Germany	17.28	18.51	24
25	Belgium	17.54	22.47	29
26	Netherlands	18.29	23.23	30
27	Spain	19.15	19.22	25
28	Sweden	19.48	13.99	19
29	Finland	20.02	13.37	18
30	United Kingdom	21.12	24.59	31
31	India	21.26	19.60	26
32	Austria	24.97	25.12	33
33	Portugal	25.83	19.83	27
34	Australia	33.46	36.11	36
35	France	33.62	38.99	37
36	Italy	36.82	34.85	35
37	Ireland	37.43	33.79	34
38	Greece	55.28	55.75	38

Table 6

Ookla Actual and Advertised Average Download Speeds, 2013-2014

Country	2014 Actual	2014 Advertised	2013 Actual	2013 Advertised
Hong Kong	79.44	85.99	51.0	59.9
Singapore	72.03	76.19	42.0	49.0
Switzerland	52.31	53.70	36.1	37.1
Sweden	50.40	62.51	40.1	46.6
Netherlands	47.28	57.86	36.6	47.7
Belgium	42.26	51.32	31.8	41.0
Lithuania	40.09	40.58	33.9	34.3
Denmark	36.86	39.95	28.0	30.4
Finland	32.46	40.52	22.4	25.9
Luxembourg	32.39	37.86	42.8	50.4
Iceland	32.24	37.59	27.0	36.1
Israel	29.93	31.20	19.8	20.2
Portugal	28.31	38.08	23.7	29.5
Estonia	27.72	29.70	21.9	23.7
Bulgaria	27.67	29.32	24.1	25.4
Czech Republic	26.63	27.91	20.8	22.0
Norway	26.22	28.75	20.3	21.5
United Kingdom	25.57	32.42	19.5	25.8
Hungary	24.96	24.98	18.5	18.3
Slovakia	24.77	25.26	18.3	18.6
United States	23.78	25.35	17.9	19.3
Ireland	23.76	37.95	15.5	23.4
Germany	23.17	28.01	18.5	22.7
Spain	21.25	26.26	14.9	18.5
Slovenia	19.88	20.89	15.4	16.1
New Zealand	19.32	21.75	13.2	16.7
France	19.02	28.72	13.3	21.7
Poland	18.70	19.89	12.8	13.4
Canada	17.59	18.46	14.1	15.2
Austria	16.88	22.52	13.7	18.2
Australia	16.79	25.27	14.4	22.6
Chile	9.73	10.15	7.5	7.8
Turkey	8.75	10.24	6.6	7.7
Greece	8.55	19.11	6.9	15.7
Mexico	6.89	7.49	5.8	6.3
Brazil	6.59	6.82	5.0	5.2
Italy	6.46	10.21	5.5	8.4
India	3.20	4.06	2.2	2.7

Table 7a

Average (Weighted) Latency (Milliseconds) by Country (2013-2014) All Available Data

Country	2014 Latency	2014 Rank	2013 Latency	2013 Rank
Bulgaria	42.24	1	47.22	2
Korea	47.65	2	45.54	1
Finland	52.91	3	73.07	19
Hungary	55.85	4	58.55	8
Denmark	57.64	5	70.91	18
Estonia	58.35	6	99.31	37
Singapore	58.54	7	86.75	34
Austria	58.54	8	63.36	12
Norway	69.06	9	66.01	14
New Zealand	69.74	10	64.65	13
Ireland	72.91	11	75.49	23
Sweden	75.21	12	81.93	30
Slovenia	75.50	13	85.48	32
Greece	75.58	14	73.45	20
United States	77.66	15	80.33	27
Italy	78.00	16	75.21	22
Germany	78.69	17	66.75	15
Netherlands	79.30	18	61.12	10
Portugal	79.65	19	55.96	5
Poland	81.90	20	73.53	21
United Kingdom	83.68	21	68.05	17
Israel	83.74	22	81.76	29
Mexico	86.91	23	109.70	38
Australia	90.36	24	82.60	31
Chile	90.79	25	76.15	26
Belgium	98.51	26	66.97	16
Canada	99.71	27	86.03	33
Czech Republic	101.40	28	50.45	3
Brazil	102.59	29	75.68	24
Spain	110.35	30	87.79	35
France	115.61	31	95.65	36
Turkey	139.28	32	75.82	25
Hong Kong			63.24	11
Iceland			57.75	7
India			114.83	39
Japan			80.96	28
Lithuania			59.31	9
Luxembourg			118.71	40
Slovakia			56.50	6
Switzerland			55.92	4

*Quality data incomplete from: Hong Kong, Iceland, India, Japan, Lithuania, Luxembourg, Slovakia, and Switzerland

Table 7b

Average (Weighted) Latency by US States and International Countries (2013-2014)
All Available Data

Country	2014 (Ms)	Rank	Country	2013 (Ms)	Rank
Michigan	34.04	1	Bulgaria	37.94	1
Maryland	40.86	2	**New Jersey**	37.96	2
Bulgaria	41.00	3	Korea	44.26	3
Connecticut	43.12	4	Finland	46.64	4
Korea, Republic of	47.12	5	**Arkansas**	49.57	5
Oklahoma	49.86	6	Czech Republic	52.48	6
Arkansas	52.77	7	Switzerland	55.86	7
Finland	53.00	8	Hungary	56.92	8
Hungary	56.05	9	Slovakia	57.00	9
Denmark	56.92	10	**Virginia**	57.54	10
Austria	58.18	11	Austria	59.49	11
Estonia	58.35	12	**Tennessee**	60.94	12
Massachusetts	58.48	13	Mexico	60.97	13
Singapore	59.05	14	Denmark	63.29	14
Georgia	59.20	15	**Georgia**	63.31	15
Colorado	62.99	16	**Oklahoma**	63.46	16
Pennsylvania	63.18	17	**Florida**	64.65	17
Missouri	63.95	18	**Indiana**	64.92	18
Oregon	68.45	19	**Nevada**	65.57	19
Norway	69.01	20	New Zealand	65.78	20
Illinois	69.25	21	Ireland	69.06	21
New Zealand	70.71	22	Hong Kong	69.57	22
Indiana	71.26	23	Lithuania	69.82	23
Nevada	71.85	24	Greece	70.04	24
Virginia	72.59	25	**Illinois**	70.58	25
Ireland	72.79	26	United Kingdom	70.72	26
Washington	75.21	27	**Texas**	72.50	27
Florida	75.51	28	Italy	73.37	28
Sweden	75.69	29	Brazil	75.13	29
Greece	75.85	30	Poland	75.59	30
Slovenia	76.37	31	**North Carolina**	75.78	31
Texas	76.97	32	**Pennsylvania**	75.89	32
Hawaii	77.20	33	Norway	76.47	33
New York	77.42	34	**Maryland**	76.62	34
District of	77.49	35	Singapore	78.73	35
Italy	78.44	36	**Oregon**	79.16	36
Germany	79.30	37	Estonia	79.54	37
Portugal	79.79	38	**Kentucky**	79.90	38
North Carolina	79.99	39	Slovenia	81.80	39
Netherlands	80.02	40	**Minnesota**	82.04	40

Country	2014 (Ms)	Rank	Country	2013 (Ms)	Rank
Poland	80.36	41	Netherlands	83.41	41
Israel	83.45	42	**Colorado**	84.00	42
United Kingdom	83.52	43	**Washington**	84.57	43
Minnesota	83.60	44	Chile	84.79	44
Ohio	84.19	45	Germany	84.90	45
California	87.18	46	**New York**	85.46	46
Mexico	87.27	47	Spain	87.22	47
Australia	90.69	48	Australia	89.17	48
Chile	90.80	49	**California**	89.62	49
Belgium	98.99	50	**Missouri**	90.75	50
Alabama	100.17	51	**Louisiana**	91.66	51
Canada	100.52	52	Sweden	91.72	52
Czech Republic	102.58	53	Belgium	92.10	53
Kentucky	102.66	54	**Kansas**	92.85	54
Brazil	103.29	55	Canada	93.91	55
Spain	109.35	56	**Wisconsin**	96.17	56
France	115.16	57	India	100.37	57
Wisconsin	124.42	58	France	103.27	58
Iowa	127.29	59	Turkey	113.52	59
Turkey	138.67	60	**Idaho**	114.64	60
			Ohio	130.43	61
			Massachusetts	136.87	62
			Michigan	159.45	63
			Alabama	185.32	64

*Quality data incomplete from: Alaska, Arizona, Delaware, Hong Kong, Iceland, Idaho, India, Japan, Kansas, Lithuania, Louisiana, Luxembourg, Maine, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, North Dakota, Rhode Island, Slovakia, South Carolina, South Dakota, Switzerland, Tennessee, Utah, Vermont, West Virginia, and Wyoming

Table 8a

Average (Weighted) Jitter by Country (2013-2014)

Country	2014 Jitter (Ms)	2014 Rank	2013 Jitter (Ms)	2013 Rank
Bulgaria	19.29	1	21.64	4
Portugal	23.56	2	25.10	10
Estonia	25.67	3	39.55	36
Korea	27.59	4	20.67	1
Denmark	28.96	5	28.61	20
Austria	29.04	6	24.17	8
New Zealand	29.10	7	21.84	5
Greece	29.51	8	21.12	2
Italy	29.72	9	24.34	9
Germany	29.90	10	21.35	3
Hungary	29.99	11	25.48	13
Finland	31.66	12	27.67	19
Ireland	32.43	13	29.21	21
Singapore	32.95	14	41.78	38
Slovenia	34.00	15	30.24	23
Norway	34.13	16	31.13	26
Sweden	37.02	17	34.21	31
United	37.17	18	33.22	30
Poland	37.33	19	30.68	25
Brazil	38.24	20	29.46	22
Israel	40.34	21	31.93	28
Netherlands	40.76	22	25.39	12
Australia	41.14	23	32.45	29
United States	43.73	24	39.41	35
Mexico	44.55	25	37.48	33
Spain	45.94	26	27.05	16
Chile	46.36	27	39.58	37
Canada	46.61	28	38.37	34
Turkey	47.80	29	26.62	15
France	48.75	30	36.50	32
Czech	49.72	31	23.39	7
Belgium	56.16	32	31.37	27
Hong Kong		N/A	27.34	17
Iceland		N/A	30.62	24
India		N/A	53.67	39
Japan		N/A	27.53	18
Lithuania		N/A	25.76	14
Luxembourg		N/A	60.01	40
Slovakia		N/A	22.72	6
Switzerland		N/A	25.22	11

*Quality data incomplete from: Hong Kong, Iceland, India, Japan, Lithuania, Luxembourg, Slovakia, and Switzerland

Table 8b

Average (Weighted) Jitter by US States and International Countries (2013-2014)
All Available Data

Country	2014 Jitter (Ms)	Rank	Country	2013 Jitter (Ms)
Michigan	14.52	1	Switzerland	11.38
Bulgaria	18.55	2	**Arkansas**	11.48
Connecticut	18.68	3	Bulgaria	19.74
Portugal	23.50	4	Finland	20.07
Oklahoma	24.83	5	Korea	21.57
Estonia	25.67	6	Greece	23.10
Arkansas	26.14	7	**New Jersey**	23.61
Korea	26.33	8	Slovakia	23.80
Denmark	27.33	9	Hungary	26.07
Maryland	28.40	10	New Zealand	26.78
Austria	28.87	11	Germany	26.93
New Zealand	29.15	12	Italy	26.95
Missouri	29.34	13	Mexico	27.28
Italy	29.62	14	Brazil	27.40
Greece	29.91	15	**Florida**	27.84
Colorado	30.00	16	Lithuania	27.85
Hungary	30.23	17	Hong Kong	28.36
Oregon	30.44	18	**Virginia**	28.44
Germany	30.50	19	Czech Republic	29.58
Finland	30.94	20	Ireland	29.68
North Carolina	31.55	21	Spain	30.47
Ireland	32.71	22	Estonia	30.67
Singapore	33.60	23	North Carolina	31.33
Slovenia	33.78	24	**Minnesota**	31.35
Nevada	34.22	25	**Nevada**	31.51
Norway	34.60	26	Slovenia	31.72
Pennsylvania	35.47	27	**Missouri**	31.83
Massachusetts	35.57	28	Poland	32.39
Poland	36.67	29	Austria	32.90
DC	36.89	30	**Georgia**	33.08
Sweden	36.89	31	**Tennessee**	33.41
Minnesota	36.91	32	United Kingdom	33.50
United Kingdom	37.21	33	Turkey	33.87
Brazil	38.98	34	**Oregon**	34.02
Florida	39.06	35	**Texas**	34.52
Israel	39.16	36	**Colorado**	34.92
Georgia	39.23	37	Netherlands	35.72
Australia	41.29	38	Norway	35.79
Washington	41.46	39	Denmark	36.43
Netherlands	41.59	40	Australia	38.27

Country	2014 Jitter (Ms)	Rank	Country	2013 Jitter (Ms)
Kentucky	43.16	41	**Maryland**	38.37
New York	43.67	42	**Oklahoma**	38.46
Ohio	44.73	43	Pennsylvania	38.48
Texas	44.78	44	**Kentucky**	38.66
Turkey	45.09	45	**Washington**	39.60
Spain	45.11	46	**Indiana**	40.44
Mexico	45.51	47	India	42.05
Illinois	46.27	48	**Illinois**	42.80
Chile	46.43	49	France	43.42
Indiana	46.74	50	**California**	45.47
Canada	46.89	51	Chile	45.83
California	48.02	52	**Idaho**	46.68
France	48.40	53	Canada	47.43
Czech Republic	50.63	54	Singapore	47.63
Hawaii	50.85	55	Belgium	49.00
Belgium	56.82	56	**Louisiana**	51.24
Wisconsin	57.06	57	**New York**	51.42
Virginia	59.94	58	**Michigan**	54.89
Alabama	84.65	59	Sweden	55.44
Iowa	99.04	60	**Ohio**	56.20
			Massachusetts	57.26
			Wisconsin	59.37
			Kansas	59.57
			Alabama	63.24

*Quality data incomplete from: Alaska, Arizona, Delaware, Hong Kong, Iceland, Idaho, India, Japan, Kansas, Lithuania, Louisiana, Luxembourg, Maine, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, North Dakota, Rhode Island, Slovakia, South Carolina, South Dakota, Switzerland, Tennessee, Utah, Vermont, West Virginia, and Wyoming

Table 9a

Average (Weighted) Percent Packet Loss by Country (2013-2014)

Country	2014 Packet Loss	2014 Rank	2013 Packet Loss	2013 Rank
Korea	0.24	1	0.93	1
Belgium	0.59	2	4.49	36
Poland	0.95	3	2.42	17
Norway	0.96	4	2.12	14
Portugal	0.96	5	3.49	28
Singapore	1.05	6	2.42	16
Austria	1.08	7	2.90	23
United	1.08	8	2.62	20
Slovenia	1.08	9	1.44	6
Ireland	1.16	10	6.97	38
Czech Republic	1.21	11	3.03	24
New Zealand	1.30	12	3.84	31
United States	1.32	13	1.39	5
Denmark	1.40	14	1.72	8
Canada	1.42	15	1.95	13
Italy	1.65	16	2.27	15
France	1.67	17	2.76	21
Netherlands	1.73	18	2.55	19
Bulgaria	1.77	19	4.24	34
Chile	1.81	20	1.79	9
Spain	1.90	21	3.68	29
Mexico	1.94	22	3.91	33
Germany	2.00	23	3.14	26
Brazil	2.09	24	3.88	32
Estonia	2.23	25	2.82	22
Sweden	2.32	26	3.25	27
Turkey	2.36	27	6.08	37
Australia	2.43	28	3.05	25
Hungary	2.51	29	4.25	35
Israel	4.65	30	1.83	11
Greece	4.67	31	10.07	40
Finland	5.57	32	7.13	39
Hong Kong		N/A	1.04	2
Iceland		N/A	1.26	3
Lithuania		N/A	1.33	4
Slovakia		N/A	1.58	7
Japan		N/A	1.80	10
Switzerland		N/A	1.86	12
India		N/A	2.48	18
Luxembourg		N/A	3.75	30

*Quality data incomplete from: Hong Kong, Iceland, India, Japan, Lithuania, Luxembourg, Slovakia, and Switzerland

Table 9b

Average (Weighted) Percent Packet Loss by US States and International Countries (2013-2014)
All Available Data

Country	2014	Rank	Country	2013	Rank
Massachusetts	0.11	1	**Alabama**	0.20	1
Iowa	0.22	2	**Kentucky**	0.22	2
Korea	0.26	3	**Arkansas**	0.22	3
Belgium	0.61	4	Switzerland	0.23	4
Michigan	0.72	5	Slovakia	0.44	5
Arkansas	0.76	6	Lithuania	0.44	6
Missouri	0.76	7	**Ohio**	0.46	7
Oklahoma	0.81	8	Hong Kong	0.69	8
District of Columbia	0.86	9	Sweden	0.81	9
Hawaii	0.87	10	Korea	0.82	10
Ohio	0.94	11	Slovenia	0.82	11
Minnesota	0.95	12	Austria	0.86	12
Washington	0.95	13	**Virginia**	0.87	13
North Carolina	0.97	14	**Indiana**	0.92	14
Portugal	0.98	15	**Michigan**	0.94	15
Norway	1.01	16	Georgia	0.95	16
California	1.02	17	Massachusetts	0.99	17
Poland	1.04	18	Minnesota	1.02	18
Illinois	1.06	19	Pennsylvania	1.05	19
United Kingdom	1.07	20	Washington	1.05	20
Singapore	1.08	21	California	1.10	21
Austria	1.08	22	Estonia	1.12	22
Nevada	1.11	23	Colorado	1.13	23
Colorado	1.13	24	Bulgaria	1.13	24
Pennsylvania	1.14	25	United Kingdom	1.20	25
Slovenia	1.19	26	Denmark	1.20	26
Oregon	1.19	27	Italy	1.20	27
Czech Republic	1.21	28	Wisconsin	1.22	28
Ireland	1.23	29	Norway	1.23	29
New Zealand	1.27	30	New Jersey	1.25	30
Wisconsin	1.30	31	Oregon	1.25	31
Kentucky	1.31	32	Idaho	1.25	32
Indiana	1.31	33	Missouri	1.28	33
Florida	1.31	34	Illinois	1.29	34
Denmark	1.32	35	Poland	1.33	35
Georgia	1.35	36	Nevada	1.36	36
Canada	1.41	37	New Zealand	1.48	37
Maryland	1.51	38	Netherlands	1.54	38
Italy	1.53	39	India	1.58	39
New York	1.54	40	New York	1.64	40
France	1.67	41	Kansas	1.66	41

Country	2014	Rank	Country	2013	Rank
Netherlands	1.73	42	Oklahoma	1.75	42
Bulgaria	1.79	43	Ireland	1.81	43
Chile	1.81	44	Florida	1.82	44
Mexico	1.87	45	North Carolina	1.86	45
Spain	1.88	46	Singapore	1.89	46
Brazil	1.95	47	Mexico	1.96	47
Germany	1.96	48	Canada	2.01	48
Texas	2.00	49	Chile	2.04	49
Turkey	2.18	50	France	2.06	50
Estonia	2.23	51	Australia	2.06	51
Sweden	2.30	52	**Texas**	2.09	52
Hungary	2.43	53	Germany	2.16	53
Australia	2.44	54	Czech Republic	2.48	54
Connecticut	3.65	55	Spain	2.52	55
Israel	4.20	56	**Louisiana**	2.70	56
Alabama	4.24	57	Turkey	2.73	57
Greece	4.27	58	**Tennessee**	2.87	58
Virginia	4.93	59	**Maryland**	3.17	59
Finland	6.07	60	Finland	3.32	60
		61	Hungary	3.82	61
		62	**Belgium**	5.37	62
		63	Brazil	5.38	63
		64	Greece	6.92	64

*Quality data incomplete from: Alaska, Arizona, Delaware, Hong Kong, Iceland, Idaho, India, Japan, Kansas, Lithuania, Louisiana, Luxembourg, Maine, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, North Dakota, Rhode Island, Slovakia, South Carolina, South Dakota, Switzerland, Tennessee, Utah, Vermont, West Virginia, and Wyoming

APPENDIX G

Broadband Deployment Comparison with Europe

In both the United States and the European Union, governments are tracking broadband deployment, especially in rural areas.[1] Historically, rural areas lagged slightly in the deployment of basic broadband, with the gap widening for high-speed broadband.[2] Consistent with what we found in the *Fourth IBDR* with respect to 2011 and 2012 data, data from 2013 and 2014 shows the United States continues to have a smaller rural coverage gap than the EU for high-speed broadband. In the most recent comprehensive study of broadband in Europe,[3] high-speed fixed broadband was found to be available to 68 percent of all households at the end of 2014, but only 25 percent of rural households – a gap of 43 percentage points. In contrast, high-speed broadband coverage in the United States in 2014 was higher overall than in the European countries in the EC study,[4] and there was a smaller gap between rural coverage and total coverage. By the end of 2014, high-speed broadband was deployed to 89 percent of all U.S. households and 58 percent of rural households – a gap of 31 percentage points. The differences in high speed coverage in rural and non-rural areas are even larger. Between December 2013 and December 2014, the high-speed broadband coverage gap in the United States between rural and non-rural households dropped significantly, from 48 to 38 percentage points. In Europe, the high-speed gap over the same time period barely declined from 52 to 50 percentage points.

EC Study. Like the United States, the EU is tracking its progress in extending broadband coverage to all of its citizens.[5] The EU's Digital Agenda includes two objectives: provide all EU citizens

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[1] The OECD has not updated its deployment (or coverage) data in several years. See http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm (*e.g.*, DSL and fiber coverage data are current as of 2009). The OECD does have more recent information on overall penetration (*i.e.*, subscriptions), but it is not considered here. In the *Fourth IBDR*, we compared U.S. and European deployment data for 2011 and 2012. *See Fourth IBDR* at Appendix G.

[2] For purposes of this discussion, basic broadband in Europe is defined as service with download speeds of at least 144 kbps and basic broadband in the U.S. is defined as service with download speeds of at least 200 kbps because that is the closest tier in the U.S. data to Europe's 144 kbps that is available for 2013 and 2014. *See* notes 6, 21 for more details. Basic broadband in the U.S. was also defined as 200 kbps for the 2011 and 2012 data in the previous IBDR. *See Fourth IBDR* at Appendix G. High-speed broadband refers to 30 Mbps for Europe in 2013 and 2014 as well as the U.S. in 2014. Because data on 30 Mbps was not collected in the U.S. in 2013, we use data on 25 Mbps, the closest speed available, for high-speed in the U.S. in 2013.

[3] Broadband Coverage in Europe in 2014: Mapping Progress Towards the Coverage Objectives of the Digital Agenda, Research Report prepared for the European Commission DG Communications Networks, Content & Technology, European Union, 2015, rel. Oct. 22, 2015, available at http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=11195 ("2014 study")

[4] The European countries in the EC study include the current 28 countries of the European Union (EU28): Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (GR), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES), Sweden (SE) and the United Kingdom (UK). For both 2013 and 2014, the European data includes three additional countries: Iceland (IS), Norway (NO) and Switzerland (CH). We refer to these 31 countries collectively as the European study countries.

[5] *See 2016 Broadband Progress Report* at para. 6, Section I ("Our analysis finds that rural and Tribal areas are being left behind, as well as certain schools and classrooms, from receiving the advanced services envisioned by Congress.").

with basic broadband coverage of at least 144 kbps for downloads[6] by the end of 2013 and "Next Generation Access" – high-speed – broadband coverage of at least 30 Mbps for downloads by the end of 2020.[7]

In this report, we compare U.S. and European deployment data from both 2013 and 2014. The European data comes from European Commission (EC) studies released in late 2014 and 2015.[8] The 2014 EC study provides a measure of progress towards Europe's broadband coverage objectives in the study countries. Of particular value, the 2014 EC study includes data at a sub-national level – corresponding to counties, departments, or provinces.[9] These sub-national data are helpful to determine broadband capability in those international communities that are comparable to U.S. communities with respect to population size, population density, topography, and demographic profile.[10] The data are also broken down into rural and non-rural areas. To define whether a region was rural or non-rural, the EC study data for both 2014 and 2013 use the definition of rural introduced for the 2012 dataset.[11] The 2013 EC study shows that basic broadband reached 97 percent of European households in the EC study by the end of 2013, and high-speed broadband reached 62 percent of those homes. According to the 2014 EC study, by the end of 2014 the percentage of households with high speed broadband had increased to 68 percent, though the percentage with basic broadband remained the same at 97 percent.

Broadband coverage continues to lag for inhabitants of rural areas.[12] At the end of 2013, basic broadband (144 kbps) coverage reached 90 percent of households in rural areas of the European countries in the EC study, while high-speed broadband (30 Mbps) reached only 18 percent of those rural

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[6] The EU Digital Agenda does not define "basic broadband" per se but relies on country-specific availability and averages. VDSL, the dominant delivery method across the EU, generally delivers faster speeds, but the generally accepted lowest speed for the Digital Agenda is 2 Mbps down/256 kbps up. An EC study of the state of European broadband in 2014 (cited in note 8 below) defines overall fixed broadband coverage as the combination of the following technologies: DSL, VDSL, standard cable, DOCSIS 3.0 cable, FTTP, and WiMAX. The EC study of the state of European broadband in 2011 that we reviewed for the *Fourth IBDR* gave the combination of DSL, standard cable, FTTP, and WiMAX the label "standard broadband" as these technologies could only guarantee 144 kbps down. *See* Broadband Coverage in Europe in 2011: Mapping Progress Towards the Coverage Objectives of the Digital Agenda, Research Report prepared for the European Commission DG Communications Networks, Content & Technology, European Union, 2012, available at http://ec.europa.eu/information_society/newsroom/cf/document.cfm?doc_id=1102.

[7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions A Digital Agenda for Europe, 2010, available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF.

[8] Broadband Coverage in Europe in 2014: Mapping Progress Towards the Coverage Objectives of the Digital Agenda, Research Report prepared for the European Commission DG Communications Networks, Content & Technology, European Union, 2015, rel. Oct. 22, 2015, available at http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=11195 ("2014 EC study"). Broadband Coverage in Europe in 2013: Mapping Progress Towards the Coverage Objectives of the Digital Agenda, Research Report prepared for the European Commission DG Communications Networks, Content & Technology, European Union, 2014, rel. Dec. 14, 2014, available at https://ec.europa.eu/digital-agenda/en/news/study-broadband-coverage-europe-2013 ("2013 EC study"). The EC studies did not include service offered by satellite providers. We excluded satellite coverage from the U.S. data to maintain comparability.

[9] The population of these sub-national areas (called NUTS-3 level units) range from 150,000 to 800,000.

[10] 47 U.S.C. § 1303(b) (2).

[11] *See* 2014 EC Study, page 16 (For the 2012, 2013, and 2014 EC studies, rural areas are defined by "using the Corrine land cover database and creating a database of population and land type in every square kilometre across Europe. Households in square kilometers with population less than one hundred were classified as rural.").

[12] In the EU's 28 countries, the 2014 study estimates that 14 percent of households live in rural areas. According to U.S. census block data, the U.S. rural share of households is similar at 19 percent.

households. By the end of 2014, high speed broadband access had increased to 25 percent of rural households, with basic broadband coverage remaining the same at 90 percent. To reach the EU's 2020 goal, the 2014 EC study concludes that considerable investment in rural areas will still be necessary.[13]

 Comparison to the United States. In the United States, different statistics are collected, but general comparisons can still be made.[14] The EC studies discussed above focus on the NUTS-3 geographical category with the population ranging from 150,000 to 800,000.[15] NUTS-3 is a political-bureaucratic jurisdiction that is a subdivision of NUTS-2. NUTS-2 is similar to U.S. states. In our comparative analysis below, we used counties as the U.S. counterpart of NUTS-3 areas. There are 3,144 counties and county equivalents such as parishes (hereinafter "counties") in the United States.[16] The basic unit of analysis in the U.S. data is the census block. In our maps, we aggregate census block data to the county level, which more closely match the level of aggregation for the European study. Because the EC study used households as the unit for measuring coverage, we do the same in our comparison.[17]

 In this Report we use the definition of rural set out in the 2014 EC study to classify European households: any square kilometer with a population of less than 100 people is rural. For the U.S. data we use the Census Bureau's determination of rural, which identifies each census block as rural or non-rural.[18] We use this definition in our online National Broadband Map, and also our Connect America Fund work.[19] Each county is made up of multiple census blocks. We can therefore determine the rural population with and without broadband deployment for each county.

 For purposes of the comparison, we consider any service above 200 kbps in the United States to be basic broadband, because that is the speed tier in both the NTIA's State Broadband Initiative data and FCC Form 477 data[20] that most closely matches the 144 kbps threshold in the EC study.[21] This disparity

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[13] *See* map of European coverage on page 41 of the 2014 European study.

[14] Because the European data in its study was from December 2013 and 2014, we also use U.S. data from December 2013 and 2014 for comparison. The U.S. data for 2013 comes from the State Broadband Initiative, while the U.S. data for 2014 comes from FCC Form 477. Though the use of different datasets does add complications, neither dataset has sufficient data for both 2013 and 2014 on its own.

[15] There are 1342 NUTS-3 regions in Europe and 3,144 counties and county equivalents in the United States. Only 350 counties fall within the NUTS-3 population range of 150,000 to 800,000. Over 115 million Americans live in the 74 counties with populations above the NUTS-3 range, while 112 million and 87 million Americans live in counties within and below the NUTS-3 range respectively. The four least populous U.S. states (plus DC) fall within the NUTS-3 population range.

[16] The population of U.S. counties varies widely outside of the NUTS-3 range, with the smallest having a population under 100 and the largest having a population over 10 million.

[17] For freely available broadband mapping data online see http://broadbandmap.gov.

[18] Rural areas are those that are not within a densely developed territory which has at least 2,500 people. *See* http://www.census.gov/geo/reference/gtc/gtc_urbanrural.html.

[19] *See* www.broadbandmap.gov and also www.fcc.gov/encyclopedia/connectiong-america.

[20] Since July 2009, the National Telecommunications & Information Administration (NTIA), in coordination with the Commission, has been collecting data concerning where broadband is deployed across the nation as part of the State Broadband Initiative (SBI) Grant Program. *See* Department of Commerce, NTIA, State Broadband Data and Development Grant Program, Docket No. 0660-ZA29, Notice of Funds Availability, 74 Fed. Reg. 32545 (July 8, 2009) (*NTIA State Mapping NOFA*), http://www.ntia.doc.gov/files/ntia/publications/fr_broadbandmappingnofa_090708.pdf. For purposes of this Report, we call this data "SBI Data."

[21] We note that in the *2015 Broadband Progress Report* for purposes of its section 1302(b) obligation, the Commission considered "advanced telecommunications capability" as 25 Mbps download and 3 Mbps upload. *2015 Broadband Progress Report* at 1377, para. 3, Section I; 47 U.S.C. § 1302(b). In the *2016 Broadband Progress Report*, the Commission found that 25 Mbps/3 Mbps standard continues to represent an appropriate benchmark for

should be remembered when looking at the U.S.'s basic broadband numbers. Similar to the Europeans, the U.S. basic broadband numbers include the following technologies for fixed terrestrial service: aDSL, sDSL, VDSL, standard cable, DOCSIS 3 cable, fiber, copper, and fixed wireless. The EC study does not include satellite connections. Similarly, we also did not include satellite connections. For high-speed broadband, we use 30 Mbps in 2014 as the EC study does, and 25 Mbps in 2013 because that is the closest speed available in the SBI data.

   Total and Rural Household Broadband Coverage. In the United States, at the end of 2013, 97 percent of all households were covered by basic broadband of 200 kbps or greater. In contrast, 87 percent of rural households were covered by basic broadband. By the end of 2014, basic broadband was available to 98 percent of households overall and 91 percent of rural households in the United States. Comparisons to the EC data are captured in the chart below.

2013 Broadband Coverage, All Households
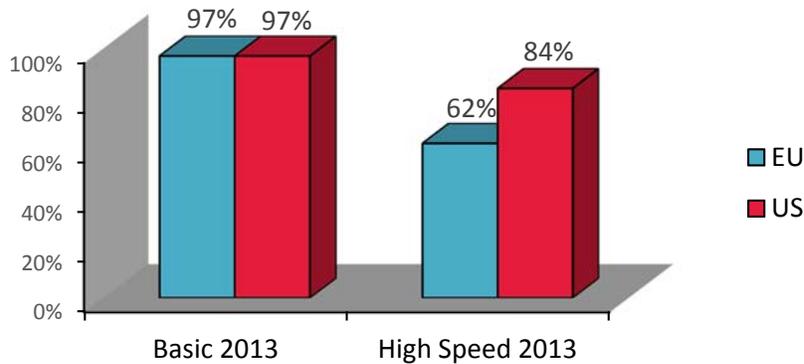
   As of December 2013, 84 percent of U.S. households nationwide, compared to 62 percent of households in the EC study had high speed broadband coverage of 30 Mbps or more.[22]

2014 Broadband Coverage, All Households

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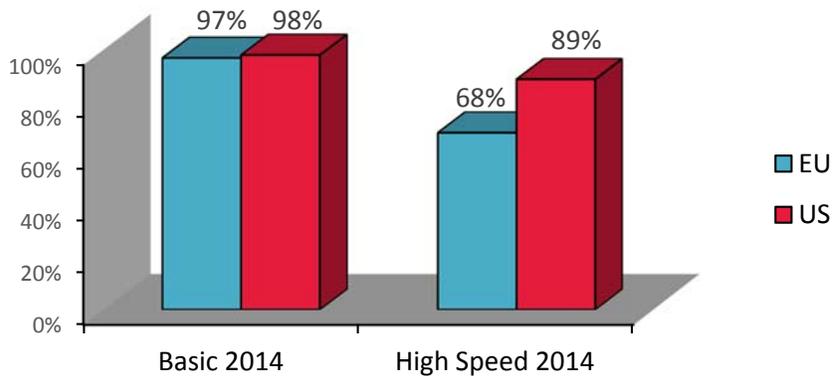
fixed broadband service. *2016 Broadband Progress Report* at 19, 51. We use the term "basic broadband" here when referring to access speeds above 200 kbps merely for convenience. The EC study defines an overall broadband threshold as including technologies that it had previously identified as only having speeds of 144 kbps and up, and 200 kbps is the closest tier for which we have data to compare.

[22] As noted above, we use U.S. deployment data for 25 Mbps in 2013 for high speed broadband. *See* n. 2, *supra*.

In 2014, high-speed broadband coverage expanded to 89 percent of households in the U.S. and 68 percent in the European countries in the EC study.

2013 Broadband Coverage, Rural Households
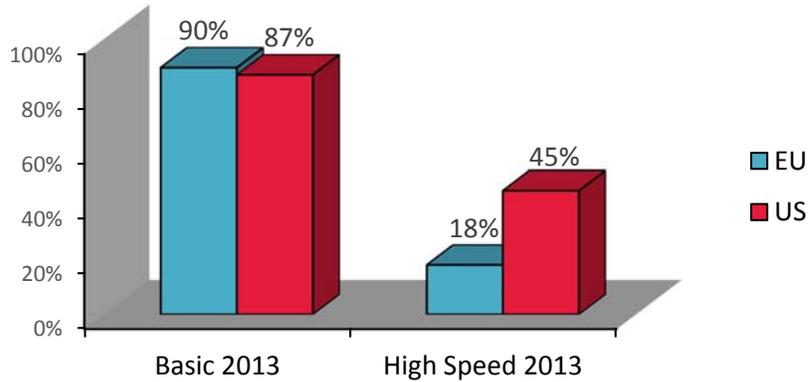
The chart above shows that in both the United States and the European countries in the EC study, rural coverage of high-speed broadband lags national and regional coverage. At the end of 2013, 90 percent of rural European households and 87 percent of U.S. rural households had basic broadband. At the end of 2013, 18 percent of European rural households and 45 percent of rural households in the United States had high-speed broadband coverage.

2014 Broadband Coverage, Rural Households
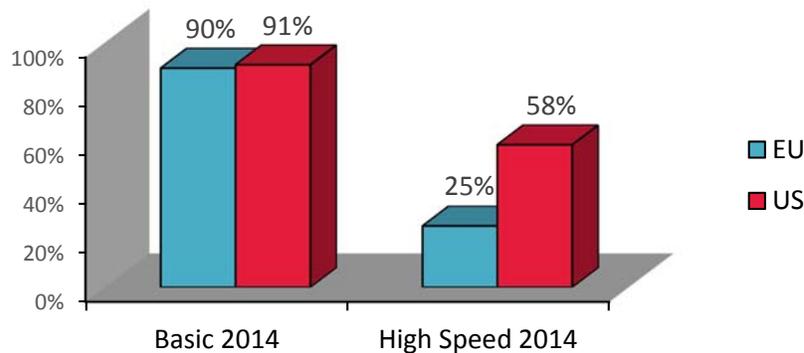
In 2014, we observe an increase in coverage, but rural coverage is still low in both regions.[23] In the European countries in the EC study, 90 percent of rural households had basic broadband coverage and 25 percent of these households had high-speed coverage. In the United States, 91 percent of rural households had basic broadband coverage, while 58 percent of rural households had high-speed broadband coverage.

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[23] In comparing 2013 and 2014 throughout this Appendix, it must be noted that the U.S. data for those years are derived from different sources, NTIA's State Broadband Initiative for 2013 and Form 477 data for 2014. *See* n. 14, *supra*.

While both the Europe and the United States have rural high-speed broadband coverage gaps, by the end of 2013 the United States had a much higher level of high-speed broadband coverage in rural areas – two and a half times the European level. In 2014, high-speed broadband coverage in the United States remained over twice the European level (58 percent in the United States and 25 percent in the European countries in the EC study).

Rural and Non-Rural Household Broadband Coverage. The charts above report the data from the 2013 and 2014 EC studies comparing rural household coverage to total household coverage, which includes households in both rural and non-rural areas. But this comparison understates the gap in broadband coverage in rural areas. If we compare household coverage in rural areas to non-rural areas, we observe wider gaps between these areas. In the European countries in the EC study in December 2013, basic broadband was deployed to 99 percent of all non-rural households, but only 90 percent of rural households - a gap of 9 percentage points. In the United States, basic broadband was deployed to 100 percent of all non-rural households, but only 87 percent of rural households - a gap of 13 percentage points.[24]

In Europe, by December 2014, the countries in the EC study had marginally reduced the gap between rural and non-rural areas for basic broadband to 8 percentage points. In the United States, the gap for basic broadband dropped – from 13 to 8 percentage points – as the percent of rural households with basic broadband coverage rose to 91 percent while the percent of non-rural households with basic broadband stayed about the same at 99 percent.

Between December 2013 and December 2014, high-speed broadband coverage in the European countries in the EC study increased from 70 to 75 percent for non-rural households and from 18 to 25 percent for rural households. The gap between non-rural and rural thus decreased from 52 percentage points in 2013 to 50 percentage points in 2014.

Between December 2013 and December 2014, high-speed broadband coverage in the United States increased from 93 to 96 percent for non-rural households and from 45 to 58 percent for rural households. The high-speed broadband gap between non-rural and rural decreased significantly, from 48 percentage points to 38 percentage points. Thus the gap between rural and non-rural high-speed coverage is smaller in the United States than it is in Europe, the absolute level of coverage of high-speed broadband is higher in the United States in both rural and non-rural areas.

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[24] We derive non-rural household coverage for the United States and Europe from the reported number of households, total and rural, and from the number of broadband connections for households, total and rural.

Broadband Coverage: Rural vs Non-Rural
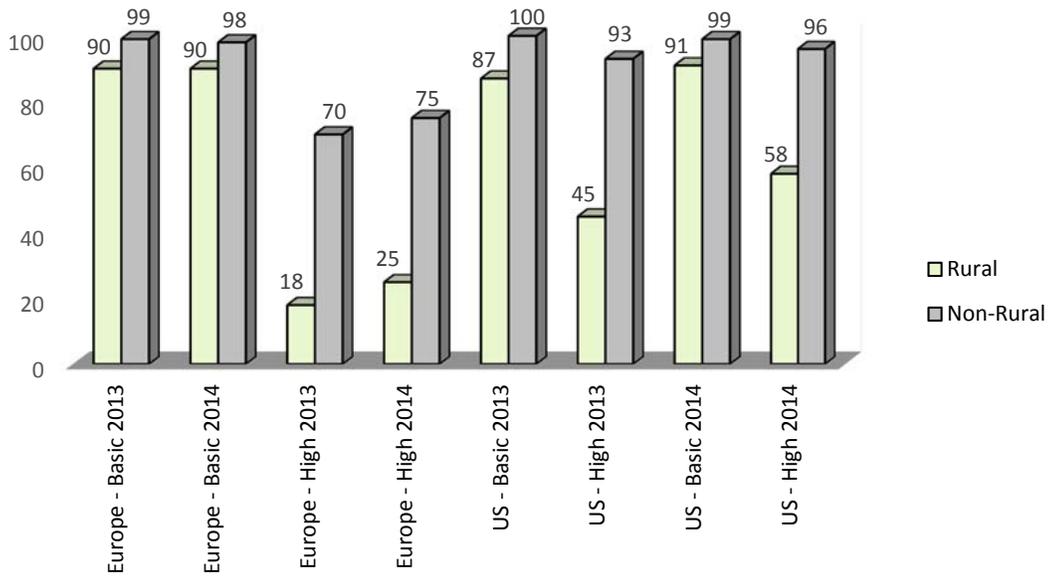
Total High-Speed Broadband Coverage by Country. The bar graphs 1 and 2 below illustrate the status of total high-speed broadband coverage in the European countries in the EC study and the United States in the years 2013 and 2014. In 2013, with an overall 84 percent high-speed broadband coverage, the United States ranks higher than 23 of the European countries in the EC study. In 2014, with an overall 89 percent high-speed broadband coverage, the United States ranks higher than 21 of the European countries in the EC study.

Graph 1: Total high-speed broadband coverage by country, December 2013
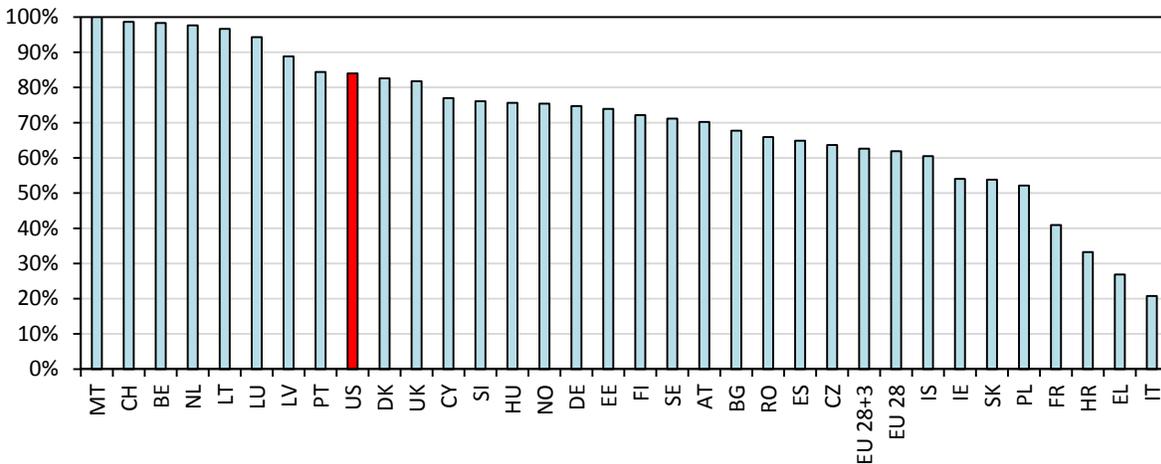
Graph 2: Total high-speed broadband coverage by country, December 2014
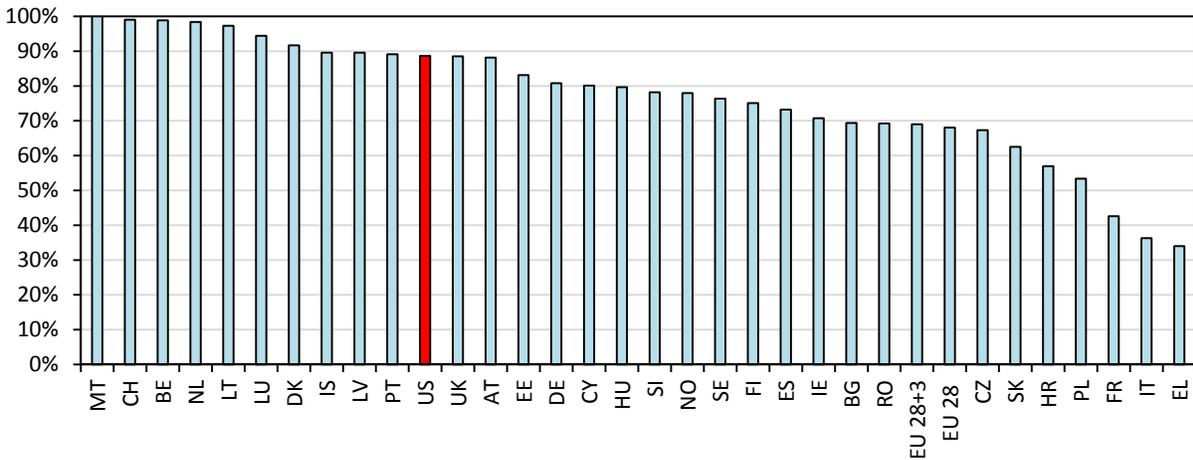
Rural High-Speed Broadband Coverage by Country. Similarly, the EC studies include data for 2013 and 2014 on the status of rural high-speed broadband coverage by country. The bar graphs 3 and 4 below illustrate the status of rural high-speed broadband coverage across the European countries in the EC study and the United States. Eight European countries (Belgium, Estonia, Lithuania, Luxembourg, Malta, Netherlands, Slovenia, and Switzerland) had higher rural high-speed broadband coverage than the United States in 2013, and eight European countries (Belgium, Iceland, Lithuania, Luxembourg, Malta, Netherlands, Slovenia, and Switzerland) had higher rural high-speed broadband coverage than the United States in 2014.

Graph 3: Rural high-speed coverage by country, December 2013
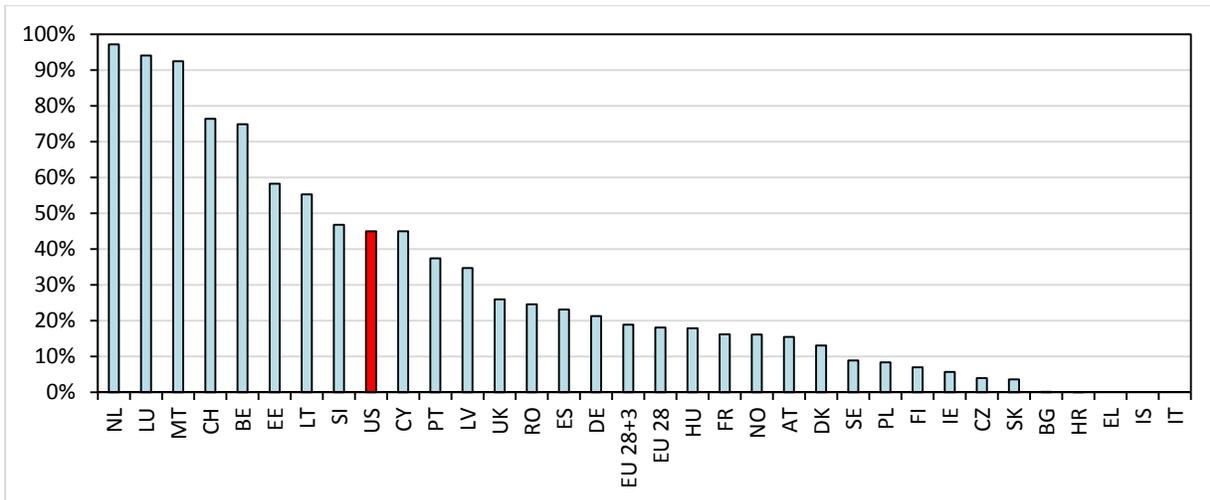
Graph 4: Rural high-speed coverage by country, December 2014
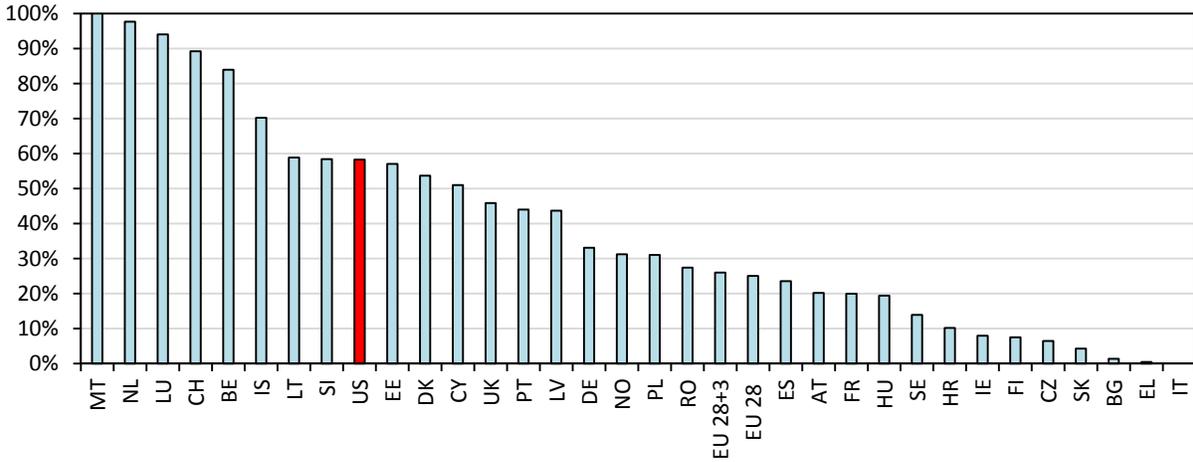
Broadband Coverage by Technology. The EC studies break down broadband into several categories: DSL, VDSL, FTTP, WiMAX, Standard Cable, DOCSIS 3 Cable, HSPA, LTE, and satellite. We have U.S. data on fiber, Standard Cable, and DOCSIS 3 Cable for 2013 and 2014 that is similar to the EC data. For VDSL we have similar data for 2014, but no data for 2013. For DSL the closest data we have is ADSL coverage, which is available for both 2013 and 2014. U.S. data for specific technologies is limited to those connections with speeds of at least 200 kbps for 2013 and 2014, while the EC data includes slower connections as well. Graphs 5 and 6 below should be understood within the context of these limitations. For basic broadband, Europe relies more heavily on DSL, while most U.S. homes have a combination of DSL and/or cable technologies available to them. For high-speed broadband, cable is deployed to more U.S. households than any other technology.

Graph 5: Coverage by Technology, 2013
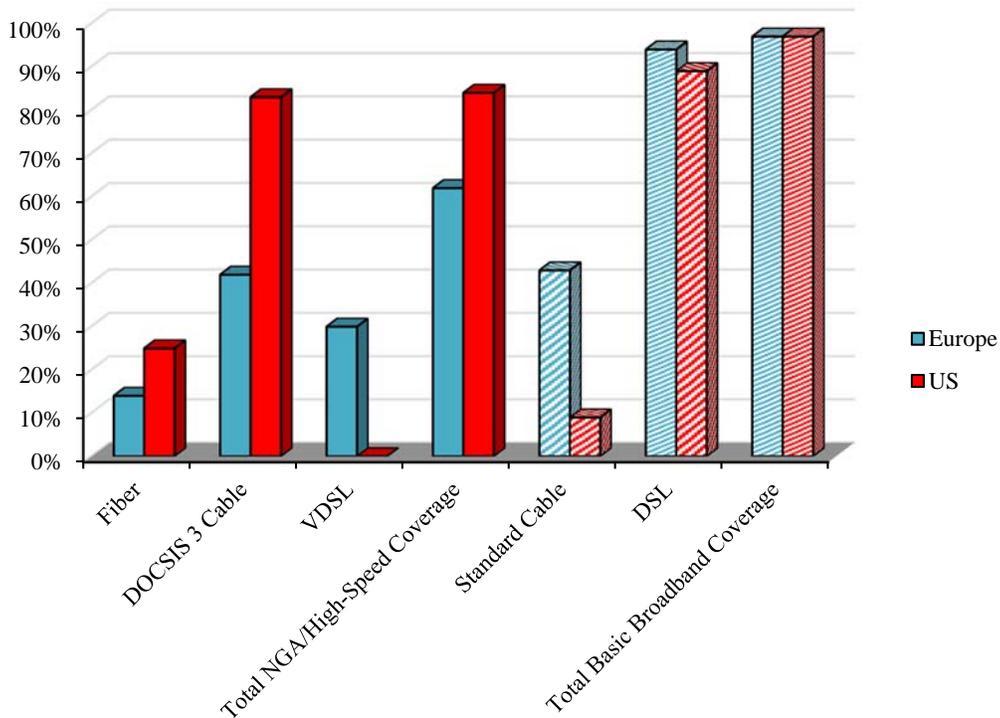
Graph 6: Coverage by Technology, 2014
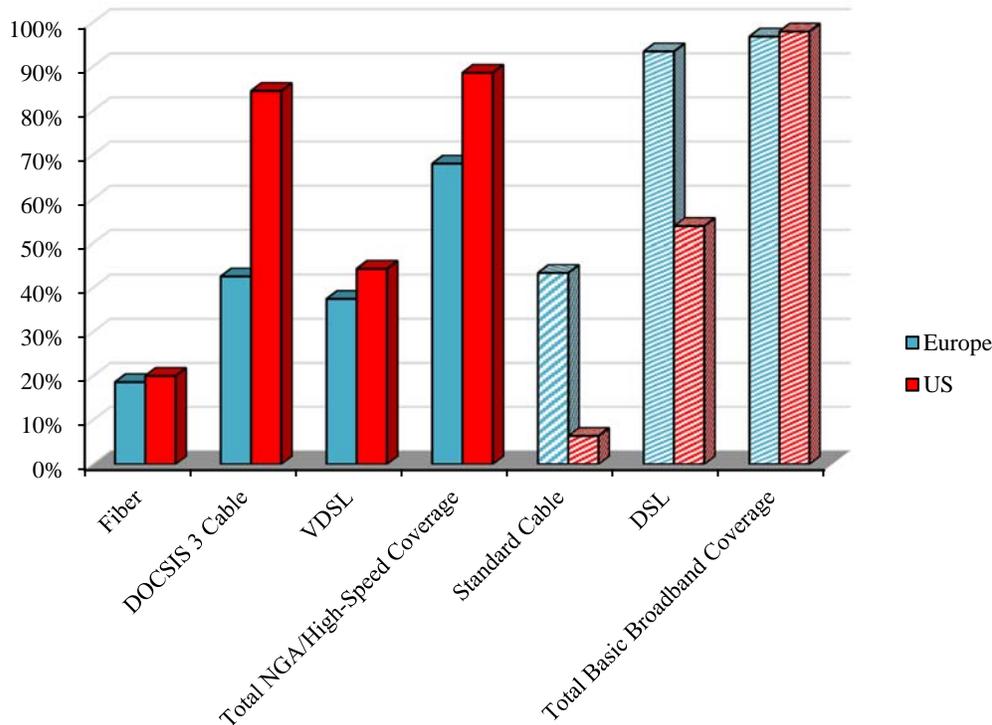
Total Comparison of Basic, High-Speed, and 100 Mbps Broadband. The 2013 and 2014 EC studies also include separate nationwide estimates of the percent of households with connections that could realistically achieve download speeds of at least 2 Mbps, 30 Mbps, and 100 Mbps. This data was calculated differently from the European data used in the rest of this appendix, and is not used elsewhere because the European studies do not provide corresponding rural calculations.[25] The charts below compare the availability of broadband at these speeds in the United States and Europe for 2013 and 2014.[26] In both 2013 and 2014 the U.S. led at the highest speeds of broadband.

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[25] Thus the EC data for 30 Mbps used here is not the same as the data used elsewhere in the report. The data for 30 Mbps elsewhere was defined by technologies that could achieve 30 Mbps theoretically, whereas the 30 Mbps data here is defined by connections that could reach the speed of 30 Mbps realistically, thus excluding some VDSL connections that could theoretically but not realistically reach 30 Mbps. *See 2014 EC Study*, pages 12, 201. *See also* n. 8.

[26] Because data on 30 Mbps was not collected in the United States in 2013, data for 25 Mbps is used as the closest available speed. Despite the discrepancy, we believe the comparison remains apt.

2013 Total Broadband Coverage by Speed
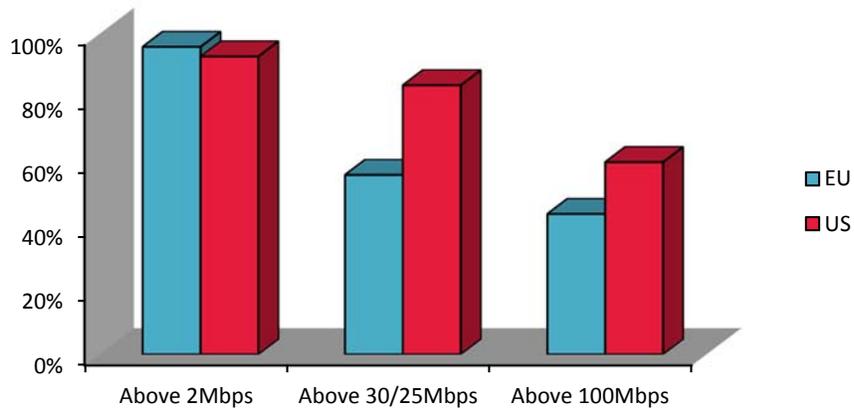
2014 Total Broadband Coverage by Speed
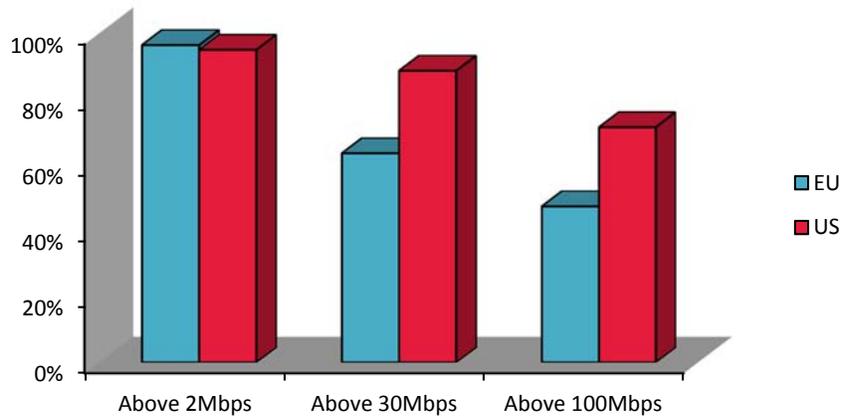
    Broadband Coverage Maps. The EC study includes maps showing the status of basic and high-speed broadband coverage across the study countries as of December 2014.[27] The EC's maps below are similar to the U.S. maps and can be used to visualize the distribution of basic broadband and high-speed broadband coverage around the United States, compared to Europe. These maps reflect data as of the end of 2014. Current U.S. maps can be found at the FCC's broadband map website: broadbandmap.gov.

Standard Fixed Broadband Coverage Maps – December 2014

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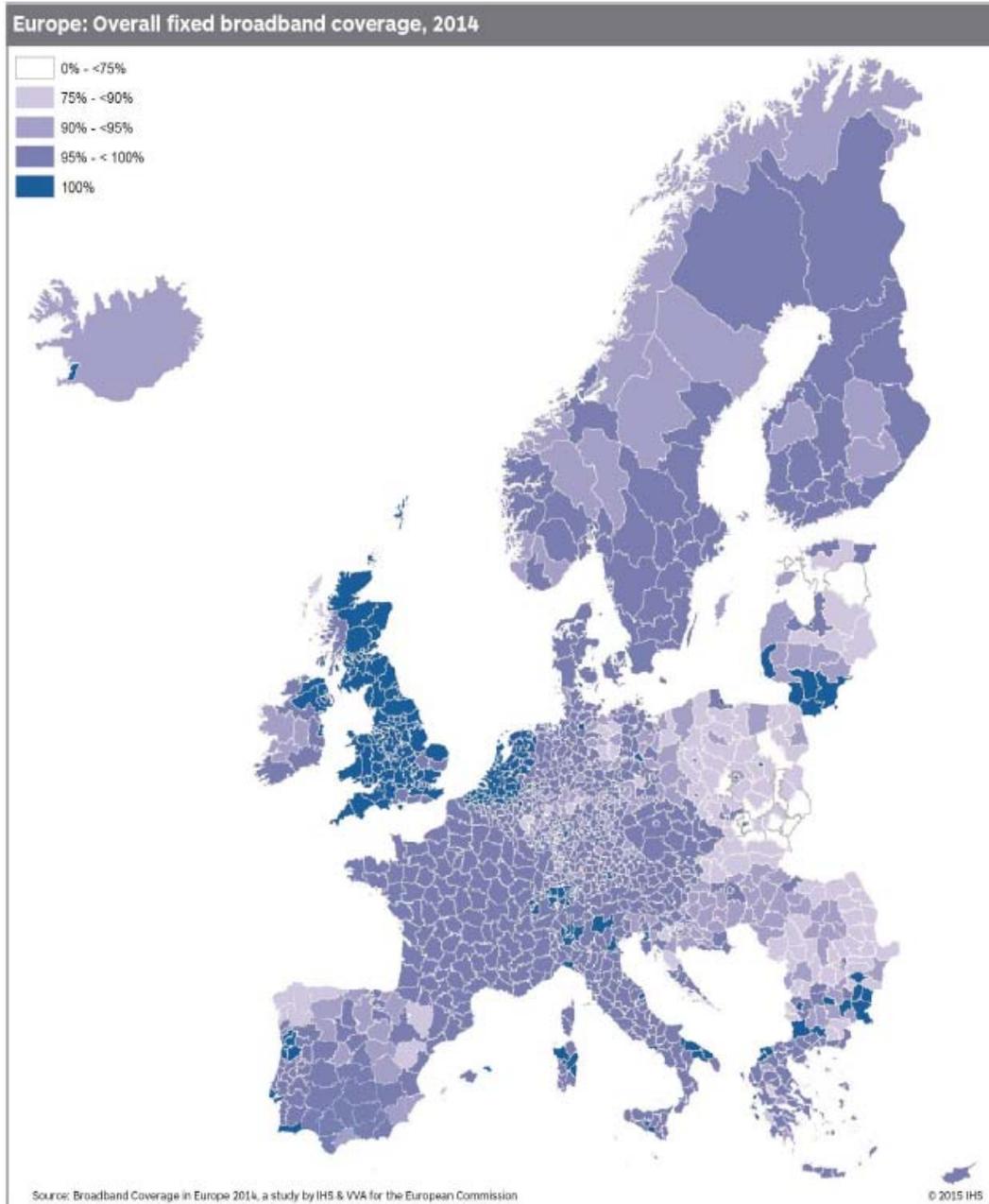
[27] *See* pages 41-42 of the 2014 EC study.

	0% to < 5%
	5% to < 35%
	35% to < 65%
	65% to < 95%
	95% to 100%

High-Speed Fixed Broadband Coverage Maps – December 2014

Legend:
- 0% to < 5%
- 5% to < 35%
- 35% to < 65%
- 65% to < 95%
- 95% to 100%